



Media-related Educational Competencies of German and US Preservice Teachers

A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

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Editorial: Media-related Educational Competencies of German and US Preservice Teachers

A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

Jennifer Tiede

Abstract

Media have become omnipresent in children's and youths' everyday lives, and they also offer rich chances and challenges for educational contexts. On the one hand, media can, for example, support students' learning effectively, enhance lessons with innovative tools and methods and help individualize teaching and learning processes. On the other hand, students need to learn, e.g., how to use these media, how to select and evaluate them and how to act responsibly in a digitalized and mediatized world. Teachers are a core stakeholder in this context. To take advantage of the benefits media offer for teaching and learning processes, to support students in the acquisition of respective competencies and to fulfill numerous other media-related tasks and challenges, teachers need to acquire respective competencies in their initial teacher education, which can be summarized as media-related educational competencies.

The relevance of these competencies is evident on different levels. In related research, respective competency models are developed, and in practices of teacher education, competencies are measured and efforts are taken to advance the competencies of preservice teachers. Against this background, this semi-cumulative dissertation presents a theory-based and empirical analysis of the competencies in question from a comprehensive and multidimensional perspective. In accordance with the central aspects outlined, the three systematic main fields focused on are models of media-related educational competencies, their measurement and practices of advancement in teacher education, as well as the interplay of these three fields. The dissertation takes on an international comparative perspective and focuses on the examples of initial teacher education in Germany and the USA.

The article-based dissertation comprises three main parts, framed by introduction and conclusion. The introduction provides a basis for the following work with regards to terminology, scope of research and overall methodology. The first main part is concerned with models of media-related educational competencies and includes a theory-based systematic comparison of three relevant models. This part explicates the varieties between competency models, and it discusses central aspects of selection and application. In Part II, methods and varieties of competency measurement are focused on, and an article

is presented which shares results of an exploratory quantitative measurement of the respective competencies of German and US preservice teachers. Overall, this part reveals the potential and limitations of competency measurement and transfers these conclusions to the competency models introduced in Part I. Part III is concerned with an analysis of current practices of advancing media-related educational competencies in Germany and the USA. In this context, stakeholders influencing these practices will be systemized and analyzed in their role and impact. The article included in Part III introduces interviews which were conducted to achieve insights into the perspectives of selected experts, regarding relevant models, practices and outcomes of media-related teacher education in Germany and the USA.

Finally, the Conclusion of the dissertation will draw together the different strands, clarify the close connection between the domains of modelling, measuring and advancing the competencies in question and discuss the interdependencies of these three dimensions. These perspectives help both to contextualize and bring together important facets which have often been treated separately in related research and will add new facets to ultimately achieve a comprehensive and multifaceted viewpoint.

Against the background of the intercultural comparative perspective, the results and findings will ultimately achieve an enhanced and deep analysis and reflection on the complex field of media-related educational competencies in Germany and the USA and beyond.

Editorial: Die medienbezogenen pädagogischen Kompetenzen deutscher und US-amerikanischer Lehramtsstudierender. Eine vergleichende Analyse von Kompetenzmodellen, Kompetenzmessungen und Praktiken der Kompetenzförderung

Zusammenfassung

Medien sind in den Lebenswelten heutiger Kinder und Jugendlicher allgegenwärtig, und auch für pädagogische Kontexte bieten sie vielfältige Chancen, aber auch Herausforderungen. Einerseits können Medien beispielsweise effektiv die Lernprozesse von Schülerinnen und Schülern unterstützen, Unterricht um innovative Instrumente und Methoden ergänzen und zur Individualisierung von Lehr- und Lernprozessen beitragen. Andererseits müssen Schülerinnen und Schüler beispielsweise lernen, wie sie diese Medien nutzen, wie sie sie auswählen und einschätzen und wie sie in einer digitalisierten Welt verantwortungsvoll handeln. Lehrerinnen und Lehrern kommt dabei eine zentrale Rolle zu. Um die Vorteile, die Medien für Lehr- und Lernprozesse bieten, nutzen zu können, um Schülerinnen und Schüler beim Erwerb entsprechender Fähigkeiten und Kompetenzen unterstützen zu können und um zahlreiche weitere medienbezogene Aufgaben und Herausforderungen bewältigen zu können, müssen Lehrerinnen und Lehrer bereits im Studium entsprechende

Kompetenzen erwerben, die als medienbezogene pädagogische Kompetenzen [media-related educational competencies] bezeichnet werden können.

Die Relevanz dieser Kompetenzen zeigt sich auf verschiedenen Ebenen. In der Wissenschaft werden entsprechende Kompetenzmodelle entwickelt, und in der Praxis der Lehrerbildung werden Kompetenzen gemessen und es werden Anstrengungen unternommen, um die Kompetenzen von Lehramtsstudierenden zu fördern. Vor diesem Hintergrund stellt diese teilkumulative Dissertation eine theoriebasierte und empirische Untersuchung der betroffenen Kompetenzen aus einer umfassenden und vielschichtigen Perspektive vor. In Übereinstimmung mit den skizzierten zentralen Aspekten sind die drei systematischen Kernfelder Modelle medienbezogener pädagogischer Kompetenzen, ihre Messung und Praktiken der Förderung im Lehramtsstudium, sowie das Zusammenspiel dieser drei Felder. Es wird eine international vergleichende Perspektive eingenommen, die beispielhaft die Lehrerbildung in Deutschland und den USA in den Blick nimmt.

Die teilkumulative Dissertation umfasst drei Hauptteile, die durch eine Einleitung und ein Schlusskapitel gerahmt werden. Die Einleitung stellt in Hinblick auf Terminologie, Forschungsabsicht und die grundlegende Methodik eine Grundlage für das folgende Werk dar. Im ersten Hauptteil werden Modelle medienbezogener pädagogischer Kompetenzen behandelt und ein theoriebasierter systematischer Vergleich dreier relevanter Modelle wird vorgestellt. So werden die Unterschiede zwischen Kompetenzmodellen verdeutlicht und zentrale Aspekte der Auswahl und des Einsatzes diskutiert. Im zweiten Teil werden Methoden und unterschiedliche Möglichkeiten der Kompetenzmessung fokussiert, und in einer veröffentlichten Studie werden Ergebnisse einer explorativen quantitativen Messung der entsprechenden Kompetenzen bei deutschen und US-amerikanischen Lehramtsstudierenden vorgestellt. Insgesamt werden in diesem Teil die Möglichkeiten und Einschränkungen der Kompetenzmessung aufgezeigt und auf die Modelle übertragen, die im ersten Teil eingeführt wurden. Im dritten Teil werden gegenwärtige Praktiken der Förderung medienbezogener pädagogischer Kompetenzen in Deutschland und den USA analysiert. In diesem Zusammenhang werden auch Parteien und Interessengruppen, die einen Einfluss auf diese Praktiken ausüben, hinsichtlich ihrer Rolle und ihres Einflusses systematisiert und analysiert. Die veröffentlichte Studie in diesem Teil stellt Experteninterviews vor, deren Ziel es ist, einen Einblick in die Perspektiven ausgewählter Expertinnen und Experten bezüglich relevanter Modelle, Praktiken und Ergebnissen der medienbezogenen Lehramtsausbildung in Deutschland und den USA zu erlangen.

Am Ende werden im Abschlusskapitel die verschiedenen Bereiche zusammengeführt und die enge Verbindung und die gegenseitigen Abhängigkeiten zwischen den Bereichen der Modellierung, der Messung und der Förderung der untersuchten Kompetenzen verdeutlicht und diskutiert. Diese Perspektiven tragen dazu bei, sowohl Dimensionen, die zuvor in der relevanten Forschung oftmals separat behandelt wurden, zu kontextualisieren und zusammenzuführen, als auch neue Facetten hinzuzufügen, um ein umfassendes und mehrperspektivisches Verständnis medienpädagogischer Kompetenzen zu erreichen.

Vor dem Hintergrund einer international vergleichenden Sichtweise werden die Ergebnisse und Erkenntnisse schlussendlich zu einer ausführlichen und tiefgehenden Analyse und Reflexion zum komplexen Themengebiet der medienbezogenen pädagogischen Kompetenz in Deutschland und den USA und darüber hinaus führen.

1. Rationale and Main Objectives of Researching Media-related Educational Competencies

Media have become increasingly relevant and widespread over the last decades and are now omnipresent in our everyday lives. Most German and US American youths have access to mobile phones, computers or laptops, TV sets and Internet at home and use these for a wide range of activities, such as social networking, gaming, watching TV, listening to music or reading (Medienpädagogischer Forschungsverbund Südwest [mpfs] 2018; Common Sense Media 2015).

This development offers considerable chances for children and youths. In their leisure time, they can enjoy numerous advantages e.g. with regards to communication and entertainment. At the same time, the omnipresence of media poses serious challenges for children and youths, for example, cyberbullying, which has become an impactful worldwide phenomenon, or propaganda. To face media-related chances and challenges, children and youths need to develop competencies which empower them to act appropriately, creatively, socially responsibly and in a self-determined way in this mediatized environment (Tulodziecki 1997; Hobbs 2010; Kultusministerkonferenz [KMK] 2012). It lies within the educational responsibility of parents, but also of teachers and schools, to foster these competencies, to consider the potential and risks related to the impact of media on learning environments and educational processes, to utilize the potential and to prepare students for the challenges of a mediatized world.

With regards to the role teachers play in the integration of media into school and lessons and in the advancement of students' respective competencies, a glance at the professional practices of teachers reveals that there are media-related challenges to be met on different levels. Central examples of such challenges include the media-supported enhancement of lessons, reflective practices and organizational aspects (Spanhel 2017; Redecker 2017). With regards to teaching and learning processes, students can take advantage of a targeted media integration, because teaching and learning processes can be enhanced, the learning environment can be enriched and students' learning and knowledge acquisition can be facilitated (Tulodziecki, Herzig, and Grafe 2019; Gronseth et al. 2010; Sharp 2014). In terms of reflective practices, there are teacher tasks connected to the role of media in today's society; they have become an important object for a guided pedagogical reflection and evaluation with students. Children and youths need to learn how to handle media responsibly,

how to analyze and select media offers reasonably and how to apply social responsibility and ethical principles to adequately respond to the challenges of their daily and multi-dimensional exposure and to meet the requirements of citizenship in a digital age (Hobbs 2010; Redmond 2016; Tulodziecki 2008). Finally, on an organizational level, teachers need to acknowledge the impact of media on educational practices, for example with regards to leadership and governance practices, infrastructure, content and curricula and teachers' professional development, collaboration and networking (Kampylis, Punie, and Devine 2015; Brüggemann and Breiter 2016; Dede 2011).

Given such media-related tasks of teachers, which will be further specified and differentiated in this thesis, it is generally agreed that specific skills and competencies are needed to fulfill complex requirements (Wilson et al. 2011; Kultusministerkonferenz [KMK] 2012; Spanhel 2017) and that initial and in-service teacher education are appropriate and necessary for (future) teachers' acquisition and advancement of these competencies (Blömeke 2003; American Association of Colleges of Teacher Education [AACTE] and Partnership for 21st Century Skills [P21] 2010; Instefjord 2014; Maderick et al. 2016). However, the precise shape, scope, extent and focus of the competencies and their outcomes are less agreed-upon and have been discussed extensively in academic discourse from different angles. A broader approach to this question of teacher competence is offered by the perspective of professionalization discourse, which seeks to answer what makes up professional action competence of teachers. Knowledge and capability, i.e., declarative, procedural and strategic knowledge, are usually understood as central components of teachers' professional action competence (Baumert and Kunter 2006) in this context. With regards to knowledge domains, Shulman's (1986) differentiation between general pedagogical knowledge, subject-matter content knowledge and pedagogical content knowledge has become widely accepted (Baumert and Kunter 2006). The professionalization discourse with all of its facets offers valuable insights into the professional competencies and knowledge of teachers and thus facilitates understanding of requirements. It also provides valid empirical measurements to enhance the validity of findings (Schaper 2009). However, the perspective of competencies and knowledge specific to media and ICT in teachers' professional practice are not yet an established part of this debate. To fill in this gap, it is valuable to consider research about respective media-related educational competencies and competency modeling in detail (Endberg 2018) and to connect the findings with the perspective of the professionalization debate.

Various competency models have been suggested to define and specify the scope of media-related educational competencies to provide a common ground for respective research, to pave the way for assessing and systemizing respective practices and to fulfill a range of further related functions (e.g., Blömeke 2000; FIT Ltd. et al. 2010; Wilson et al. 2011; Mishra and Koehler 2006; Krumsvik 2011; Redecker 2017). Based

on such models, measurement instruments have been developed to operationalize the constructs described by models and to measure the performance of the competencies in question (e.g., Siller 2007; Schmidt et al. 2009; Drummond and Sweeney 2017; Tiede and Grafe 2016; Kapsalis 2019).

Findings from such theory-based and empirical approaches to understanding and defining media-related educational competencies gain relevance for actual practices in initial teacher education by respective concepts and approaches, which helps institutions of higher education ensure that the competencies in question are systematically advanced with preservice teachers. For example, there are guidelines, such as the ISTE standards for educators (International Society for Teaching in Education [ISTE] 2017; cf. Chapter 4.2.2), DigCompEdu (Redecker 2017; cf. Chapter 4.1.3) or the Orientierungsrahmen Medienpädagogik (orientation frame for media pedagogy; Sektion Medienpädagogik 2017), offering orientation for respective objectives in initial teacher education and related study programs across universities, states and countries.

Against the background of the multifaceted discourses about, and applications of, the concept of media-related educational competencies outlined above, it was decided to focus on three main dimensions for the following work, namely modeling, measuring and practices of advancing media-related educational competencies. A concentration on these three dimensions is also supported by related literature; for example, Hartig, Klieme and Leutner (2008) point out the relevance of these three fields for future educational research. Against this background, it is considered beneficial to analyze the three dimensions in depth and critically discuss their relationships.

Given the close relationship of educational practices and their cultural or national background, it is useful to consider more than one country for respective analyses, because initial teacher education is relatively constant when one country is considered on its own. There are aspects of teacher education systems within a country that do not change significantly in the short term, such as the overall structure and organization of teacher education, federal structures in educational issues, or the reputation and role of the teaching profession. Hence, research about teacher education is restricted if it refers to one country and culture only. Contextualizing the situation in different countries allows for looking at the wider picture, opening up the perspective and overcoming the constraints of one's own culturally shaped views, a procedure that allows for valuable insights beyond the own limited perspective (Blömeke and Paine 2008) and that facilitates the acquisition of a "peripheral vision" (Bateson 1994).

Hence, the analyses and discussions introduced in the following work will concentrate on the examples of two countries, namely Germany and the USA. These two countries are considered appropriate for respective comparative considerations

because both of them have a long and comprehensive tradition of scientific discourses on media pedagogy and media education. These discourses often happened separately from each other but still share central concepts and attitudes, which makes them an appropriate starting point for a comparison (Grafe 2011; Blömeke and Paine 2008). Naturally, there are also factors delimiting the comparability of these two countries, such as differing languages and study structures. Further aspects to be considered include the contrastable but not congruent disciplines of *Medienpädagogik*, educational technology and media literacy. Respective analyses of the benefits and challenges of international comparative research and on the comparison of Germany and the USA will be presented in Chapter 3.2.

Researching models and measurements of media-related educational competencies and practices of their advancement, and discussing the links and relationships between these three dimensions in an international comparative perspective, can be considered a research desideratum from several viewpoints. As it has been argued initially, from a normative viewpoint, the digitalized living environment of children and youths necessitates a suitable inclusion of media-related topics into their lessons both to embrace the potential linked to media and to achieve a comprehensive and systematic preparation of responsible and competent future citizens in a digitalized world. Consequently, it is of genuine interest to prepare future teachers appropriately for these complex tasks and to contribute to a systematic competency advancement. The claim of appropriate teacher preparation is realized primarily by initial teacher education programs where preservice teachers can acquire relevant competencies. However, a glance at practice reveals that the current status is not sufficient in all cases and that the media-related education of preservice teachers shows heterogeneous quality and quantity (Foulger et al. 2017; Torres and Mercado 2006; Schiefner-Rohs 2012; Bertelsmann Stiftung et al. 2018). Educational and media pedagogical research has been contributing to the exploration and analysis of the competencies in question and thus to a systematization of respective processes by theory- and practice-based competency models, measurement instruments and numerous related studies. However, numerous deficits have been pointed out, e.g., with regards to a sound scientific foundation (Schiefner-Rohs 2012; Brantley-Dias and Ertmer 2013), empirical validation (Endberg 2018; Archambault and Barnett 2010) and systematic implementation into initial teacher education and its assessment (Culver and Redmond 2019; Bertelsmann Stiftung et al. 2018). Hence, a comprehensive analysis of the competencies in question that takes into account and links all of the three perspectives of modeling, measuring and advancing competencies is a research desideratum.

The following dissertation will correspond to this research desideratum and introduce a theory-based and empirical analysis of the competencies in question, which will be referred to as media-related educational competencies, from a

comprehensive and multidimensional perspective by selected examples from two countries. In accordance with the central aspects outlined, the three main dimensions focused on are models of media-related educational competencies, their measurement and practices of advancement from an international comparative perspective, as well as the interplay of these three dimensions.

On this basis, the following research questions will guide the work:

- Which central models of media-related educational competencies are there in German and US research, and what are their shared characteristics and differences?
- How can media-related educational competencies be measured, and which instruments are used for the models introduced?
- How are media-related educational competencies advanced in German and US American study programs of teacher education?
- What is the relationship between modeling, measuring and advancing media-related educational competencies in both countries?

To provide a basis for subsequent considerations, a chapter on the theoretical frame will clarify the topic and scope of research and central definitions, and a chapter on the methodological frame will introduce methodological choices which influence the overall perspective of the dissertation. In the following, the dissertation is structured in three main parts, which correspond to the three main dimensions of researching the media-related educational competencies outlined.

Part I is concerned with the context and theoretical foundations of competency modeling. It contextualizes the models selected for in-depth analysis by references to related national and international concepts, and it discusses theoretical aspects of competency modeling. Against this background, a systematic and category-based comparison of three selected models of media-related educational competencies with differing backgrounds is introduced to illustrate characteristics, influences, benefits and challenges of competency modeling. The models selected are the European Digital Competence Framework for Educators (DigCompEdu; Redecker 2017), the German M³K competency model of *medienpädagogische Kompetenz* (M³K; Herzig et al. 2015; Tiede and Grafe 2016) and the US American model of Technological, Pedagogical and Content Knowledge (TPACK; Mishra and Koehler 2006).

Part II then focuses on the measurement of media-related competencies. General characteristics of competency measurement are outlined and respective considerations of measurement instruments of the three models previously compared are added. Afterward, Paper 1, “Media Pedagogy in German and U.S. Teacher Education,” provides an example of competency measurement by introducing a comparative study which was conducted with German and US preservice teachers focused on media-related educational competencies.

Part III extends the perspective to current practices of advancing media-related educational competencies in teacher education and related educational study programs in both countries and analyses the *status quo* and stakeholders. The second paper, “The Integration of Media-Related Studies and Competencies into US and German Initial Teacher Education. A Cross-National Analysis of Contemporary Practices and Trends” completes the examination with an expert interview study which explores models, possibilities and varieties of integrating the competencies into teacher education, the outcomes of such processes and the stakeholders who have an influence in this field.

Based on these analyses, the Conclusion draws together the different strands, summarizes the overall results, emphasizes the relationship between models, measurements and practices of advancing media-related educational competencies and points out perspectives for further research.

The doctoral degree regulations at the University of Würzburg allow for a semi-cumulative format, which means reducing the number of papers included in the dissertation for the benefit of a larger share of additional frame text. The following two papers are included in this dissertation:

Paper 1: Tiede, Jennifer, and Silke Grafe. 2016. “Media Pedagogy in German and U.S. Teacher Education.” *Comunicar* 24 (49): 19–28. <https://doi.org/10.3916/C49-2016-02>.

Abstract: Various research works and practitioners conclude that media pedagogy should be integrated in teacher education in order to enable future teachers to use media for their lessons effectively and successfully. However, this realization is not necessarily reflected in actual university curricula, as preservice teachers at some places can still finish their studies without ever dealing with media pedagogical issues. To understand, assess and eventually improve the status of media pedagogical teacher education, comprehensive research is required. Against this background, the following article seeks to present a theory-based and empirical overview of the status quo of preservice teachers’ pedagogical media competencies focusing Germany and the USA exemplarily. To form a basis, different models of pedagogical media competencies from both countries will be introduced and the extent to which these competencies have become part of teacher education programs and related studies will be summarized. Afterwards, method and selected results of a study will be described where the skills in question were measured with students from both countries, based on a comprehensive model of pedagogical media competencies that connects German and international research in this field. The international comparative perspective will help broaden the viewpoint and understand differences, but also similarities. These data serve to identify different ways of

integrating media pedagogy into teacher training and draw conclusions on the consequences these processes entail for preservice teachers and their pedagogical media competencies.

Zusammenfassung:

Verschiedene Forschungsarbeiten und Praktikerinnen und Praktiker kommen zu dem Ergebnis, dass Medienpädagogik ins Lehramtsstudium integriert werden sollte, damit zukünftige Lehrerinnen und Lehrer befähigt werden, Medien effektiv und erfolgreich in ihren Unterricht einzubinden. Diese Erkenntnis spiegelt sich aber nicht unbedingt in heutigen universitären Curricula wider, denn Lehramtsstudierende können mancherorts immer noch ihr Studium abschließen, ohne sich jemals mit medienpädagogischen Fragestellungen auseinander zu setzen. Um den Status der medienpädagogischen Lehrerbildung zu verstehen, einzuschätzen und letztlich zu verbessern, ist umfangreiche Forschung nötig. Vor diesem Hintergrund stellt der folgende Artikel einen theoriebasierten und empirischen Überblick über den aktuellen Status der medienpädagogischen Kompetenzen Lehramtsstudierender vor und nimmt dabei exemplarisch Deutschland und die USA in den Blick. Grundlegend werden verschiedene Modelle medienpädagogischer Kompetenzen aus beiden Ländern vorgestellt und der Umfang, in dem diese Kompetenzen Teil von Lehramtsstudiengängen und verwandten Studien geworden sind, wird zusammengefasst. Anschließend werden die Methodik und ausgewählte Ergebnisse einer Studie beschrieben, in der die relevanten Fähigkeiten bei Studierenden aus beiden Ländern gemessen wurden, basierend auf einem umfassenden Modell medienpädagogischer Kompetenz, welches deutsche und internationale Forschung in diesem Feld verbindet. Die international vergleichende Perspektive wird dazu beitragen, die Perspektive zu weiten und Unterschiede, aber auch Ähnlichkeiten zu verdeutlichen. Diese Daten dienen dazu, verschiedene Wege der Integration von Medienpädagogik ins Lehramtsstudium zu identifizieren und Schlussfolgerungen zu ziehen zu den Konsequenzen, die diese Prozesse für Lehramtsstudierende und ihre medienpädagogischen Kompetenzen mit sich bringen.

Paper 2: Tiede, Jennifer, and Silke Grafe. 2019. "The Integration of Media-Related Studies and Competencies into US and German Initial Teacher Education. A Cross-National Analysis of Contemporary Practices and Trends." In *Proceedings of Society for Information Technology & Teacher Education International Conference*, edited by Kevin Graziano, 1709–17. Las Vegas, NV, United States: Association for the Advancement of Computing in Education (AACE). <https://www.learnlib.org/p/207873>.

Abstract: Many institutions of initial teacher education have realized the necessity to integrate media-related studies into their curricula. However, there are no binding regulations for these processes. As a result, the shape and extent of respective activities varies considerably, not only between different countries, but also within countries with decentralized educational structures such as Germany and the USA. The following paper will present the results of 11 interviews with experts from Germany and the USA which explored current practices and trends in the integration of media-related studies and competencies into initial teacher education. The data collected focus on models of media-related educational competencies, on possibilities and varieties of integrating media-related studies into teacher education curricula, on the outcomes of such efforts and on stakeholders who influence these processes. The cross-national comparative perspective will help contextualize the findings and draw conclusions on the status quo.

Zusammenfassung:

Viele lehrerbildende Institutionen haben die Notwendigkeit erkannt, medienbezogene Studieninhalte in ihre Curricula einzubinden. Dennoch existieren keine verbindlichen Regularien für diese Prozesse. Deshalb variieren Form und Umfang der entsprechenden Aktivitäten stark, nicht nur zwischen Ländern, sondern auch innerhalb von Ländern mit dezentralen Strukturen in Bildungskontexten, so wie Deutschland und die USA. Der folgende Artikel wird die Ergebnisse von 11 Interviews mit deutschen und US-Amerikanischen Expertinnen und Experten vorstellen, in denen aktuelle Praktiken und Trends bei der Integration von medienbezogenen Studien und Kompetenzen ins Lehramtsstudium untersucht wurden. Die gesammelten Daten fokussieren Modelle medienbezogener pädagogischer Kompetenz, Möglichkeiten und Arten der Integration medienbezogener Studieninhalte in Lehramtscurricula, die Ergebnisse dieser Bemühungen und Stakeholder, die diese Prozesse beeinflussen. Die international vergleichende Perspektive wird dazu beitragen, die Ergebnisse zu kontextualisieren und Schlussfolgerungen zum aktuellen Stand zu ziehen.

Further publications in the thematic context of this dissertation published by the author are Tiede and Grafe (2020), Boos, Tiede, Grafe, and Hesse (2016), and Tiede, Grafe, and Hobbs (2015).

2. Terminological Frame: A Clarification of Key Concepts

It has been stated initially that the competencies teachers need to successfully meet the multi-faceted requirements of media in educational contexts are of core interest for this dissertation. The competencies considered necessary or desirable, e.g., from normative or empirical viewpoints, vary from source to source and from perspective to perspective. Against this background of conceptual multiplicity, the following chapter will provide an overview of the inherent concepts in three steps. First, it will be clarified how to understand competences and competencies. In a second step, the perspective will be narrowed down to the professional competencies of teachers. Finally, it will be concretized what this means for the professional competencies in relation to media and how established concepts approach and define this topic. Against the background of these terms and definitions, different competency models have been developed in related research to substantiate the definitions and include aspects, areas or fields of competencies to describe precisely what constitutes a competence. Such models will be analyzed in detail in Part I, building on the following fundamental semantic considerations.

2.1 Competence

First, it is necessary to clarify what a *competence* or *competency* is, because this term is often used in various contexts. According to Klieme and Hartig (2007), it is essential for any reflection on human behavior and for its theoretical and empirical investigation. A growing use of the concept of competence in scientific and political contexts has led to a broad variety of definitions even within cultures or languages (Shavelson 2010) – an observation that leads Weinert (2001a) to talk about “conceptual inflation” (Hartig and Klieme 2006, 128), while Le Deist and Winterton (2005) even call competence such a “fuzzy concept” (p. 29) that they find it impossible to identify one coherent theory or definition that reconciles all usages. Against the background of this wide base, the focus will be narrowed down to educational contexts in the following.

Based on a broad review of competence definitions and models from the backgrounds of Human Resource Management and Vocational Training and Education, Sampson and Fytros (2008) define competence as

“a set of personal characteristics (e.g. knowledge, skills, attitudes) that an individual possess [*sic*] or needs to acquire, in order to perform an activity within a specific context. Performance may range from the basic level of proficiency to the highest levels of excellence.” (p. 66)

This definition comprises three main dimensions which have been deduced from the review. The first dimension is personal characteristics, which do not only include knowledge, skills and attitudes but also further aspects, such as abilities, behaviors, traits, values, motives, self-concepts, aspects of one's self-image, social role and/or self-control (Sampson and Fytros 2008). The second dimension refers to the competence proficiency level. The authors see *proficiency* as a quantifying dimension of competence, with proficiency levels being used to classify competences at specific levels according to an individual's performance. The third dimension stresses the influence of the context in which the competence is used, as, for example, functions, occupations or specific tasks.

A more complex analysis of uses of the term *competence* is presented by Weinert (1999), who can be allocated to the pragmatic-functional tradition of American psychology (Klieme and Hartig 2007). In an attempt to create an overview of competence definitions, he differentiates six kinds of competences:

1. Competences as *general psychological, dispositional constructs* which help people master a variety of tasks;
2. Competences as *specific performance dispositions* which relate to specific classes of situations and requirements functionally. These specific performance dispositions can also be characterized as knowledge, skills, or routines;
3. Competences as the *motivational orientations* needed for mastering challenging tasks;
4. *Action competence* as an integration of the first three concepts, related to the demands of a specific field of action, e.g., for a profession;
5. *Meta competences* as the knowledge, strategies or motivations that facilitate the acquirement as well as the application of specific competences;
6. *Key competences* as competences in a functional sense as described in 2), but relevant for a quite broad variety of situations or demands. This includes things like native language skills or mathematic skills. (Weinert 2001b; translation slightly adapted from Dehmel, Li, and Sloane 2011, 16)

In later works, Weinert summarizes and narrows down these approaches to the following definition, which has been widely acknowledged: "cognitive abilities and skills that individuals either have or can acquire to solve specific problems as well as related motivational, volitional and social willingness and abilities for taking successful and conscious advantage of problem solutions in varying situations" (Weinert 2001b; translation slightly adapted from Dehmel, Li, and Sloane 2011, 16). This definition is frequently referred to as a standard within German literature (Dehmel, Li, and Sloane 2011). It shows parallels to the afore-mentioned definition of Sampson and Fytros (2008) in terms of individual characteristics and context reference but differs otherwise, as it does not include the notion of competency levels or a quantification of proficiency.

In the context of the ambiguities and differences inherent in different concepts of *Kompetenz*, the English language brings about another complexifying element by differentiating between *competence* and *competency*. This differentiation is non-existent in German, where the concept is consistently called *Kompetenz*. In English, the differentiation of *competence* and *competency* is disputable, and sometimes both terms are even considered interchangeable and used inconsistently (Le Deist and Winterton 2005; Sampson and Fytros 2008). Against this background, the understanding and differentiation of *competence* and *competency* in this work are based on Blömeke, Gustafsson, and Shavelson (2015), who argue from the perspective of educational research and summarize:

“There is some agreement [...] that “competence” (plural “competences”) is the broader term whereas “competency” (competencies) refers to the different constituents of competence. The first term describes a complex characteristic from a holistic viewpoint whereas the latter takes an analytic stance. The constituents (or resources) may be cognitive, conative, affective or motivational. [...] Competence and competency are regarded as learnable and can thus be improved through deliberate practice.” (p. 5)

This understanding is supported also by Sampson and Fytros (2008) who, in reference to Cheetham and Chivers (2005), claim that “competencies are only a subset of the required competences for a given professional and/or academic field” (p. 159).

A reoccurring issue in the context of competence and competency definitions is the relationship to the term *skills*. In the formerly mentioned definitions of the concept of competence, it becomes clear that skills are often understood as one constituent of competence, among others such as mindsets and knowledge (Sampson and Fytros 2008; Weinert 2001b). This understanding is echoed and further specified in the definition of Council of Europe (2016), where *skill* is defined as “the capacity for carrying out complex, well-organised patterns of either thinking or behavior in an adaptive manner in order to achieve a particular end or goal” (p. 44) and constitutes competence together with values, attitudes and knowledge and critical understanding (p. 35).

2.2 Professional Teacher Competence

The previous definitions offer insights into shapes and understandings of the construct of competence, and it has become evident that the viewpoint of the respective discourse is of central importance in this regard. Hence, it is consistent to consider the relevance to the context of teaching as a profession. In the professionalization debate, questions of competency modeling and acquisition are linked to the question of what makes up the professionalization of teaching and professional teacher

knowledge. It builds on the notion that teaching is a professional practice and thus to be differentiated from non-professional occupations, although this distinction is arguable (Bonnet and Hericks 2014; Martin 2017). Among other characteristics, professional practice also means acting in highly complex systems and having substantial influence on the lives of others, which therefore requires a complex academic education and respective competencies (Terhart 2011; Hericks and Stelmaszyk 2010; Martin 2017). The focus on competencies is congruent with empirical evidence suggesting that learning achievements depend on the quality of instruction and that this quality of instruction depends significantly on the professional knowledge of teachers. Hence, a causal relationship between poor professional knowledge and poor student learning achievement is assumed (Köller 2012; cf. also Martin 2017).

The professional action knowledge and competencies teachers should possess are specified by established approaches. According to Baumert and Kunter (2006), the professional action competence of teachers is usually understood as an interplay of knowledge and skills, i.e., declarative, procedural and strategic knowledge. Shulman's (1986) work is received as an important foundation in this context. He specifies the relevant knowledge domains in this context as general pedagogical knowledge, subject-matter content knowledge, and pedagogical content knowledge (PCK) and thus advances an innovative notion of blending the formerly distinct areas of pedagogy and content (Mishra and Koehler 2006). A considerable number of authors from international contexts adopted this concept, specified components and thus developed a range of models of professional action competence of teachers (e.g., Baumert and Kunter 2006; Grossman 1990; 1995; Bromme 1992; 1997; Sherin 1996).

According to Endberg (2018), such a professionalization approach has been producing rich opportunities and sound approaches for modeling and measuring subject-specific competencies successfully, while empirically sound evidence is yet challenging to achieve for media pedagogy research. The author points out that there are only scarce connections between the professionalization approach and the field of media pedagogy as far as the competencies teachers need in relation to all kinds of media-related tasks are concerned, especially in the German discourse. She concludes that an exception to this separation of discourses on the professional action competence of teachers and on the media pedagogical perspective can be found in the TPACK model (cf. Chapter 4.2.1). While this viewpoint on media pedagogical research as detached from the scientific professionalization discourse and overall lack of empirical evidence can be challenged against the background of models beyond TPACK, such as M³K, the criticism yet emphasizes the necessity to clarify the distinct perspective of media pedagogical research on respective teacher competencies. A respective overview will be provided in the following.

2.3 Medienpädagogische Kompetenz

From the 1970s, a vivid scientific discourse on the concept of *Medienkompetenz* [media competence] emanated from German educational research, building on the works of Baacke (1973; 1996; 1997) to acknowledge changing opportunities and challenges for education in connection with the spread and increasing availability of media (Tulodziecki 2012). *Medienkompetenz* describes the “ability to apply all kinds of media for the communicative and action-related repertoires of humans in a way that actively acquires the world” (Baacke 1996, 6; own translation). In other words, it is understood that individuals who are *medienkompetent* are ready and able to act appropriately, self-determined, creatively and socially responsible in media contexts (Tulodziecki, Herzig, and Grafe 2019, 80). Central established concepts and definitions building on Baacke’s work also include related works by Aufenanger (e.g., 1997; 1999; 2001), Tulodziecki (e.g. 1997), Schorb (2005), or Spanhel (1999; 2006; cf. Tulodziecki, Herzig, and Grafe 2019; Tulodziecki and Grafe 2019). From a terminological and conceptual perspective, the term *Medienkompetenz* has also been challenged and reconsidered repeatedly, e.g., in relation to the terms *Medienbildung* (Tulodziecki 2010; 2011) or *digitale Kompetenzen* (Kerres 2018).

Against this background of the discourse on *Medienkompetenz*, in the 1990s, German educational researchers began to acknowledge the need for a concept of extended teacher competencies that amend and exceed the teachers’ own competent use of media and *Medienkompetenz* (Tulodziecki 2012). It was realized that media influence educational processes and thus the professional practice of teachers both indirectly and directly. On the one hand, the living environment which is infused by media impacts conditions, objectives, tasks and contents of professional teaching practice. On the other hand, media have a direct impact on possibilities, shapes, methods and structures of communicative, pedagogical and professional teacher actions. These influences were now understood to require appropriate and specific competencies of teachers to cope appropriately with the challenges connected to it (Spanhel 2017). This way, the concept of *Medienpädagogische Kompetenz* evolved (Tulodziecki 2012) to describe the competencies teacher need to fulfill all kinds of media-related challenges in their professional practice. It literally translates as “media-pedagogical competence” or, as translated in the M³K-project, as “pedagogical media competencies” (Tiede and Grafe 2016).

In this context of German educational research, a critical reflection on the use of competence concepts in media educational research was published by Tulodziecki (2010; 2011). Concentrating on the term *Medienkompetenz* [media competence], the author points out a systematic problem in its usage: it is used both as a general condition or characteristic in media-related actions and as an objective in the sense of competency acquisition, as emphasized, for example, by Sampson and Fytros (2008). As a solution, Tulodziecki (2010; 2011) suggests using the term *Medienkompetenz* in

the latter context to reflect on objectives and differing proficiency levels in the field and to speak about *Medienbildung* for media-related processes of educational relevance (cf. also Schorb 2009; Hugger 2006; Marotzki and Jörissen 2008). Overall, the term *medienpädagogische Kompetenz* is agreed upon now and considered well-established in the contemporary German scientific discourse.

2.4 *Media Literacy and Pedagogical Digital Competence*

In the English language, related terminology is less consistent. The competencies of applying and using media for a wide range of purposes, as represented in the German concept of *Medienkompetenz*, is referred to as *digital literacy* (Buckingham 2006), *media literacy* (Hobbs and Jensen 2009), *digital competence* (Ferrari 2012; 2013) or *media competence* (Ferrés and Piscitelli 2012). However, with regards to the denomination of what corresponds to the German concept of *Medienpädagogische Kompetenz*, some authors, such as Voogt (2012), avoid using a comprehensive term at all and paraphrase it, for example, as “competencies teachers need to be able to teach in the knowledge society” (p. 17). Related terms that are used in English research include, but are not limited to, *student teachers’ digital competence* (Røkenes and Krumsvik 2014), *digital competence of educators* (Redecker 2017), *teacher ICT competency* (FIT Ltd. et al. 2010) or *pedagogical digital competence* (From 2017). To achieve an enhanced understanding of the varieties and differences in reference to central terminology, it is therefore useful to look at selected definitions of *educators’* or *pedagogical digital competence(s)* as one example of a term used frequently in this context.

In the context of the European framework DigCompEdu, Redecker (2017) speaks about *educators’ digital competences* as competencies needed “to effectively use digital technologies for teaching” (p. 15). This definition is comparably narrow and considers the perspective of teaching with media only, to the disadvantage of further competency aspects such as fostering students’ media literacy or using media in contexts of professional development, which are actually included in the DigCompEdu model. The emphasis of effectivity reveals a functional viewpoint and points to an understanding of education as an improvable ecosystem with maximizable effectiveness, a perspective which might also be rooted in the political motivation and understanding of competencies behind the definition and model development process, because it naturally strives for systematic improvements and an emphasis on effectiveness.

A second definition can be found in From (2017), who postulates

“the ability to consistently apply the attitudes, knowledge and skills required to plan and conduct, and to evaluate and revise on an ongoing basis, ICT-supported teaching, based on theory, current research and proven experience with a view to supporting students’ learning in the best possible way.” (p. 43)

Like in the case of Redecker’s (2017) definition, the focus is on “ICT-supported teaching,” i.e., teaching with media. Besides, this definition represents a more complex approach. The construct of *competencies* is broken down to *attitudes*, *knowledge* and *skills* – this resembles the competency understanding proposed by Sampson and Fytros (2008) on first sight but neglects the corresponding explanation emphasizing that attitudes, knowledge and skills are only three examples out of a range of personal characteristics. The definition includes different iterative phases of media-supported teaching. Moreover, the foundation of media-supported teaching is divided into theory, research and experience, and the overall objective of these competencies is specified by an optimized contribution to supporting student learning. Notably, this more complex approach stems from a university background, and the wider perspective supports the claim of providing a well-founded definition based on relevant research sources. From (2017) mentions the objective of supporting students’ learning, which implies an understanding of the teacher’s role in educational processes as a facilitator and supporter of students who are consequently accepted as active and self-directed learners. This view shows references to constructivist learning approaches and acknowledges the opportunities offered by digital media in terms of fostering innovative role assignments and learning formats.

Instefjord (2014) summarizes “digital competence in teacher education” as “knowledge, skills and attitudes required in order to use technology critically and reflectively in the process of building new knowledge” (p. 156). As in the case of From’s (2017) definition, *attitudes*, *knowledge* and *skills* are used to specify *competencies*. Again, the scope of this definition is rather narrow because it only includes the context of knowledge building and thus neglects, e.g., a media-related organizational perspective. Yet a direct comparison suggests slightly different assumptions. Learning is referred to as “building knowledge,” which represents a constructivist understanding again. However, the actor remains unclear and the students’ perspective is not explicitly considered. Since the definition focuses on the attitudes, knowledge and skills of preservice teachers, the interpretation seems likely that the preservice teachers themselves are understood to build the knowledge for and with students. This contrasts with the view of From’s (2017) definition, where teachers are understood as mentors and supporters for students in their own construction of knowledge. Thus, it implies a different perspective on teaching and learning processes and on roles in educational and knowledge-construction processes, which ultimately

impacts the nature of the competencies in question. It is interesting to visualize these differences, especially because both authors work in an academic context and even share a Scandinavian background. Obviously, there is a certain range in understanding digital competence, even if researchers share comparable presumptions.

Krumsvik (2011) postulates a definition of digital competence as “the teacher/TEs’ proficiency in using ICT in a professional context with good pedagogic-didactic judgement and his or her awareness of its implications for learning strategies and the digital Bildung of pupils and students” (pp. 44–45). Against the background of the previously mentioned examples, it becomes evident that this definition is comparably broad in its scope. “Using ICT in a professional context” does not only include the perspective of teaching with media, it can also refer to a range of further media-related educational tasks teachers have to meet, such as professional development or supporting students’ acquisition of media literacy. The awareness of learning strategies and the digital Bildung of pupils and students supports this broad perspective and unites the foci both on the teacher and students. This corresponds to Krumsvik’s (2011) understanding of his Scandinavian perspective, as he explains that

“competence as a concept has a broader, more holistic meaning in Scandinavian English than in traditional English. [...] Teachers’ digital competence is seen to incorporate a more complex and holistic level of proficiency in the use of ICT with pedagogical judgement in educational contexts.” (p. 44)

However, in comparison to the other definitions, the translation of *competence* as *proficiency* stands out. As discussed above, *proficiency* indicates a level of competency rather than explaining or substituting for the term; the terminology appears imprecise at this point. Overall, the third Scandinavian academic approach to defining educational digital competence brings about a third unique perspective and supports the assumption that there is conceptual ambiguity even within one context.

All in all, the considerations in this chapter reveal that there is a conceptual variety in the understanding of *competence* with regards to the perspectives of different countries but also in terms of research traditions and pedagogical viewpoints. The denomination of the media-related competence in question is subject to discussion and is treated differently in different contexts. As Spante, Hashemi, Lundin, and Algiers (2018) confirm, in accordance with the findings from the definitions mentioned above, there are regional differences in the use of terms like *digital literacy* and *digital competence*. Based on a systematic review in the context of related concepts in higher education, the authors conclude that concepts, usages and definitions vary strongly and that *digital competence* tends to be used in European contexts, while the USA, and the UK and Ireland, tend to refer to *digital literacy*. The authors also state that the term *digital literacy* is mentioned or used without further definition or explanation in a majority of sources, whereas *digital competence* is mostly defined in

multiple contexts and sometimes even discussed further and/or developed. Furthermore, there are concepts of digital competence which are specifically targeted at the competencies of (preservice) teachers in the sense of *medienpädagogische Kompetenz*, while there is no specific model of media literacy of (preservice) teachers.

However, it is important to acknowledge that such definitions and concepts are not mutually exclusive. As the examples selected illustrate, they rather represent different approaches to one shared topic and are always shaped by their background. It is noteworthy in this context how terminological considerations reveal that a specific research discourse on the competencies teachers need in relation to media is less established in US research, which otherwise has a strong tradition of research on students' and citizens' media literacy. Instead of an elaboration on the concept of specific teacher competencies, there are practically oriented guidelines in the USA to help educators teach with and about media (cf. the ISTE standards and the NAMLE Core Principles of Media Literacy Education, Chapter 4.2), structural considerations from a professionalization-oriented perspective on knowledge rather than on competencies (cf. TPACK, Chapter 4.2.1) and an increasing interest in the competencies of teacher educators with regards to teaching with media, i.e., educational technology (cf. the TETCs, Chapter 4.2.4). It will be relevant for the following considerations to bear these different approaches to the research field of media-related educational competencies in mind.

3. Methodological Frame: Approaching Media-related Educational Competencies from an International Comparative Perspective

3.1 “Media-related Educational Competencies” as a *Tertium Comparationis*

The heterogeneity of terms and definitions outlined in the previous chapter indicates that a thorough comparative analysis of the competencies in question requires a careful selection of terminology. In addition to this, it is advisable, especially in the context of comparisons, not to use a specific definition or approach from one of the objects to be compared. Employing categories and terms from one concept and applying them to other objects would also entail applying the ideas, background and meaning that shape this concept to others and thus giving up a neutral and unbiased perspective. Instead, it is an established practice in the field of comparative educational research to take a step back from specific definitions and approaches and to use a *tertium comparationis*, which means finding a neutral superordinate category instead of applying terminology or concepts from one of the objects (Waterkamp 2006; Bereday 1964). Against this background, it was decided for the following work to refer to the competencies in question as *media-related educational competencies* as a working term in the sense of a previously unestablished *tertium comparationis*. *Media* in this context are understood as mediators by which potential signs in communication contexts can be recorded or created and transferred, played back or processed and presented as an image or symbol, with technical support (Tulodziecki, Herzig, and Grafe 2019). This definition includes means such as books and newspapers but also digital media like films and TV, computers, tablets or smartphones. Against the background of this definition, it makes sense for the field of media pedagogy in general – and for the focus of the following work and of the competencies to be explored – to concentrate on those modes of experience which are technically conveyed and technically available (Tulodziecki and Grafe 2019). The compound *media-related* in this context includes all kinds of contexts in which such technical agents come into play, either in direct use, e.g., as a means for purposes of illustration, or indirectly, e.g., as an object of reflection.

The adjective *educational* emphasizes the systematic connection of the analyses to the field of educational sciences. It should be noted in this context that the precise scope and understanding of *education*, which is at the core of this science, depends on the respective context and language. In German, there are the two complementary concepts of *Erziehung* and *Bildung*, which both translate as *education*. As Adick (2008) points out, this raises the issue of the relationship between these concepts and puts into question their comparability. She concludes that both concepts of education, *Erziehung* and *Bildung*, can be accepted as the objectives for comparative reflections in educational science and that it is possible to communicate about this

across languages. Hence, *educational* appears as an adequate adjective for the purpose of allocating the *tertium comparationis* to the fields of educational science and the corresponding German *Erziehungswissenschaft*. At the same time, there is a second function of this adjective: it is necessary to make a clear distinction between media-related educational competencies and concepts such as *Medienkompetenz* [media competence] or media literacy, which do not focus on the educators' or teachers' perspective and the specific pedagogical requirements. As pointed out in Chapter 2, such a distinctive lexeme is also reflected in existing terms, as for example in *Medienpädagogische Kompetenz* or in *digital competence of educators*.

Finally, considering the difference between *competence* and *competency* both terms are generally suitable for the following analysis because both the holistic concept and its constituents are focused. However, an analytic viewpoint is a central concern because, especially in the context of comparative research, it is also necessary to consider different concepts and competency aspects on a microlevel. Hence, the term and dimension of *competencies* will be focused in the following.

All in all, the suggested working term *media-related educational competencies* fulfills the purpose of being neutral, and it can be understood to include and refer to the concepts mentioned above, from the perspectives of both German and English, without using one of them. Consequently, the term does not share a definition of one of the concepts it includes but is meant to apply to all aspects, in the sense of skills, knowledge, attitudes, etc., which are introduced by the different concepts. Persons in an educating role, such as preservice teachers or inservice educators, should know and be capable of these aspects in the context of media and information technologies in school-related or educational settings to fulfill a wide range of media-related tasks and respective challenges successfully and efficiently.

3.2 International Comparative Research

3.2.1 International Comparative Methodology

Working by the methodology of international comparative research means comparing “issues or phenomena in two or more countries, societies or cultures” (Hantrais 2009, 2), which has been described to be not only a method but also a strategy that influences the whole research process from design to analysis (Hantrais 2009). Applying such an international comparative perspective brings about a number of benefits and challenges.

It has been claimed repeatedly in research that it is a central deficit of teacher education research to apply a focus too narrow e.g. in terms of nationally, locally or thematically restricted viewpoints, which is why broader perspectives are needed

(Grossman and McDonald 2008; König et al. 2011). Opening up the perspective to more than one country will enrich insights, contextualize findings and provide a sound basis for conclusions on different levels:

“Properly done, comparative education can deepen understanding of our own education and society; it can be of assistance to policymakers and administrators; and it can form a most valuable part of the education of teachers. Expressed another way, comparative education can help us understand better our own past, locate ourselves more exactly in the present, and discern a little more clearly what our educational future may be.” (Noah 1986, 154)

Consequently, studies and research taking on an international comparative perspective are beneficial in many ways because they allow for grounded conclusions with regards to generating, interrogating, testing or supporting hypotheses and theory, if applied correctly. They facilitate deeper learning about other cultures and thus provide deeper understanding about one’s own culture, which is important in terms of avoiding ethnocentrism (Hantrais 2009), i.e., a “view of things in which one’s own group is the center of everything, and all others are scaled and rated with reference to it” (Sumner 1906, 213), which is clearly counterproductive for an analysis aimed at objective and transferable conclusions. Further potential benefits include understanding important tendencies shared across nations (Fedorov, Levitskava, and Camarero 2016) and evaluating the educational processes of one’s own nation against the background of other well-performing nations (Torney-Purta 1990; LeTendre et al. 2001); this can be helpful for stimulating systematic improvements (Iyengar, Witenstein, and Byker 2014; Altun 2007) and informing policy (Hantrais 2009).

However, as the condition “properly done” in Noah’s (1986) quotation implies, the success of intercultural comparative analyses is related to and dependent on special challenges. Harkness (2008) points to the central issue of comparability, which in this context means that “the properties of data, questions, meanings, or populations, and so forth admit and justify comparison” (p. 60). Comparability needs to be enhanced by appropriate, yet not necessarily total standardization (Harkness 2008). The challenge of comparability is related to differences between cultures because different cultures have heterogeneous preconditions, understandings, or contexts. Teacher education in particular is closely tied both to its cultural and national background, for example, in terms of the influence of historical developments, its dependence on policy and its central role in and relevance for society. Therefore, an international comparative view on teacher education needs to be particularly aware of the restrictions and requirements of comparability. In this context, language and meaning are of core importance. Translation processes are often necessary but bring along certain risks, because, in the transfer of concepts and terms, connotations and

shades of meaning are at risk of being neglected. In some cases, the English language, which is usually used as a target language for such comparisons, does not include terms that other languages offer and vice versa (Blömeke and Paine 2008). As argued above, the German concepts of *Bildung* and *Erziehung*, both translating as *education*, are insightful examples for such a discrepancy, which can yet be approached by the methods of comparative education (Phillips 2006; Adick 2008). Further problematic terms in this context also include the central concepts of *Kompetenz/competence*, *Didaktik/didactics* and *Pädagogik/pedagogy*, which all have a literal translation but are used in differing contexts and carry differing connotations (Grafe 2011).

Such challenges concerning the comparability of results from different cultures as mentioned, e.g., by Harkness (2008) and Blömeke and Paine (2008) do not render intercultural comparative research impossible or necessarily deficient but highlight a need for an increased acknowledgment of specific comparative facets, viewpoints and methods. On a general level, the findings of LeTendre et al. (2001) support an assumed comparability of educational institutions and systems despite cultural differences. The authors juxtapose German, US and Japanese institutional isomorphism, i.e., largely homogenous and similar educational processes and teacher and schooling systems around the world, with their cultural variation. They conclude that there is a certain overemphasis in research on cultural impact. This is described as misleading researchers to neglect the fact that schooling and teaching, and in this sense teacher education as well, are systems which share similar predicaments. Hence, it seems acceptable to compare them even if there are differences on the cultural level, as pointed out above.

Moreover, with regards to the challenges outlined above, there are established approaches developed in international comparative research which are commonly applied to ensure valid results and comparability of materials, particularly of test instruments, from and for different cultural and language backgrounds. It has been described that translations are an important element in this context, and there are elaborate measures to achieve validity and applicability of translations, such as elaborate team translation approaches (cf. Harkness 2008; Survey Research Center 2010). Naturally, the comparability of test results depends on factors beyond translation and has to be ensured with regards to multiple viewpoints. Blömeke (2011) lists the following aspects as central when seeking validity and equivalence in comparative studies: first of all, ensuring content validity, which includes establishing personal relationships as a precondition of successful intercultural communication, understanding different ways of speaking and thinking as a precondition for the development of several project steps, and realizing, processing, and interpreting new information; and secondly, ensuring the empirical equivalence of data. In terms of the design of appropriate questions, Harkness (2008) suggests considering different options such as simultaneous, parallel and sequential approaches, and ask-different-questions

models or ask-the-same-question approaches. Furthermore, she points out that complex adaptations of different kinds can be necessary to enhance comparability, which means changing contents or design components of a question to make it more suitable for a new sociocultural context or population.

Against the background of these conditions, the intercultural comparative perspective is considered an applicable approach for the objective of exploring models, measurements and practices of advancement of media-related educational competencies in this dissertation because a comparative perspective will provide insights which go beyond the restrictions of one cultural background and thus increase the relevance and informative value of the analyses and conclusions. As argued above, teacher education in particular is closely tied to its national and cultural background, and looking at it from a comparative and comprehensive perspective helps avoid ethnocentrism and at the same time corresponds to the research desiderata postulated, e.g., by Grossman and McDonald (2008) and König et al. (2011) in terms of broadened perspectives.

With regards to the challenges pointed out above, measures need to be taken in this work to ensure valid and worthwhile conclusions. Comparability and tenuous translations have been identified as key issues in this context. Consequently, it was decided to retain the concept of *Medienpädagogische Kompetenzen* in German because of its central value for the topic of the dissertation and because a translation such as *media pedagogical competencies* or *pedagogical media competencies* can be expected either to carry different connotations and meanings than the original term or to be difficult to understand at all. The same applies to a number of further important terms, for example, *Mediendidaktische Kompetenz* or *Medienerzieherische Kompetenz*. However, retaining all of these problematic terms in their original language would affect the readability and understandability of the text. Hence, these further terms will either be subscribed by suitable periphrases and *tertia comparationis* such as “teaching with media” as a reference for *Mediendidaktik* or, if unavoidable, particularly in the context of introducing German models, be translated with literally appropriate terms. But, for their contextualization and understanding, it is advisable to keep in mind their origin and context, which will be supported by references to the original terms. Additionally, from an empirical perspective, measures will be taken to ensure comparability at the best. A complex adaptation process will be applied for a competency measurement instrument, which will be explained in detail in Part II. Central measures in this context include established translation procedures as suggested by Harkness (2008) or Survey Research Center (2010) and a focus on an extensive cognitive pretesting (Karabenick et al. 2007).

3.2.2 *Selection of Countries for Comparison: Germany and the USA*

Hantrais (2009) emphasizes the importance of selecting appropriate objects of inquiry, which can be transferred to the selection of countries to be compared. A number of related research works focus on Germany and the USA in different contexts (e.g., Grafe 2011; Blömeke and Paine 2008; König et al. 2011; LeTendre et al. 2001; Brückner et al. 2015), which evokes the impression that Germany and the USA are appropriate objects for a respective analysis. It can be observed in related research that such a selection of countries for international comparative analyses is not always justified or discussed (e.g., Clarke et al. 2006; Merz-Atalik, Beuse, and OBrien 2016). Yet, it is essential to look at the comparability of two presumably appropriate countries in detail before designing a comparative study.

Numerous differences distinguish teacher education programs in Germany and the USA, for example, with regards to systemic and organizational structures. On a systemic level, preservice teachers in most US states can acquire their teaching license after completing a Bachelor's degree with coursework in their subjects, pedagogy and teaching methods and a practicum or student teaching experience (Ries, Yanes Cabrera, and González Carriedo 2016). German preservice teachers are required to fulfill an academic phase of three and a half to five years at universities. It includes subject studies, subject-didactic studies and general educational studies as well as internships with a duration of several weeks or sometimes a whole semester. Finally, they achieve, depending on the state, either a Bachelor's and a Master's degree or an equivalent *Staatsexamen* and then have to complete an inservice training phase of one and a half to two years, which is organized and mentored by the state's education authority and independent from universities (Cortina and Thames 2013; Kammerl and Mayrberger 2011). According to Blömeke and Paine (2008), professional development and inservice education are emphasized and rewarded in the USA. In Germany, binding obligations for continuing professional development are handled individually by the German federal states but generally rather neglected. Consequently, professional development and inservice education rely on personal interest and motivation of the teachers (cf. also Blömeke 2009). With regards to organizational aspects of study programs, US preservice teachers are organized in years or cohort groups and taught according to pre-set schedules for which the institutions are responsible. Especially in undergraduate courses, there are but few options for selection. German preservice teachers, on the other hand, have a smaller number of obligatory courses and choose several electives from a selection offered by the institution. Within a framework of compulsory requirements depending on the local system and structure of teacher education, preservice teachers organize their own schedules individually. On the level of contents, general pedagogical knowledge is an illustrative example of a content area which plays a clearly different role in both systems of teacher education. It is distinguished, emphasized and structurally

established as an own important content area in German programs but integrated to a varying degree into other areas, such as educational foundations or generic methods/instructional design courses, in the USA (Blömeke and Paine 2008).

Despite these and several further differences in the organization of teacher education, Germany and the USA also share certain characteristics. Examples relevant to the context of this dissertation include, for example, cultural backgrounds, systemic organization of teacher education and pedagogical discourses in general. To start with, it is valuable to pay attention to cultural backgrounds. There are, of course, considerable differences and peculiarities with each of them, the complexity of which eludes a detailed comparison at this point. Yet on a basic level, they can both be summarized as Western countries with essential basic assumptions about democracy, human rights, the role of education, and further related aspects. Trivial as this may seem, it is yet important to acknowledge against the background of the issues of translation and of different terminology and of underlying concepts as described above, which can be expected to even increase if the common ground of two cultures has less substance. In addition to this, with regards to teacher education, both countries show systemic resemblance on a level superordinate to the organizational differences pointed out above. Teacher education is a task of higher education institutions, requires according entry requirements and results in a degree and teaching license. In both countries, the organization of initial teacher education is widely subject to the states or *Bundesländer*, with restricted influence of the federal government.

Also, with regards to the pedagogical discourse, there are noteworthy similarities. As Blömeke and Paine (2008) point out, both countries share a “strong sense of the need for and contentious debates about the possibilities of reform of teacher education” (p. 2028), which have led to an increased awareness of the importance of teacher education and continuing reform efforts (cf. also Cochran-Smith 2009). The related pedagogical discourses were described to have run largely independent from each other in the past, with increasing efforts for connection and exchange especially on the German side (Grafe 2011). There are also significant overlaps and connections between the two with regards to certain concepts of interest for the topic of this dissertation, which will be explored in greater detail in Part I.

Overall, the literature-based consideration of similarities and differences and methodological challenges lead to the conclusion that Germany and the USA offer a valid basis for the aspired comparison. While the focus of this work necessarily has to be restricted to a selection of countries to allow for a deep and concentrated analysis, the perspective will be widened in suitable contexts to take into account the developments of countries beyond Germany and the USA by further comparisons and references. It will be desirable in future studies to extend the results achieved in this work to further contexts and to substantiate the perspective achieved by further countries, cultures, and analyses.

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Media-related Educational Competencies of German and US Preservice Teachers. A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

Part I: Modeling Media-related Educational Competencies

Jennifer Tiede

The following part is concerned with modeling media-related educational competencies from a theoretical viewpoint. First, the state of research in both countries will be summarized in the following chapter by a selection of central, related models and frameworks from an international context and from the USA and Germany. Generally, all competency models share a certain dependence on their national or international background or origin. This is true for deductively derived models, which mirror a certain selection of sources considered important by the researchers, and it is equally true for inductively developed models, reflecting practices and experiences from a specific background. Hence, the structure of presentation follows the objective of including a wide range of respective backgrounds. Although the main focus of this dissertation is on a comparison of Germany and the USA, it is yet valuable to include international models in the following considerations as well. Characterized by an explicitly broad applicability and impact, they offer a contrast and enrich the perspective with potentially different foci and emphases. Hence, the perspective will be widened to international models first and then narrowed down to the USA and Germany, as the two countries of key interest. In favor of a systematic presentation of selected central models, a category-based exploration will be introduced in Chapter 4. With regards to appropriate categories for such a presentation, a glance at existing models reveals that there are numerous model characteristics that are helpful to contrast for a systemic exploration. It will be subject to Chapter 5 to bring together and systemize these characteristics and to apply the resulting categories to examples of models in detail. To facilitate such a grounded analysis, the main objective of Chapter 4 will be to provide an overview of existing models and thus depict the international and national backgrounds of the two countries focused in this dissertation. At the same time, this presentation will serve as a suitable basis to select appropriate models for an in-depth analysis. Against the background of these objectives, it appears functional to focus on selected model characteristics to achieve a comprehensive and context-focused presentation of central contents. From the spectrum of cases introduced, three models will be identified for a successive in-depth comparative analysis in Chapter 5, where a systematic approach will be developed and applied to describe, analyze and compare these models. The overall aim of these analyses is to provide an answer to the first of the research questions: "Which central models of media-related educational competencies are there in German and US research, and what are their shared characteristics and differences?"

4. Overview of Models of Media-related Competencies

To identify suitable models, an electronic search was initially conducted, combining both Google Scholar and the electronic search engine of the University library which searches, e.g., the databases Education Resources Information Center (ERIC) and FIS Bildung Literaturdatenbank. Literature previously known to the author was also considered and relevant sources were added to the data basis. The following three limitations were predefined for an inclusion of sources: 1) Publication date: published after 2005, 2) National background: either from the USA, from Germany or from an international background, 3) Availability: with full-text availability. To account for the varying terminology in the field, different sets of terms both in English and German were searched and combined. The first set included, e.g., “digital,” “media,” “technology,” or “ICT.” The second set of terms consisted of terms like “competency,” “competence,” “knowledge,” “skills,” and “literacy.” The third set of terms included “framework,” “model,” “guidelines,” and “standards.” The fourth set comprised terms like “educational,” “pedagogical,” “teacher education,” “teacher preparation,” or “teacher.” The selection of models from the results of this research for inclusion into the following overview primarily followed the criterion of relevance: models included are received and used widely and contribute to the pedagogical discourse on media-related competencies in their countries or respective backgrounds. In accordance with this interdependency of the different models, the presentation will follow a chronological order to visualize the development within the research traditions in the given frame, starting with the broader background of international models and then narrowing down the perspective to models from the US and Germany as the contexts of key interest for this work. To achieve a systematic comparative perspective and to focus the viewpoint in favor of a structured overview, the following competency model characteristics were selected for inclusion in the following presentation: 1) author and background, 2) structure and main contents summarized, 3) model function, and 4) impact and connection to the research background.

4.1 *International Models*

A selection of suitable examples from the field of international models includes the European eTQF – Teachers Competency and Qualifications Framework in the use of ICT’s in education (FIT Ltd. et al. 2010), the UNESCO ICT Competency Framework for Teachers (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2018), and the DigCompEdu Framework (Redecker 2017).

4.1.1 eTQF

The eTQF Teachers Competency and Qualifications Framework in the use of ICTs in education (FIT Ltd. et al. 2010) stems from a mixed background with authors coming from the industry sector (FIT Ltd.), governmental authorities (The City of Dublin Vocational Education Committee), and research (FOR.COM Consortium and South West College). Its development has been funded with support from the European Commission.

Teachers' ICT competencies are structured into four competence areas, namely 1) ICT, 2) Pedagogy, 3) Curriculum and Assessment, and 4) Professional Development. Each of these competence areas comprises one to six aspects, for example, "Administration" in the field ICT or "Teaching and Learning" in the field Pedagogy. There is a four-step proficiency scale to differentiate the level of competency for each of these aspects. For example, the aspect "Administration" from the field of ICT ranges from the introductory level of "Aware of the use and benefits of student management systems," up to the expert level of "Source, critique and implement emerging learning management systems as appropriate to the educational context" (FIT Ltd. et al. 2010).

The main function of the eTQF framework is described as supporting teachers' acquisition of ICTs. It is amended by an online tool to identify one's own strengths and fields for improvement and is supposed to help teachers, headmasters, education managers and education authorities to support competency acquisition (FIT Ltd., n.d.). In accordance with this, there is an explicit focus on inservice teachers and continuing professional development.

The link between the eTQF framework and the international research background is challenging to reconstruct due to the missing disclosure of sources. However, the fact that partners from Ireland and Italy collaborated and that there was EU funding renders an inclusion of sources from different national backgrounds likely. Moreover, a press release announced the involvement of over 200 teachers in Ireland, the UK and Italy (FIT Ltd., n.d.). This points to an impact of the framework on teachers in at least three European countries and thus suggests a contribution to the context of European teachers' continuing professional development. In terms of scientific reception, this model overall appears seldom referred to in related research, except for mentions in overviews of related models (e.g., Zervas, Chatzistavrianos, and Sampson 2014; Sergis, Zervas, and Sampson 2014). However, eTQF apparently achieved a certain impact in its function as a basis for the development of further models, e.g., the Norwegian Professional Digital Competence Framework for Teachers (Kelentrić, Helland, and Arstorp 2017), or for DigCompEdu (Joint Research Centre [JRC] 2017).

4.1.2 UNESCO ICT CFT

The ICT CFT Competency Framework for Teachers has been published by UNESCO and recently updated to an improved version 3 (2018). Support was provided by stakeholders from the industry sector (CISCO, Intel and Microsoft), by educational researchers (ISTE), and by further experts, e.g., European Schoolnet and Joint Research Centre (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2018).

The framework is designed as a matrix. On the left axis, there are six competency areas, which are, 1) Understanding ICT in education, 2) Curriculum and Assessment, 3) Pedagogy, 4) Application of Digital Skills, 5) Organization and Administration, and 6) Teacher Professional Learning. In the sense of a proficiency scale, there are three successive stages of teacher development at the upper axis: 1) Knowledge Acquisition, 2) Knowledge deepening, and 3) Knowledge Creation. The fields resulting from both axes are filled with competency aspects desirable for teachers. To give an example, the three competency aspects included in “Teacher Professional Learning” are “Digital Literacy” on the stage of Knowledge Acquisition, “Networking” on the stage of Knowledge Deepening, and “Teacher as Innovator” on the stage of Knowledge Creation (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2018).

The main function of the framework is guidance for pre- and inservice teacher training on the use of ICTs across the educational system, with teacher educators, educational experts, political stakeholders, teacher support personnel and other professional development providers as a target group (*ibid.*).

According to UNESCO (2018), the previous 2011 version of the ICT CFT was quite influential on a global level, an assumption which is supported by references in multiple further sources such as overviews of respective models and reviews (Zervas, Chatzistavrianos, and Sampson 2014), implementations on school level (Sergis, Zervas, and Sampson 2014) and on the level of national curricula (Butcher, Moore, and Hoosen 2014), implementation guidelines (Midoro 2013), or studies and surveys (Ansong-Gyimah 2017). It is described to have impacted national educational policies, the creation of national teacher standards, national levels of teacher ICT competency and training initiatives, education curricula and professional development courses (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2018). Hence, there is a strong link between this global framework and a presumably high number of national educational contexts.

4.1.3 *DigCompEdu*

A third international model is presented by the DigCompEdu framework (Redecker 2017). It was published by the Joint Research Centre of the European Commission [JRC], which is a service of the European Commission (cf. Chapter 5).

DigCompEdu proposes six competence areas that comprise 22 educator-specific digital competences. The first area, professional engagement, aims at professional engagement. This includes Organizational Communication, Professional Collaboration, Reflective Practice, and Digital CPD. Area two includes competences relating to digital resources: Selecting, Creating and Modifying, and Managing, Protecting, Sharing. Area three is about teaching and learning, i.e., Teaching, Guidance, Collaborative Learning, and Self-Regulated Learning. The fourth area refers to assessment tasks in the context of digital resources, namely Assessment Strategies, Analyzing Evidence, and Feedback & Planning. Area five describes competences needed for the empowerment of learners: Accessibility & Inclusion, Differentiation & Personalization, and Actively Engaging Learners. Finally, area six focusses on the facilitation of learners' digital competence, which includes Information & Media Literacy, Communication, Content Creation, Responsible Use, and Problem Solving (Redecker 2017; cf. Chapter 5.2.4).

Each of these aspects is further specified by increasing levels of progression. These competence stages are linked to the six proficiency levels by the Common European Framework of Reference for Languages (CEFR), ranging from A1 to C2, and coupled with the following role descriptors: Newcomer, Explorer, Enthusiast, Professional, Expert, Pioneer (Redecker 2017, 28). Corresponding proficiency statements reflect these levels of progression, as for example in 3.1, Teaching, in the field of Teaching and Learning: the progression for the level of A1, Newcomer, is described as "Making little use of digital technologies for instruction," and the corresponding proficiency statement is "I do not or only very rarely use digital devices or digital content in my teaching" (Redecker 2017, 53). Proficiency increases up to the highest level of C2, Pioneer, which describes an educator "using digital technologies to innovate teaching strategies": "I provide full courses of learning modules in a digital learning environment. I experiment with and develop new formats and pedagogical methods for instruction" (*ibid*).

The main functions of DigCompEdu are summarized as a conclusion on, and summary of, existing literature, guiding policy across all levels; a template for the local development of concrete instruments, discussion and exchange of best practice across borders; and a reference for the validation of local frameworks and tools (Joint Research Centre [JRC] 2017).

An earlier draft version of the framework discloses its sources, and it becomes evident that a broad basis of national and international, mainly European, media-related competency frameworks, guidelines, standards, etc. was used for the

development of DigCompEdu, and that great efforts were taken to ensure an appropriate evaluation and inclusion of the competencies found in these sources (*ibid.*). To this degree, it builds on a broad background of sources and serves as a summary of a wide research background. The impact of DigCompEdu is increasing quickly, especially in terms of application scenarios (Kullaslahti, Ruhalahti, and Brauer 2019; T. Koehler, Igel, and Wollersheim 2018; Benali, Kaddouri, and Azzimani 2018; Blanchard et al. 2019; Caena and Redecker 2019; cf. Chapter 5).

4.1.4 *Interim conclusion on international models of media-related educational competencies*

The three competency models introduced in this chapter all share a distinct international focus and strive for international applicability. Yet there are differences inherent in the three models, for example, with regards to authorship, structure and content focus, function, and impact and connection to research background. These model characteristics will be juxtaposed in the following to achieve a first contextual comparative viewpoint.

Both eTQF and UNESCO ICT CFT stem from a mixed background, as research institutions, industry partners, political and further stakeholders contributed to the model development process. Hence, a range of different interests can be assumed to have influenced the model's drafting, potentially including motivators like reputation or financial interests among the prevailing research-based objectives. DigCompEdu, on the other hand, was developed by a research team from the Joint Research Centre as a service to the European Union. The research background suggests a strong political perspective in the model and a corresponding focus on European international applicability and feasibility.

The model structures vary, as can be seen on first sight. ETQF and UNESCO ICT CFT are both designed as a matrix, which facilitates a conform structure but appears less flexible compared to DigCompEdu. DigCompEdu, on the other hand, has a considerably high complexity, with highly detailed competency descriptions and proficiency scales. It will be necessary to research in greater detail in the following in-depth analysis the effects that different levels of complexity and detail can have on the applicability and usefulness of models.

With regards to contents, it is obvious that eTQF has a clear emphasis on ICT. There are six competency aspects in relation to ICT, while there are only three in the field of pedagogy, which illustrates this emphasis. The date of publication is relevant in this regard: eTQF was published in 2010, and the understanding and emphases of the relation between ICT and media-related competencies evolved significantly since then. This can also be spotted in the adaptations made to the UNESCO ICT CFT from 2011 to 2018: the former competency field "ICT" was reorganized as "Application of

Digital Skills” and thus illustrates an advanced and contemporary understanding of ICT subordinate to respective pedagogical skills or competencies. UNESCO ICT CFT focuses more on the educator perspective and competencies and less on the technologies. This approach is even enhanced with DigCompEdu which leaves behind the matrix format and postulates innovative and flexible competency fields around media-related competencies that are usually closely connected to teaching and learning contexts (cf. Chapter 5.2.5).

In terms of functions, all three models summarized above share the general objective of contributing to initial and continuing teacher education through guidance and orientation and of enhancing research and practice with a systematic model. In accordance with the political relevance pointed out in the context of authorship, DigCompEdu additionally emphasizes international applicability and guiding policy as important functions.

More differences between the three models become obvious in the context of impact and connection to the research background. While eTQF was received primarily as a source for the development of further models, UNESCO ICT CFT achieved a high impact, and research around DigCompEdu is also evolving increasingly. It will be subject to in-depth analysis in Chapter 5 to explore which differences between models have an impact on their varying relevance and reception. The following sections will illustrate how far respective model differences and shared characteristics also apply in the national contexts of the US and Germany.

4.2 US Models

In the USA researchers have also been working on defining and modeling the respective competencies. The US research context comprises research-based models (TETCs), knowledge models (TPACK), and guidelines or standards with a distinctly practical focus (ISTE standards and NAMLE Core Principles of Media Literacy Education). Notably, such guidelines are often not equivalent to scientific competency models in terms of research foundation and validation. According to Tulodziecki and Grafe (2019), competence needs to be concretized by standards for different age groups or target groups in order to be used as an objective or reference point for educational processes. Hence, standards should be based on models and can be understood as a bridge or linking element between models and practice. However, the ISTE standards and the NAMLE Core Principles of Media Literacy Education have a comparably large impact on the US context of initial teacher education and reveal that the distinction between models and standards is not always realized systematically. Therefore, it is considered pragmatic and suitable to include both standards and models in the following, despite their systematic dissimilarity.

4.2.1 *TPACK*

TPACK is a well-established model that describes the concept and interplay of Technological Pedagogical Content Knowledge. It was published in 2006 by Mishra and Koehler based on their experiences as teacher educators in a US initial teacher education program and on Shulman's (1986) concept of Pedagogical Content Knowledge.

The TPACK model basically postulates three knowledge domains central to teacher professional knowledge: Technological Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK). The three domains are not separated but overlap: this way, the domains of Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Pedagogical Content Knowledge (PCK) emerge. At the point where all three domains overlap, Technological Pedagogical Content Knowledge (TPACK) emerges as an interplay and combination of all elements. These dimensions of knowledge are not further specified in the model but are explained in detail in related publications (Mishra and Koehler 2006). For the contextualization of TPACK, it is important to acknowledge that the focus is on knowledge and not on competencies.

TPACK claims relevance for different functions. In detail, these functions are described as guiding research and curriculum development; offering analytic tools for studying teacher knowledge and educational technology; helping in designing pedagogical strategies; describing a goal of teacher education; and, overall, "contributing, at multiple levels, to theory, pedagogy, methodology, and practice" (Mishra and Koehler 2006, 1046).

With regard to the origin and creation of TPACK, Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) stands out as the predominant research source. Hence, the model works as a link between the tradition of professionalization research and research on media educational science (Endberg 2018). Beyond the reference to Shulman (1986), the authors' experiences and practice significantly shaped the model design. In terms of reception, the impact of the TPACK model is considerable and numerous receptions, adaptations and succeeding works of research prove its high popularity (M. J. Koehler et al. 2014). It is noteworthy that this reception is not limited to the US national context but illustrates the international relevance of TPACK (e.g., Chai et al. 2011; Jordan 2011; Endberg 2018; cf. Chapter 5).

4.2.2 *ISTE standards for educators*

The ISTE standards for educators are a core outcome of the engagement of the International Society for Technology in Education [ISTE] and "define the digital age skills and pedagogical insights educators need to teach, work and learn" (International Society for Technology in Education [ISTE] n.d.). There are also ISTE standards for the target groups of students, education leaders, and coaches, as well as computational

thinking competencies for educators and ISTE standards for computer science educators.

In their latest 2017 version, the ISTE standards for educators define educators as empowered professionals and as learning catalysts. In the sense of competency fields, there are seven roles educators should fulfill. Three of these roles are grouped under the headline of “empowered professional”:

1. learners (educators should engage in professional development and continuously learn and improve their practice),
2. leaders (they should lead in student empowerment and success and in improving teaching and learning), and
3. citizens (they should inspire their students regarding a positive contribution to and responsible participation in the digital world).

The following four roles are summarized under the headline of “learning catalysts”:

4. collaborators (they should collaborate with colleagues and students for various purposes),
5. designers (they should design authentic and learner-driven activities and environments),
6. facilitators (they should facilitate student learning with technology to help students achieve the ISTE Standards for Students), and
7. analysts (they should understand and use data for instruction and supportive purposes) (International Society for Technology in Education [ISTE] 2017).

Each of these roles is specified by three to four indicators, such as 4.a) Collaborator: “Dedicate planning time to collaborate with colleagues to create authentic learning experiences that leverage technology” (*ibid.*).

In terms of functions, the ISTE standards aim to facilitate the transformation of learning and teaching and to empower connected learners in a connected world (International Society for Technology in Education [ISTE] n.d.) by offering plain and concrete guidance for educators and for their role understanding. Hence, there is a distinct practical focus, which is a contribution to the improvement of practices in teacher education.

With regard to the relation between ISTE standards and research background, there is a close connection of the standards to a wide range of US sources and selected resources from outside the US. The development methodology of the 2016 version combined a literature review with a focus on scientific research on topics such as empowered student learning, computational thinking or digital citizenship, with consultations with different stakeholder groups and experts and public feedback from the USA and over 50 other nations (International Society for Technology in Education [ISTE] 2016).

As far as the impact is concerned, numerous sources, especially from the US context, give the impression that there is a strong influence of the standards on current practices. Besides the scientific reception and contextualization of the ISTE standards (DeSantis 2016), their indicators are suitable for adoption and application for assessment purposes (cf. Çoklar and Odabaşı 2009; Sharp 2014; Şimşek and Yazar 2016; Grable, Hunt, and Wood 2004; in Germany: Siller 2007). The ISTE standards have also frequently been used as a framework for the evaluation, development and improvement of related study programs (Alghazo 2006; Sutton 2011; Lewis 2015).

4.2.3 *NAMLE Core Principles of Media Literacy Education*

The National Association for Media Literacy Education [NAMLE] describes itself as a US national organization dedicated to media literacy and to fostering critical thinking, effective communication and empowered media participation (National Association for Media Literacy Education [NAMLE] n.d.). In this context, the NAMLE Core Principles of Media Literacy Education (2007), based on previous scholarship in related fields, were published to “articulate a common ground around which media literacy educators and advocates can coalesce” (*ibid.*, p. 1).

The NAMLE Principles basically list six statements and specify them by a number of implications for practice. The six statements are:

1. “Media Literacy Education requires active inquiry and critical thinking about the messages we receive and create”;
2. “Media Literacy Education expands the concept of literacy (i.e., reading and writing) to include all forms of media”;
3. “Media Literacy Education builds and reinforces skills for learners of all ages. Like print literacy, those skills necessitate integrated, interactive, and repeated practice”;
4. “Media Literacy Education develops informed, reflective and engaged participants essential for a democratic society”;
5. “Media Literacy Education recognizes that media are a part of culture and function as agents of socialization”;
6. “Media Literacy Education affirms that people use their individual skills, beliefs and experiences to construct their own meanings from media messages” (*ibid.*).

An example of the implications for practice linked to each of these sentences is 6.1: “MLE is not about teaching students what to think; it is about teaching them how they can arrive at informed choices that are most consistent with their own values” (*ibid.*).

The main functions of the NAMLE Core Principles are fostering dialogue and contributing to the development of clear and measurable outcomes for US schools

(*ibid.*). This is achieved by a focus on the perspective of Media Literacy Education and descriptions of characteristics and guidelines for this discipline, as opposed to the specification of teachers' knowledge, as in TPACK, or competencies, as in the ISTE standards for educators. To this degree, they are not directly relevant for an analysis of educators' competencies. Yet they shape a systematic picture of aspects considered relevant for teaching media literacy in the US and are thus an important source in the context of respective competency models, especially because there is no corresponding scientific model of media literacy competencies for US educators so far.

The NAMLE Core Principles of Media Literacy Education were authored by ten members of NAMLE with a research background in US media literacy, namely Lynnda Bergsma, David Considine, Sherri Hope Culver, Renee Hobbs, Amy Jensen, Faith Rogow, Elana Yonah Rosen, Cyndy Scheibe, Sharon Sellers-Clark, and Elizabeth Thoman. Sources used for crafting the document included the international and national works of associations, centers and institutes, e.g., the Association for Media Literacy; political sources, e.g., the Ontario Ministry of Education Media Literacy Resource Guideline; and publications from relevant researchers in the field, which are listed in the publication (National Association for Media Literacy Education [NAMLE] 2007). Hence, there is a strong connection between the NAMLE principles and the national research background amended by international references. Consequently, the reception of the principles has been prominent, especially in their target field of US media literacy education, as, for example, in implementations as described by Rogow (2009) and Kim (2016), or as a basis for the quantification and measurement of media literacy (Arke and Primack 2009).

4.2.4 TETCs

The Teacher Educator Technology Competencies [TETCs] are a recent contribution to the US research discourse. They were published by Foulger, Graziano, Schmidt-Crawford, and Slykhuis in 2017 and describe the technology competencies “*all* teacher educators need in order to support teacher candidates as they prepare to become technology-using teachers” (Foulger et al. 2017, 413).

The TETCs comprise twelve competencies:

- “Teacher educators will design instruction that utilizes content-specific technologies to enhance teaching and learning,
- Teacher educators will incorporate pedagogical approaches that prepare teacher candidates to effectively use technology,
- Teacher educators will support the development of the knowledge, skills, and attitudes of teacher candidates as related to teaching with technology in their content area,
- Teacher educators will use online tools to enhance teaching and learning,

- Teacher educators will use technology to differentiate instruction to meet diverse learning needs,
- Teacher educators will use appropriate technology tools for assessment,
- Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environments,
- Teacher educators will use technology to connect globally with a variety of regions and cultures,
- Teacher educators will address the legal, ethical, and socially-responsible use of technology in education,
- Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching,
- Teacher educators will engage in leadership and advocacy for using technology, and
- Teacher educators will apply basic troubleshooting skills to resolve technology issues” (Foulger et al. 2017, 432–33).

As in the case of most of the other models and guidelines introduced, the overall function of the TETCs is directed towards the improvement of initial teacher education practices. This function is specified explicitly: the authors support the vision of a comprehensive infusion of technology into the whole teacher education curricula, as opposed to stand-alone educational technology courses (i.e., Technology Infusion Approach; Foulger et al. 2017; Foulger, Wetzel, and Buss 2019), and the TETCs are designed as an instrument for fostering this development and for offering a reference for all teacher educators to become competent in the field of educational technology.

The TETCs are well-founded in primarily national research; they were developed deductively from a wide range of sources and validated with the help of experts (Foulger et al. 2017). Hence, they are strongly rooted in the US national research context and are designed to contribute significant research input for systematic improvements. There is a political dimension of the efforts, too, given that the TETCs were also developed to answer policy claims in the National Education Technology Plan from 2017 (*ibid.*). It is noteworthy that in comparison to the other models and guidelines introduced, their focus is on teacher educators instead of preservice or in-service teachers. This way, they broaden the field of research and contribute another important facet to the overall scientific discourse. Due to their recent publication, the TETCs are referred to in scientific sources mainly by the authors and by other members of the Society for Information Technology and Teacher Education (SITE) – the society where the TETCs were primarily introduced and discussed so far, as, for example, in Graziano, Foulger, Schmidt-Crawford, and Slykhuis (2017) or in Knezek and Christensen (2019).

4.2.5 *Interim conclusion on US models of media-related educational competencies*

A contextualization and juxtaposition of these four models and guidelines from the USA reveals insightful comparative conclusions. The comparison criteria focused on were authorship, structure and content focus, function, and impact and connection to research background.

Authorship of the US models point to a certain role of professional associations and societies in the context of competency modeling in the US: both the ISTE standards and the NAMLE Core Principles of Media Literacy Education indicate the connection to their respective association in their very names, and while the TETCs are published by four researchers, their connection to the SITE is evident, given that the competency framework was discussed with SITE participants, was first published at a SITE conference (Foulger et al. 2017), and is referred to in a number of papers from SITE Proceedings (Knezek and Christensen 2019; Carpenter et al. 2019). TPACK appears as the only framework without an evident connection to a society or association. While the models and standards selected for this overview are not exhaustive, their contextualization yet implies that professional societies in the USA play an important role in the development and establishment of impactful frameworks.

There are differences on a structural level between TPACK, on one hand, and the ISTE standards, NAMLE Principles and TETCs, on the other. TPACK has a model structure with three main dimensions and their intersections, while the other three frameworks are designed as lists with headlines or main aspects with additional explanations and clarifications. These different structures bring about obviously different levels of detail inherent in the basic model. Additionally, in terms of content, the four models show clearly diverging foci. As has been argued above and will be more deeply explored in Chapter 5, TPACK has a narrow focus on the knowledge domains needed for an educational implementation of digital media into teaching and learning contexts. In comparison to that, the ISTE standards assume a broader perspective and provide guidance on practical competencies needed by educators for teaching and learning contexts with a certain focus on the educational technology perspective. The NAMLE Core Principles, on the contrary, emphasize a media literacy perspective with a focus on educational processes instead of educators' competencies; and the TETCs add a view on the dimension of teacher educators, also focusing on educational technology competencies. There are a number of cross-references between these four frameworks. For example, there are connections evident between the ISTE Standards and the NAMLE Core Principles: in statement 6.2 from the NAMLE Core Principle, it says "MLE helps students become aware of and reflect on the meaning that they make of media messages, including how the meaning they make relates to their own values" (National Association for Media Literacy Education [NAMLE] 2007, 5), which corresponds to ISTE standard 3b: Educators "establish a learning culture that promotes curiosity and critical examination of online resources and fosters

digital literacy and media fluency” (International Society for Teaching in Education [ISTE] 2017). However, their perspectives differ significantly; the ISTE standards are oriented towards educators’ competencies or skills while the NAMLE standards are focused on educational processes. Also, DeSantis (2016) points out certain overlaps of the ISTE standards and TPACK but cannot confirm a relationship between TPACK and ISTE proficiencies of preservice teachers in a study. The authors of the TETCs emphasize the importance and impact of the ISTE standards but conclude that it is necessary to develop a separate framework with a specific focus on teacher educators. This brief overview of contents illustrates that the four frameworks emphasize different foci and are separated by disciplinary orientation and target groups.

Consequently, the four models share central functions in terms of a contribution to, and systematization of, media-related education, but they assume different viewpoints. They also have different target groups, as they address either preservice teachers (TPACK), inservice teachers (ISTE standards and NAMLE Core Principles), or teacher educators (TETCs). The guideline characteristics of the ISTE standards, the NAMLE Core Principles and also the concrete formulations in the TETCs facilitate a direct and user-friendly application in a variety of educational processes as a means of orientation, reference and structure, while TPACK requires further specifications due to its broad and open design, but can also be used in the functions of an orientation and reference framework.

A view into literature and practice reveals that these functions are realized and have an impact on the respective backgrounds to varying degrees. TPACK is particularly widely used not only in the US but beyond, especially for measurement and reference purposes, while the ISTE standards stand out with their relevance in the alignment and systematic structuring of initial teacher education curricula in the US. The NAMLE Principles are mainly used as a reference for media literacy education in the US, albeit on a less binding level if compared to the ISTE standards, which also shape some state standards (cf. Chapter 10.2.2). The TETCs, which are quite recent, are still being researched and thus have the lowest impact on research background in comparison to the other frameworks but receive growing scientific awareness, as described above. This finding is related to the connection of the four frameworks to their own backgrounds. It is noteworthy that TPACK, the ISTE standards, the NAMLE Core Principles and the TETCs explicitly build on US national sources with selected references to international resources.

Overall, the differing foci can be read to imply that the four frameworks generally complement each other because they all contribute to forming one comprehensive picture of media-related education in the US. Against the background of the lower level of detail inherent in TPACK, it is noteworthy that this model appears to have the highest international impact. The role that TPACK plays in international contexts and its characteristic focus in the light of other models will be elaborated in Chapter 5.

4.3 German Models

In Germany, there is a tradition of a lively pedagogical discourse which, as described in Chapter 2, encompasses a considerable amount of research focused on teachers' *Medienkompetenzen* [media competencies]. It focused on the term *medienpädagogische Kompetenzen* [media pedagogical competencies] in the 1990s when different research projects led to the conclusion that teachers need skills beyond their own use and application of digital media, such as the design of media-enhanced learning environments or the integration of media education into the genuine pedagogical frame (Baacke 1995; Tulodziecki 1995; 2012). However, research related to *medienpädagogische Kompetenzen* and according models received less attention for a long time (Kammerl and Mayrberger 2011). As Siller (2007) points out, this is due to chronology – a focus on media competencies was the basis upon which there was increasingly more research on *medienpädagogische Kompetenzen* being conducted in a second step –, and also due to difficulties in the conception of *medienpädagogische Kompetenz*. In 2007, the author described the dialogue about groundwork in this field as only at its beginning, an assumption that can be questioned critically against the background of the important and influential approaches that date back to the 1990s and will be introduced in the following section. It can be said that a lot of work has been done in this field in the last few decades, but it has not yet brought forward a consensus on a definition or a universal model. The following selected models from this field illustrate the varieties and different foci that models of media-related educational competence have been adopting.

4.3.1 Tulodziecki

An early contribution to the German research field and an important milestone in the German discourse on *Medienpädagogische Kompetenzen* are the five target areas of media pedagogy proposed by Tulodziecki and Blömeke (1997), German educational researchers working in the field of initial teacher education. The target areas claim that teachers should be ready and able (1) to demonstrate media competence themselves; (2) to understand the significance of media in the lives of children and youths and to include them in their teaching with and about media; (3) to assess media offerings regarding their appropriateness for lessons and to develop their own contributions to teaching and learning processes and to plan, realize and evaluate according teaching units; (4) to realize media-related educational tasks in lessons and in mentoring; and (5) to understand and influence school-related conditions of working with media (such as personal or organizational) and to contribute to media-pedagogical concepts in the sense of school reform (Tulodziecki 2012).

Based on his earlier works, on respective project work in Paderborn (e.g., 1997a; 1997b; 1997c; 1998; 1999; Moll and Tulodziecki 2000) and the wider German national

research background, Tulodziecki further suggests standards for *medienpädagogische Kompetenzen* in teacher education. He defines *standards* as an expression of competencies that should be reached at a certain point in initial teacher education (2012; in conformity with Klieme et al. 2003) and explains in detail the model that is the basis of his standards.

Tulodziecki's (2012) model of teachers' *medienpädagogische Kompetenzen* includes three main target areas, which are (1) the use of media for the stimulation and support of learning processes, (2) the realization of media-related educational tasks, and (3) the development of media pedagogical concepts in school (p. 282). Each of these areas further comprises five competency aspects, which are

- understanding and assessing conditions for media pedagogical actions (on an individual, societal and historical level);
- characterizing and assessing theoretical approaches for media pedagogical actions (from an empirical and normative perspective and/or with regards to a possible realization);
- analyzing and assessing examples of media pedagogical actions (with regards to preconditions and objectives as well as procedures and devices);
- developing own suggestions for media pedagogical actions, based on theory (including the description of objectives, under consideration of preconditions and including plans about appropriate procedures and devices); and
- testing and evaluating theory-based examples for media pedagogical actions (collecting, analyzing and interpreting data; pp. 283-284).

Tulodziecki (2012) also provides examples of standards to specify each of these competency aspects for each area, while pointing out that these are examples only and need to be adapted with regard to specific conditions such as the state, university, or study program for which the standards are required.

In a more recent contribution, Tulodziecki (2017) refines and amends this model. Based on his earlier considerations and also taking into account the M³K model (Herzig et al. 2015), which shows strong references to Tulodziecki's (2012) model, he aspires to shape a curricular framework for media pedagogical studies, including relevant topics and contents. This framework includes four competency fields, which are (1) Learning and teaching with media/in digital environments, (2) Realizing educational and mentoring activities in the context of mediatization and digitalization, (3) Developing and evaluating projects or teaching-learning-units for learning about media (including digital basics), and (4) Improving institutional frame conditions for media pedagogical actions (Tulodziecki 2017, 7). Obviously, the three competency areas as defined in 2012 were reformulated and restructured to include "(3) Developing and evaluating projects or teaching-learning-units for learning about media (including digital basics)," which was not a distinct competency area before. The five

competency aspects, on the other hand, were retained in their original definition, except for the second one, “characterizing and assessing theoretical approaches for media pedagogical actions,” which has been differentiated as “characterizing and assessing theoretical approaches about and empirical research on media pedagogical actions” (*ibid.*).

In terms of functions, the overall context of Tulodziecki’s works contributes to the systematic foundation of (German) teacher education by providing a structured reference frame. In this context, the competency model serves as a foundation for the formulation of sound standards which can then contribute to systematic advancements through the functions of evaluation, orientation, qualification, curriculum, reform, professionalization, and certification (Tulodziecki 2012).

There is a strong link between Tulodziecki’s works and the national German research context. References to numerous German authors from this field are constantly included and integrated, and other important German educational researchers build on Tulodziecki’s works as well (e.g., Blömeke 2000; Herzig et al. 2015; Spanhel 2017). Consequently, Tulodziecki’s works on models of *Medienpädagogische Kompetenz* can be considered central sources within the national German research discourse on media-related educational competencies.

4.3.2 *Blömeke*

Besides the early concepts of *medienpädagogische Kompetenz* introduced by Tulodziecki, as described above, further related concepts were introduced by Baacke (e.g., 1973; 1987; 1994; 1996a; 1996b; 1999) and Schulz-Zander (e.g., 1997). The three approaches of Tulodziecki, Baacke and Schulz-Zander share a significant number of central characteristics which have been summarized and synthesized by Blömeke (2000) into a comprehensive deductive model. Hence, it appears functional to include Blömeke’s (2000) model as a representation of and conclusion from the formerly mentioned three approaches.

The author abstracts five core areas of *Medienpädagogische Kompetenzen* which are part of all three approaches. These five areas are:

1. Media didactical competence, defined as the ability to use media and information technology in appropriate teaching and learning formats in a reflected way and to further develop them;
2. Media educational competence, defined as the ability to cover media-related topics in the sense of pedagogical principles in school;
3. Socialization-related competence in media contexts, defined as the ability to consider learning conditions constructively during media pedagogical actions;
4. School reform competence in media contexts, defined as the ability to design the conditions of media pedagogical acting innovatively; and

5. Own media competence, defined as the ability for appropriate, self-determined, creative and socially responsible acting in the context of media and information technologies (Blömeke 2000).

All five competency areas comprise two or three competency aspects.

According to Blömeke (2000), it is necessary for teachers to have *medienpädagogische Kompetenzen* in order to be able to facilitate their students' acquisition of media competencies, which is considered a fundamental and important task of schools (cf. also Blömeke 2003; Siller 2007). The overall purpose of Blömeke's work has been summarized as a contribution towards the shaping of a profile of media pedagogy in teacher education. The definition of contents and learning objectives relevant for media pedagogy are linked to the question of ways to anchor them in teacher education (*ibid.*).

The close connection between Blömeke's model and the German research background has been emphasized above in the context of model sources. It is worth mentioning that the resulting model also had a strong mutual impact, as it has been considered a basis for most subsequent German developments (Siller 2007).

4.3.3 Bremer

One of the approaches that developed on the basis of Blömeke's and Tulodziecki's earlier works has been published by Bremer (2011a) in the context of a state-wide initiative based on political support in the state of Hesse. Against the background of research and former German approaches, Bremer (2011a) postulates six competency areas:

1. Content-related competencies: instrumental-pragmatic basics (preservice teachers have learned to use media effectively for supporting their own learning in their studies);
2. Content-related competencies: theoretical basics (preservice teachers have learned to differentiate and delimit scenarios for new media in educational processes with regard to their various potential conducive to learning, and to evaluate the model functions of new media and to illustrate these by examples from their subjects);
3. Content-related competencies: using media in class (preservice teachers have learned to use new media in educational processes to achieve new ways of illustrating and fostering understanding, to organize the use of new media in educational processes to encourage learners' self-organization and self-dependence, and to advocate the pedagogical meaningfulness of media-use scenarios they developed);

4. Process-related competencies: the ability to work in a (heterogeneous) team in media-related contexts;
5. Process-related competencies: mediation skills (preservice teachers have learned to impart knowledge and skills related to new media in a way that others may learn from); and
6. Process-related competencies: auto-didactic competence (preservice teachers have learned to assess developments in the field of new media to derive their own need for continuing education).

The author introduces a model of *medienpädagogische Kompetenzen* for preservice teachers in the German federal state of Hesse. Notably, this model has a distinct practical focus and relevance, as it was developed on the initiative of and with support by the state Hesse, in the context of the development of a state-wide concept for *Medienkompetenz* in teacher education for all phases of teacher education: university initial teacher education, practical teacher education at school, and continuous professional development (Arbeitsgruppe “Neue Medien in der universitären Lehrerbildung” 2004).

Against the background of the formerly mentioned sources, the imprecise use of terminology in Bremer’s approach stands out. The author speaks about *Medienkompetenz*, but the competencies described go beyond media competence and clearly refer to *medienpädagogische Kompetenzen*, a term that is also inconsistently used throughout the document. Additionally, the concept that emerged from the project based on the competency model is called “Medienbildungskompetenz für Lehrende,” which translates as “Media education competence for teachers,” and is a third related term used without definition or clear distinction to *Medienkompetenz* or *medienpädagogische Kompetenzen* (cf. Tulodziecki 2010; 2011). This adds to the conceptual lack of precision.

As pointed out above, Bremer’s (2011a) competency model was influential particularly in the context of teacher education in the state of Hesse and served as a basis for the development of a competency certificate for preservice teachers at Goethe-Universität Frankfurt and of a media education concept for all preservice teachers in Hesse (Bremer 2011b).

4.3.4 M³K

The M³K project was a three-year German research project running from 2013 to 2015, conducted by four university partners and research institutions and funded by the German Federal Ministry of Education and Research. Its main objective was modeling and empirically validating a competency model of *medienpädagogische Kompetenz*.

In the M³K model, *Medienpädagogische Kompetenz* is basically understood as an interplay of the three main competency fields of *Mediendidaktik* (teaching with media), *Medienerziehung* (teaching about media) and *Medienbezogene Schulentwicklung* (media-related school reform). In addition to this, technological knowledge and non-cognitive facets, i.e., beliefs and perceived self-efficacy, are understood as important and conducive basic aspects having an impact on respective *medienpädagogische Kompetenzen* (Herzig and Martin 2018).

Based on this fundamental understanding, competency aspects amend the three main areas and thus shape a matrix: at the upper axis, there are the three main areas, i.e. *Mediendidaktik* (teaching with media), *Medienerziehung* (teaching about media) and *Medienbezogene Schulentwicklung* (media-related school reform). Five competency aspects form the vertical axis. These competency aspects are (a) understanding and assessing conditions, (b) describing and evaluating theoretical approaches, (c) analyzing and evaluating examples, (d) developing one's own theory-based suggestions, and (e) implementing and evaluating theory-based examples. Each field between the two axes is filled with standards that specify the competency outcomes. For example, the two standards in the field of media education for the competency aspect of “describing and evaluating theoretical approaches” are: “Student teachers are able to describe concepts of media education and related empirical findings appropriately,” and “Student teachers are able to assess concepts from an empirical, normative or practical perspective” (Herzig et al. 2015; Tiede and Grafe 2016; Herzig et al. 2016). In most cases, these standards are further differentiated.

Beyond a grounded contribution to research on *medienpädagogische Kompetenz* and respective systematic advancements for German teacher education, the functions of the M³K model also include forming a suitable basis for the respective competency measurement which can then help validate the model (Herzig et al. 2015).

Against the background of the German research approaches outlined above, it is evident that the M³K model has been derived deductively, building primarily on established national sources such as the works of Tulodziecki and Blömeke. For example, a clear connection to Blömeke (2000) and Tulodziecki (2012) is visible in the assignment of media didactics/teaching with media, media education/teaching about media, and media-related school reform as the three main areas of competencies. Also, the five aspects of competencies represented in the left axis of the matrix, and the overall structure of a matrix, resemble the ideas postulated by Tulodziecki (2012). These parallels stem from the overall intention of the M³K project to develop a deductively and inductively reasoned and empirically validated structural model (Herzig et al. 2016), and they suggest a thorough literature review be performed in the development process and illustrate the role of the M³K model as an advancement of the Paderborn approach significantly shaped by Tulodziecki, as described above. The attempt to both model and empirically measure the competence in question

represents the innovative approach in the M³K project because such a validation is novel to the German research context so far (*ibid.*). The scientific reception of the M³K model includes references in related literature (Goetz 2018; Goecke, Stiller, and Pech 2018), further model developments (Tulodziecki 2017), international comparative analyses (Tiede and Grafe 2016; 2019) and an orientation of teacher education curricula in single institutions (Tiede and Grafe 2019; cf. Chapter 11.2).

4.3.5 *Interim conclusion on German models of media-related educational competencies*

Overall, the four German models of *medienpädagogische Kompetenz* introduced reveal both parallels and mutual references, as well as a number of differences with regards to the criteria of authorship, structure and content focus, function, and impact and connection to research background.

In terms of authorship, they have all been published by educational researchers with a university background, either based on individual works (Blömeke) or on a project context (Tulodziecki, Bremer, M³K), which brings about funding and, consequently, the interests of further funding stakeholders. Again, all four models build explicitly on national German sources and thus overlap. Consequently, the structures of the four frameworks are similar: all of them list basic competency areas which are then explained or specified by standards.

Considering their contents, they are all, with the exception of Bremer's (2011a) model, connected by the basic idea of teaching with media and teaching about media as two core dimensions of *medienpädagogische Kompetenz* and of a media-related school reform competence. Further aspects that shape all approaches to varying degrees are the notions of social competencies and of own technological skills – even though the roles of such aspects differ. For example, while they are an inherent part of Blömeke's (2000) model, they are considered to be either integrated, as in the case of social competencies, or a correlate, as in the case of technological knowledge in M³K. In relation to the other approaches, it is evident that Bremer's deviates, for example, from Tulodziecki's and Blömeke's models by shifting emphases. The notion of media educational competency, i.e., competencies in teaching about media, is rather neglected, while the media didactical, social and technical perspectives are stressed.

All of the four models are united by their objective to contribute to the context of German initial teacher education and to provide a framework to fulfill numerous functions in this context, such as orientation and guidance.

However, the scope of actual influence varies: while Tulodziecki's and Blömeke's works are considered to be core groundwork for most respective publications and developments in German-speaking countries, the influence of Bremer's model appears mainly limited to the state of Hesse. Out of the selection, M³K is the only model that

was analyzed and exploratorily tested against an international background (Tiede and Grafe 2016; 2019) but has received limited impact on actual practices in Germany so far, a fact that might also be linked to the non-finalized validation of the measurement instrument (Herzig et al. 2015; Endberg 2018). A noteworthy observation concerning the links of the introduced German competency models to their national research background is the fact that they are all closely linked and build on each other. While setting their own emphases, as in the case of Bremer's model, they all share the basic idea of a construct of *Medienpädagogische Kompetenz* and include competency areas as structural means.

4.4 Interim Conclusion on the Overview of Models of Media-related Educational Competencies from Three Different Contexts

All in all, the brief overview in this chapter of selected models and frameworks of media-related educational competencies from international contexts, the USA and Germany offers an introductory approach to the complex field of competency modeling and allows for first conclusions regarding the first research question: "Which central models of media-related educational competencies are there in German and US research, and what are their shared characteristics and differences?" In favor of a systematic and comprehensive approach, these characteristics and differences were specified to the categories of author and background, structure and main contents summarized, model function, and impact and connection to the research background.

The consideration of model authorships proves that different stakeholders can be involved in the process of competency modeling. As one might expect, most of the authors of the models introduced have a research and university background. In the US context, a certain tendency of organizing the modeling process via professional associations was discovered, whereas individual approaches led to the design of German models, and formal project structures shaped the frame for international and German models. In the case of such formal project structures, researchers as authors sometimes worked together with industry partners, as in the case of the international approaches eTQF and UNESCO ICT CFT and, through funding, also embraced a political perspective which dominates international approaches in particular and shapes a perspective of broad applicability of the resulting models.

The contents of the models vary clearly, although there are certain links, either explicitly – as in the case of the M³K model, which has been described by the authors to build, e.g., on Blömeke's (2000) model (Herzig et al. 2016) – or indirectly, as in the case of the ISTE standards and TPACK, which share certain assumptions and aspects. DigCompEdu stands out in this context because of its clear disclosure of sources that included a wide range of national and international approaches. However, it

has also become obvious that there are significant divergences between some competency models, rooted in different structures, perspectives and foci. In the case of the US, some of the approaches introduced hardly had any assumptions in common; for example, the ISTE standards aim at supporting teachers in the media-enhanced transformation of teaching and learning, while the NAMLE standards are targeted at the facilitation of media literacy education. The disciplinary distinction between the perspectives of media literacy and educational technology contributes significantly to the models being focused rather narrowly. The international models introduced, however, share a certain emphasis on comparable competencies. Likewise, the German sources were closely interconnected by a shared concept of *Medienpädagogische Kompetenz* and by building on Tulodziecki's and Blömeke's works in particular.

Also, on a structural level, the approaches introduced from the US varied due to the inclusion of standards and guidelines as opposed to research-based scientific competency models, as in the international and German frameworks. This inclusion of standards and guidelines was considered necessary due to a lack of respective research-based competency models and also due to the relevance of the ISTE standards and the NAMLE Core Principles of Media Literacy Education for the context of media-related teacher education in the US. The design of these standards brings about a direct applicability in educational contexts. Overall, all of the approaches introduced were connected by the general function to contribute to initial teacher education or educational contexts in a more general frame by providing a structure for orientation and guidance. As pointed out, the impact varies from local realizations, as in the case of M³K, to national relevance, as in the case of the NAMLE Principles, and to a wide international application, as can be seen with DigCompEdu.

However, the impact achieved by the different models introduced cannot fully be explained by the overview provided. While it is obvious that an international model such as DigCompEdu, funded and supported by the European Commission, is likely to achieve a larger impact compared to a national and non-English model such as M³K, it is still questionable how the model characteristics are connected, how far single models from different research backgrounds can be contextualized, and what can be learned from such a contextualization. Hence, against the background of the introductory comparative observations mentioned above, it is now consistent to consider a selection of models in greater depth and to apply a structured methodology for researching these and other decisive model features, based on related literature and research. Such a methodology will be developed and applied in the following chapter, which introduces a differentiated systematic comparison of three selected models of media-related educational competencies.

5. Systematic International Comparison of Competency Models

5.1 Model Comparison Methodology

5.1.1 Research Approach and Procedure

The research interest of the following chapter corresponds to the second part of the research question introduced in the beginning: “Which central models of media-related educational competencies are there in German and US research, and what are their shared characteristics and differences?” In favor of a well-grounded conclusion on such characteristics and differences, it is useful to apply a systematic comparison building on the previous chapter to analyze shared characteristics and differences of selected competency models and thus to ultimately achieve an enhanced understanding of what competency modeling means and comprises. The discipline of comparative education offers a variety of methodological approaches for comparisons serving different purposes. Theisen and Adams (1990; cf. also Phillips 2006) suggest differentiating between analytical, descriptive, evaluative, and exploratory research types. Analytical research serves to describe roles, to specify cause-and-effect relations or to explain relations and consequences; descriptive research describes phenomena or conditions and relations between variables; evaluative research judges the merit, value, or worth of a program or technique and facilitates interpretations useful for decision making; and exploratory research aims to generate new hypotheses or questions and explores relationships and functions with potential for in-depth research (for an overview of methods, cf. also Phillips and Schweisfurth 2006; Bray, Adamson, and Mason 2007; Khakpour 2012). The methodological approach applied in the following can be allocated to the analytical research methodology as described by Theisen and Adams (1990) because the relationship between competency aspects and their meaning for the whole model will be focused on from an analytical stance.

A concrete approach from the field of analytical research, which has become a standard of reference within German comparative educational research, has been postulated by Hilker (1962). For the procedure of systematic comparisons, the author suggests four steps: 1) Description, in the sense of a baseline study to investigate the objects in question by means of own observations and/or literature; 2) Interpretation, as an explicative analysis against the background of historical and societal conditions; 3) Juxtaposition, as a first step of comparison, where the pedagogical phenomena in question are considered side by side with respect to pre-defined criteria; and 4) Comparison, as a second step of comparison, where consistent criteria for evaluation are developed on a superordinate level and where theory-based hypotheses may be developed (1962; summarized in Adick 2008). This approach is

considered applicable for the following analysis because it allows for a systematic and analytical comparison of models and model characteristics, it offers a step-by-step procedure and it is well-established within German research. Its proximity to Bereday's (1964) often used approach (Adick 2018) suggests a suitability also for international comparative contexts.

However, Adick (2008) also thematizes a critique which has been addressed to Hilker's approach regarding the inductive nature of his procedure. The approach takes a beginning in empirical findings and claims the development of a comparison in the course of the process. The conclusion and hypotheses at the end stem from single empirical observations, although it does not logically make sense to make inferences about regularities from single observations. To meet this critique and to achieve a sound methodology, certain adoptions were made in the following by an emphasis put on the pre-definition of comparison criteria. Hence, the comparison of the models was preceded by an exhaustive literature review in the field of competency modeling in order to clear main functions and characteristics of competency models. In this context, central sources include Hartig and Klieme (2006), Klieme and Hartig (2007), Artelt and Schneider (2011), Neumann (2013), and the taxonomy of cognitive skills (Bloom and Krathwohl 1956; Anderson and Krathwohl 2001). The model characteristics specified in these works relate to a variety of aspects, and competency models are described from different perspectives. On this basis, the findings were classified, and categories were deducted to achieve a comprehensive approach that takes into account the state of research. These categories are 1) background, 2) methodology/model genesis, 3) structure, and 4) contents.

In the analysis, the four steps of comparison as suggested by Hilker (1962) were performed successively to ensure a technically sound analysis: after the literature review and the genesis of criteria based on this review, the models were first described separately, then interpreted, then juxtaposed and only then compared. However, the adoption of Hilker's approach in terms of a category-based procedure applied throughout these four steps suggests an according structure also for the presentation of results. Therefore, the following chapter will draw findings together following the structure of the deductively developed categories. It will first describe each of the three models in the study with respect to a category and then integrate findings on a comparative and interpretative level. Such an approach will help avoid redundancies and achieve an adequate and coherent presentation in accordance with the category-based procedure.

5.1.2 *Selection of Models*

The presentation in Chapter 4 of relevant models from the three areas of interest, i.e., international, US, and German contexts, provides a sound basis for a grounded decision regarding suitable objects for the succeeding in-depth analysis. Based on relevant literature regarding competency model features, characteristics and examples, this decision was informed by the following criteria: 1) Innovative potential of the model: does it contribute something new to its national or even international research background?, 2) Impact: is the model recognized and well-established?, 3) Measurement instruments: are there measurement instruments existent or in development?, and 4) Validation: is the model well-grounded and validated?

A fifth aspect did not directly influence the selection of models but rather served as a criterion to evaluate and confirm the final selection, namely the principle of maximum contrast (Przyborski and Wohlrab-Sahr 2014): do the models selected display a variety of cases, i.e., are they different from each other and cover diverse backgrounds and characteristics? Such a maximum contrast of examined cases is helpful to ensure a wide coverage of the field of research, and while a number of cases as low as three can hardly display all facets of a field, it is yet desirable to aim for contrasts and to include variety.

In accordance with the focus of this work, a competency model from Germany and one from a US background were included in the sample. However, as became evident in the first comparative remarks in Chapter 4, it is worthwhile to also consider the level of international competency modeling due to its special predicaments in terms of conditions, background and impact. International models may serve as a shared reference for different national models, and their approach is valuable to take into consideration as well. Hence, it was decided to add an international model as a third source to the sample.

On this basis, the following three models were selected for the comparison: the German M³K model, the US American TPACK model, and the European DigComp-Edu model. Notably, neither of these models excels in each of the four selective aspects pointed out earlier, but all of them have characteristics that qualify them for the purpose of comparison. M³K has innovative potential, because it summarizes, amends and reshapes former approaches in the field and adds new methods. Its innovative potential is closely linked to its validation because the distinctive feature of this model, which sets it apart from its context of German pedagogical research literature, is the exhaustive validation process performed in the course of its development. Hence, it is appropriate to include this model, even if the impact is still comparably low due to its being quite recent, and although a measurement instrument is under development but has not been validated and published yet.

The distinctive feature of TPACK is its high impact, because “amongst the similar and related approaches, the TPACK framework has received the most traction

in research and in professional development approaches, as evidenced by over 600 journal articles about TPACK” (Koehler et al. 2014, 102). Its popularity led to a variety of model developments, validation studies and measurement instruments, and while the model validity has been challenged repeatedly (e.g., Archambault and Barnett 2010; Lux, Bangert, and Whittier 2011), the overall reception and validation of TPACK can be understood to be confirmative and qualifies TPACK for a consideration in the context of this comparison.

Finally, DigCompEdu was selected because of its high innovative potential and comprehensive research background. The model is based on a variety of international media-related competency frameworks and includes works mostly from Europe, but also beyond. As it was published only recently, the impact is still low but is increasing quickly, and a measurement instrument has already been developed.

As these considerations reveal, each of the three models selected has a distinctive feature that sets it apart and justifies its use in the following comparison. The fact that these features all refer to a different criterion – M³K is exceptional with regards to its validation process, TPACK has a particularly high impact, and DigCompEdu has a unique international research background – is consistent with the claim of maximum contrast.

5.1.3 *Genesis of Analysis Categories*

The analysis categories of background, model genesis, structure and contents comprise a range of aspects that will be introduced in the following.

Background

The aspects in this category illustrate where the models come from and what their basic intention is. The following aspects were selected: Date of publication, because it helps to assess the publicity and potential impact and reception of the models; their authorship, which is particularly revealing with regards to the background of authors (e.g., scientific, political, economic, etc.); national vs. international orientation; target groups; and main objectives or functions.

In general, the potential functions of competency models are multifold. On a systemic level, they offer a standard reference for political, content didactical and school practice-oriented discourses and thus contribute to the generation of political or administrative control knowledge. On the level of schools and lessons, competency models allow for criterial comparisons and help educators evaluate and optimize their competencies. They are an important means for measuring and evaluating the results of learning and teaching processes and thus facilitate pedagogical interventions. They inform school development processes, e.g., in terms of curriculum

revisions or development, and contribute to professionalization. On the level of individual diagnosis, competency models can, for example, support formative evaluations (Pant 2013; Tulodziecki and Grafe 2019).

Model genesis

In general, competence models may be developed *a priori*, which means that they are developed based on theory and operationalized into test items before data gathering processes, or *post hoc*, meaning that they categorize empirical findings or that a phenomenon was discovered in practice and described afterward, as opposed to a systematic development on the basis of theory (Kauertz, Neumann, and Haertig 2012; I. Neumann 2011). This differentiation shows close reference also to the possible differentiation between inductive and deductive strategies for modeling competencies: according to Schaper (Schaper 2009a; 2009b), an inductive approach means generating the model based on empirical analysis, while a deductive procedure builds on existing competency categories based on theoretical models. From a research perspective, *a priori* models are often considered more valuable for a number of reasons. They have a broader basis and include more aspects than those found in a specific test group, they are empirically tested, and they have a higher re-test reliability (Kauertz, Neumann, and Haertig 2012; I. Neumann 2011). Schaper (2009b) suggests a combination of methods as the most adequate procedure for modeling competencies.

A further aspect of model genesis refers to the model validation. According to Schaper (2009b), all models, whether derived inductively or deductively, are hypothetical constructs and thus require validation. This process may include content validation to test whether the competency facets identified represent the field of interest appropriately, construct validation to verify that the model and its operationalization measure the construct intended, and criterion validation to test whether the results of a measurement correlate with results from the measurement of a corresponding characteristic.

Structure

Type of model and overall structure

Based on Klieme and Hartig (2007), Artelt and Schneider (2011) suggest a differentiation between *Kompetenzstrukturmodelle* (structural competency models) and *Kompetenzniveaumodelle* (competency level models). Structural competency models focus on the relationship between latent competency constructs or, as Hartig and

Klieme (2006) phrase it, on the dimensionality of competencies: these models describe which dimensions of a competence can be differentiated, their characteristics and their relationship. Competency level models, on the other hand, scale and quantify competencies. Assuming that competence is a continuum, these models abstract levels which summarize a certain level of competency. Thus, these models also describe the specific skills linked to different occurrences of single competencies: the levels indicate, for example, which demands a person with a high competency will meet and which results a person with a low competency can still achieve (Artelt and Schneider 2011; Hartig and Klieme 2006). Schaper (2009b) adds *Kompetenzentwicklungsmodelle* (competency development models) as a third category for models describing the stages or sequences in which competencies should be acquired in an effective process of competency acquisition. Thus, competency development models primarily serve to evaluate and classify learning achievements and to derive requirements for further development. However, the author points out a lack of competency development models in research on teacher education, and Winther (2011; 2016) similarly argues that elaborate models of this kind are scarce. Overall, competency level models and competency development models appear to share important characteristics in terms of a differentiation of proficiency. They also apply different foci (determining fixed stages vs. evaluating a learning process) while assuming a comparable model structure. Based on this proximity of structures, the model types introduced can be assumed to be non-selective in certain cases, i.e., they overlap and share characteristics. This is particularly true for the role of levels which ascertain a specific status but represent a developmental perspective at the same time.

Level of detail

According to Neumann (2013), competency models serve to structure a competence into different sub-competencies and describe different levels of competence with respect to these sub-competencies. Models vary with regard to the number of sub-competencies and the grain size of the competence levels, i.e., the differentiation of the scale that measures the competence levels. These two characteristics define the level of detail of a competence model. Strictly speaking, Neumann's (2013) classifications refer to competency models and would thus exclude an application to TPACK, which describes knowledge domains. However, the classification makes sense also in the context of modeling knowledge domains because of structural similarities in both types of model.

Against this background, the following basic classification was defined for the following comparison: a low level of detail indicates that a model describes few sub-competencies and does not include a scale for measuring competence levels. A medium level of detail refers to models that offer a more elaborate set of

sub-competencies but no or only a basic scale for measuring competence levels. A high level of detail means that models include a large number of sub-competencies and a detailed scale for competency levels.

Contents

Topic and terminology

The literature review revealed that topics and terminology of related models vary from case to case. While they are all connected by their reference to media-related educational competencies, the terminology for the underlying construct ranges from “competence” (as in DigCompEdu) and “competencies” (as in M³K, eTQF or UNESCO ICT-CFT) to “literacy” (as in the MIL curriculum or the NAMLE Core Principles) or “knowledge domains” (as in TPACK). They refer to either “digital” (as in DigCompEdu), to “media” (as in M³K or the NAMLE Core Principles), to “media and information” (as in the MIL curriculum), to “ICT” (as in eTQF and UNESCO ICT-CFT) or to “technology, pedagogy, and content” (as in TPACK).

As these terms represent constructs, their definitions vary but are related. As argued in Chapter 2, the concept of competence in particular has been subject to various definitional approaches and has been understood in varying ways. With regard to the interdependency of *knowledge* and *competence/competency*, for example, some approaches from the background of cognitive psychology define knowledge as a component of competence (Weinert 2001) or even define competence or competency as knowledge, as in Simonton (2003), Mayer (2003) or Csapó (2004; for a comprehensive overview on concepts of competence, cf. Klieme and Hartig 2007).

Aspects, areas and fields

To contextualize the contents of the three models, it makes sense to approach their competency aspects by means of pre-structured categories in order to maintain an independent viewpoint and to follow the idea of *tertia comparationis*. Hence, the following categories were developed heuristically to capture all main aspects of the three models:

1. Using media and ICT to enhance educational processes: this category includes aspects relating to the pedagogical use of media in teaching and learning contexts. Hence, it is closely related to the German construct of *Mediendidaktik* and to the US discipline of educational technology.

2. Teaching about media/facilitating learners' media literacy: in this category, competencies are summarized referring to media educational tasks. These competencies are necessary for teachers to not only use media as a tool but also, e.g., to successfully foster reflective and responsible uses among their students. Hence, the category relates to the German concept of *Medienerziehung* and to the US concept of media literacy.
3. Teachers' own technological knowledge and ICT competencies: this knowledge and competency field summarizes all aspects necessary for a proficient use and handling of media and ICT in the sense of application and technical implementation, which is generally considered an important precondition for pedagogical media applications.
4. Media-related professional development: the competencies in this category refer to the context of professional development, i.e., of the continuing professional development and further education of teachers that can also benefit from targeted support by digital media, for example, in terms of continuing training, communication, or organization.
5. Media-related organizational development: this category addresses the competencies required in the field of organizational development in media-related contexts and is primarily targeted at the reformation and development of schools as the organizational frame for the teaching profession. The relevance of media in this field comes into play, e.g., in the implementation of efficient new media concepts for schools or in the improvement of organizational processes aided by ICT.
6. Content-related competencies: competencies with a reference to subject-specific domains, i.e., contents from school subjects, are summarized in this category.
7. Further generic professional teacher competencies: this broad category includes further aspects found in the models considered without a direct reference to media but with specification also for media-related contexts, such as competencies referring to learner orientation or assessment.

Notably, the definition of “further aspects without a direct reference to media” applies also to categories four to seven, because all of them describe competencies which also exist without a reference to media and ICT contexts. “Media-related professional development,” for example, can be understood as a subset of general professional development competencies going beyond the media context. Yet categories four to seven were explicated due to their relevance for the models considered.

Taxonomies of the cognitive domain

For the classification of cognitive skills or competencies, it is an established practice in educational science to use Bloom's and Krathwohl's taxonomy (1956), or its updated version by Anderson and Krathwohl (2001; cf. Wilson 2016, regarding the differences and developments between the two versions). Considering the use of the terms *skills*, *competences/competencies* and *knowledge*, which vary among models, as pointed out above, *cognitive skills* in this context are understood quite broadly as one domain of human learning as opposed to affective or psychomotor skills. This renders the taxonomy applicable also for models referring to knowledge domains.

Bloom and Krathwohl (1956) define the six levels of cognitive skills, in order of increasing complexity, as 1) Knowledge, 2) Comprehension, 3) Application, 4) Analysis, 5) Synthesis, and 6) Evaluation. According to Anderson and Krathwohl (2001), they are 1) Remembering, 2) Understanding, 3) Applying, 4) Analyzing, 5) Evaluating, and 6) Creating.

Overall, the aspects introduced in this chapter illustrate different perspectives applicable to an in-depth analysis of competency models, and they show how models can be compared and assessed on different levels. A respective application will be introduced in the following chapter.

5.2 Category-based Model Comparison

Based on the analysis categories introduced above, it is now possible to apply the different viewpoints to the three models selected for an in-depth comparison (cf. Chapter 5.1.2). Consequently, the following chapter will introduce a criterion-based international comparative analysis of the three models DigCompEdu, TPACK and M³K.

5.2.1 Background

Date of publication

DigCompEdu was published in December 2017 (Redecker 2017) and M³K was developed in 2013 (Herzig et al. 2015). Koehler and Mishra officially introduced the concept of TPACK in 2005 and 2006 (Koehler and Mishra 2005; Mishra and Koehler 2006). These data allow for two conclusions: first, TPACK appears as the longest-established framework and DigCompEdu is comparably new. Second, the chronology suggests possible references between the models: M³K could build on TPACK while DigCompEdu could rely on both models as a source. It has to be investigated in the following to what degree the differing model age is relevant for the impact of the models, and if the potential cross-references do actually apply.

Authorship

DigCompEdu was developed by a team from the Joint Research Centre [JRC] led by Christine Redecker and edited by Yves Punie as the Deputy Head of Unit of the JRC Unit Human Capital and Employment. The JRC is the European Commission's science and knowledge service supporting EU policies with independent scientific evidence. It is based in Brussels with research sites in Belgium, Italy, Germany, the Netherlands, and Spain, and its work is largely funded by the EU's budget for Research and Innovation (Joint Research Centre [JRC] n.d.). TPACK, on the other hand, originates from a university context. It was published by Punya Mishra and Matthew J. Koehler, who are two researchers and teacher educators from Michigan State University in Michigan, USA. No external funding was involved in the original drafting of the model (Mishra and Koehler 2006). M³K also stems from an academic context. It was developed in a three-year German research project running from 2013 to 2015 and conducted by four university partners – the Universities of Würzburg and Bremen and two teams from the University of Paderborn – and a research institution, the German Leibniz-Institut für Bildungsforschung und Bildungsinformation [Leibniz Institute for Research and Information in Education; DIPF]. The M³K project was funded by the German Federal Ministry of Education and Research [BMBF] in the funding line “Competency modeling and competency measurement in the higher education sector” (KoKoHS; Humboldt-Universität zu Berlin and Johannes Gutenberg-Universität Mainz 2019; Zlatkin-Troitschanskaia et al. 2017).

These authorships have implications in terms of sources and reference frames and in terms of stakeholder interests. The authorship and funding of DigCompEdu clearly point to an international orientation, and the EU funding implies an intended relevance of the model for international applicability. With regards to the M³K model, the national German research team and federal funding render a more national focus of the model likely. As in the case of DigCompEdu, the political stakeholder interest in this project can be expected to shape direction and outcomes. The project context creates framework conditions for a systematic and research-based model genesis process. TPACK also stems from researchers of one shared national background, but there is no direct political influence discernible in the development process. It will be revealing to explore in the following analysis how much these national or international frames have an impact on the focus. Hence, to substantiate findings from authorship, it is helpful to have a closer look at evidence from the models and related publications with regards to the reference framework.

National vs. international orientation

DigCompEdu was published in English and is intended for an international application all over Europe and beyond (Redecker 2017). TPACK has a primarily national reference frame, as it was originally targeted at US teacher education and written in English (Mishra and Koehler 2006), although it was operationalized for measurements in other national contexts as well later on (e.g., Endberg 2018; Sang et al. 2016). The M³K model has been developed in German, and it explicitly refers to German initial teacher education (Herzig et al. 2015). These observations substantiate the conclusion that M³K and TPACK are primarily focused on their national backgrounds, while DigCompEdu has a wider background in terms of political and international relevance.

Target group

DigCompEdu has European inservice educators as a target audience (Redecker 2017). TPACK was originally developed to describe the competencies of US elementary school preservice teachers (Mishra and Koehler 2006), even though various applications and developments of the model specified or extended this target group (e.g., Niess et al. 2009; Jordan 2011). M³K is explicitly targeted at German preservice teachers in the first phase of German teacher education taking place at universities (Herzig et al. 2015; Tiede and Grafe 2016).

Given the shared characteristics and differences between the German and US systems of teacher education (cf. Chapter 3.2.2), it will be revealing to look at the influences these national framings can have on the model contents. It can be hypothesized that the different focus on preservice teachers (M³K, TPACK) versus inservice teachers (DigCompEdu) will have a differentiating impact on the contents included in the models.

Main objectives and functions

The main objectives of DigCompEdu are summarized as: a conclusion on, and summary of, existing literature; guiding policy across all levels; a template for the local development of concrete instruments; a discussion and exchange of best practice across borders; and a reference for validating local frameworks and tools (Joint Research Centre [JRC] 2017). The main objectives of TPACK are: guiding research and curriculum development; offering analytic tools for studying teacher knowledge and educational technology; helping in the design of pedagogical strategies; describing a goal of teacher education; and “contributing, at multiple levels, to theory, pedagogy, methodology, and practice” (Mishra and Koehler 2006, 1046). Similarly, the main objective of M³K is a contribution to the improvement of teacher education programs.

The model summarizes German literature in the field of media-related teacher competencies and is intended to serve as a basis for respective competency measuring, as well as giving a guideline and standards for their advancement in the course of teacher education (Grafe and Breiter 2014).

In terms of Tulodziecki's and Grafe's (2019) classification, all three models are primarily intended for the functions of curriculum development and orientation and are also applicable for other functions, such as the evaluation of teaching and learning processes. Against the background of the different premises introduced above, the overall project objectives are remarkably similar. As a conclusion of all facets considered in this chapter on model backgrounds so far, all three models are designed in favor of a theory-based systematic curriculum development. Yet there are differences between the models with regards to their publication, authorship, reference context and orientation and target group, showing that the three models follow different approaches to reach similar goals.

5.2.2 Model Genesis

A comprehensive desk research was performed at the beginning of the work on Dig-CompEdu, focusing on existing national and international frameworks in Europe, initiatives, standards, etc. Research literature and expert consultations were included too, with a focus on frameworks from current practice (Joint Research Centre [JRC] 2017). From this research, the following sources were selected to serve as a basis for the new framework: 4 European initiatives, 11 national and 4 international frameworks/standards, 7 national self-assessment tools, 4 International and national course and certification schemes, and three pieces of research literature and expert opinions (*ibid.*, p. 47–54). The selected sources were then analyzed, and their distinct elements were mapped and clustered. This way, a first framework was drafted and validated, first by back-casting the competences onto the original frameworks and then by a three-step stakeholder consultation process that included teacher and expert workshops and expert opinions (Redecker 2017). This procedure follows the principles of an *a priori* or deductive research approach, including content validation.

The TPACK model genesis is primarily based on experiences made by the authors in the course of their university teaching and has been explained to amend Shulman's (1986) theory of Pedagogical Content Knowledge (M. J. Koehler et al. 2004; M. J. Koehler and Mishra 2005; Mishra and Koehler 2005; 2006; 2007; M. J. Koehler, Mishra, and Yahya 2007; Mishra, Peruski, and Koehler 2007; cf. Abbitt 2011). Hence, the development process combines characteristics of an *a priori* approach, due to the foundation in Shulman's (1986) work, with facets of a *post hoc* or inductive approach, due to the conclusions drawn from practice retrospectively. Yet, references

to other theories have also been pointed out: e.g., Pierson (2001) earlier explained the concept of technological pedagogical content knowledge, and other researchers used similar terms and concepts at about the same time (e.g., Angeli and Valanides 2005; Niess 2005). The TPACK model was validated in various studies by content validation and construct validation (for an overview of TPACK-related studies, cf. Voogt et al. 2012; Chai, Koh, and Tsai 2013).

For M³K, a broad literature review was performed at the beginning, focusing on national German research literature (e.g., Tulodziecki, Herzig, and Grafe 2010; Tulodziecki 2012; Blömeke 2000; Gysbers 2008) and including selected examples of international sources such as TPACK. Against this background, the model was drafted and subsequently validated inductively-empirically by a content validation (Schaper 2009b). National and international experts in the fields of media pedagogy and teacher education (n = 10) were interviewed in a semi-structured and qualitative methodology following the critical incident technique (Butterfield et al. 2005; Flanagan 1954). The interviews were evaluated and found to support and validate the proposed model (Herzig et al. 2015). Hence, the model can be summarized to stem from an *a priori* or deductive research approach.

Overall, the model geneses of M³K and DigCompEdu show certain similarities, as they were designed *a priori*, i.e., deductively, and were based on existent sources. TPACK also builds on one established source but otherwise approaches the development process inductively, which makes it an example of a model genesis process that unites *a priori* and *post hoc* research methodology characteristics. In accordance with the requirement of validity in the model selection for this analysis, all three models were validated in the course of their genesis or afterward.

5.2.3 Model Reception and Ongoing Development

In accordance with its recentness, the scientific reception of DigCompEdu is still emerging, although numerous research works from different countries already refer to it (e.g., Kullaslahti, Ruhalahti, and Brauer 2019; T. Koehler, Igel, and Wollersheim 2018; Benali, Kaddouri, and Azzimani 2018; Blanchard et al. 2019). The TPACK model, however, was validated, tested and used exhaustively in multiple studies (for an overview of TPACK-related studies, cf. Voogt et al. 2012; Chai, Koh, and Tsai 2013). In the course of this validation and further works on TPACK, the model has been challenged for various reasons. For example, some studies had difficulties in reproducing the seven knowledge domains in exploratory factor analysis (EFA; Archambault and Barnett 2010; Lux, Bangert, and Whittier 2011), and some questioned the theoretical construct, e.g., as “neither well defined nor stable” (Brantley-Dias and Ertmer 2013, 108) or as relying on a “fuzzy” base, namely PCK (Archambault and Crippen 2009; cf. also Angeli and Valanides 2009; Cox and Graham 2009; Voogt et al. 2012). Thus,

receptions are heterogeneous, but the overall status of research has been found to largely confirm all seven factors of TPACK and to address the criticism of lacking construct validation (Chai, Koh, and Tsai 2016). On the whole, it is recognized as “one of the most well-received and widely researched theoretical frameworks for technology integration in the classrooms” (Koh, Chai, and Lee 2015, 459).

The M³K model has been noticed primarily in the German research community so far, as e.g., in Goetz (2018), Goecke et al. (2018), or Endberg (2018). Tulodziecki (2017) synthesizes it with other related German sources to develop a curricular framework for studies in the field of media pedagogy.

The scope of scientific reception of the three models in the study is heterogeneous. The quickly increasing reception of DigCompEdu implies an increasing interest in, and impact of, this model. The reception of TPACK is already enormous and illustrates that this model is a reference for many contexts and sources. With regards to the primarily German background, the German language and non-finalized empirical validation, the accessibility and application of M³K is currently mainly limited to national contexts, although publications have begun to introduce it also to an international audience (Tiede, Grafe, and Hobbs 2015; Tiede and Grafe 2016; 2019). Remaining in the German context, related publications are comparably scarce. It will be subject to the analysis of the following model aspects to consider reasons for the different perceptions of the three models and to contextualize the interplay of background, model genesis and contents.

5.2.4 *Structure*

Type of model and overall structure

DigCompEdu offers six main areas of digital competence. These areas are (1) Professional engagement, (2) Digital resources, (3) Teaching and learning, (4) Assessment, (5) Empowering learners, and (6) Facilitating learners' digital competence. Each of these areas comprises certain competency aspects, amounting to 22 in total. Some of the competency aspects are linked, as illustrated in Figure 1.

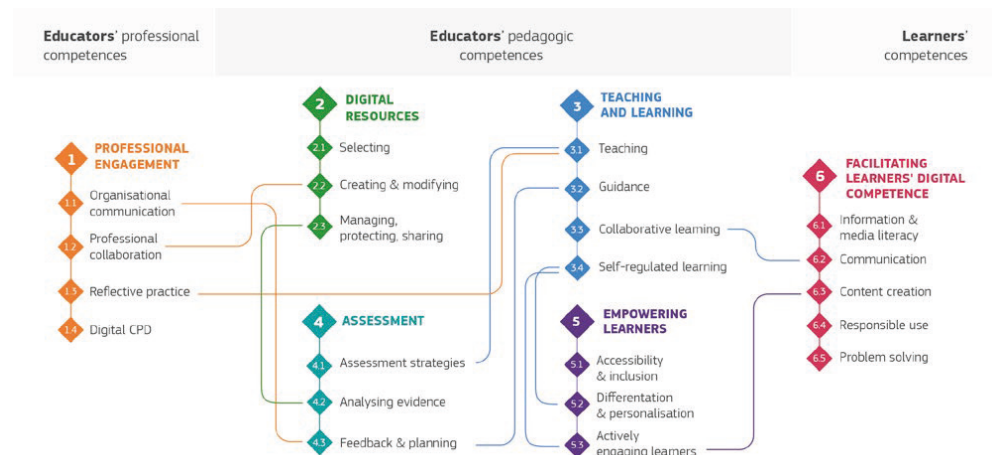


Fig. 1.: DigCompEdu Competency Model (Redecker, 2017, p. 8).

A central and distinctive feature of DigCompEdu is the proficiency scale included: each competence is described in six levels of progression, increasing from Newcomer and Explorer to Enthusiast and Professional, up to Expert and Pioneer, with according proficiency statements (Redecker 2017). The focus on the evaluation of learning success and on feedback and improvement makes DigCompEdu a competency development model. Hence, it answers the research desideratum of a systematic competency development model within the field of teacher education research expressed by Schaper (2009b). The levels are based on Bloom's and Krathwohl's taxonomy. In their terminology and design, they are linked to the Common European Framework of Reference for Languages (CEFR) taxonomy (Redecker 2017).

TPACK presents three dimensions of knowledge, namely Technological Knowledge, Pedagogical Knowledge, and Content Knowledge. These dimensions are arranged on one level without any sub-levels or categories, and their relationship and the overlaps originating from the interplay of these three dimensions are emphasized (Mishra and Koehler 2006; cf. Fig. 2). This makes TPACK a structural competency model in the sense of Klieme and Hartig (2007).

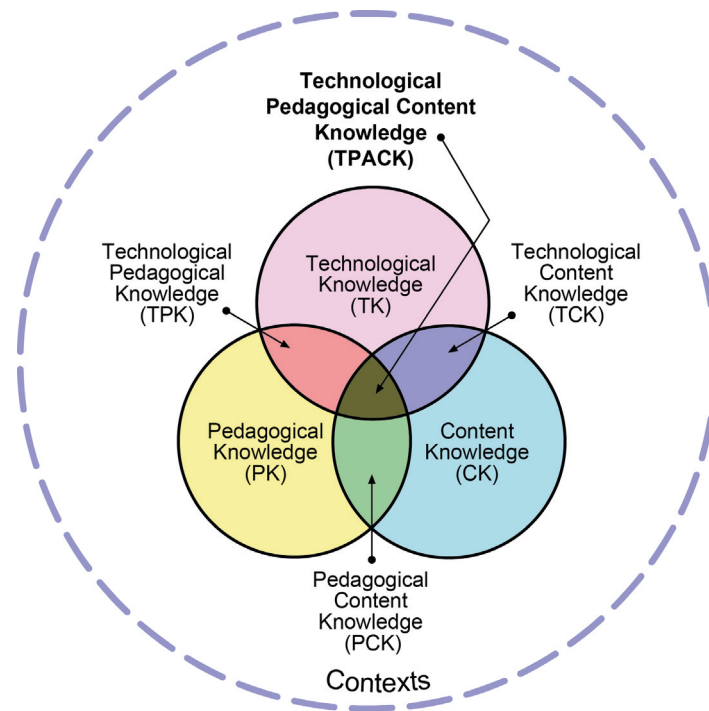


Fig. 2.: TPACK model (<http://tpack.org>).

M³K also defines three main dimensions, which can be described as “teaching with media,” “teaching about media,” and “media-related school reform.” However, M³K also specifies competency aspects, and it is structured as a matrix, which explicates the interplay between competency fields and aspects. The matrix comprises the three mentioned competency dimensions at the upper axis and five competency aspects at the left axis. These competency aspects are (a) understanding and assessing conditions, (b) describing and evaluating theoretical approaches, (c) analyzing and evaluating examples, (d) developing one’s one theory-based suggestions, and (e) implementing and evaluating theory-based examples. The fields that emerge are filled with standards of increasing complexity which are subject to a certain hierarchy based on Bloom’s and Krathwohl’s taxonomy (1956; Herzig et al. 2015). To sum up, M³K is a genuine structural competency model due to the focus on the interplay of dimensions, but with partly hierarchical and level-oriented standards suggesting a structural proximity to competency level models as well. Figure 3 shows the structural competency model in an overview, including non-cognitive facets, i.e., beliefs and perceived self-efficacy, and technical knowledge as further aspects with an influence on the shape and extent of *medienpädagogische Kompetenz* (Martin 2017).



Fig. 3.: M³K Structural competency model of Medienpädagogische Kompetenz (Diagram adapted from Herzig et al., 2016, p. 11).

To summarize the findings regarding the overall model structure, DigCompEdu has been allocated to the group of competency development models; TPACK clearly is a structural competency model; and M³K has been interpreted to belong to this category as well even though it represents a more complex level-oriented approach in comparison to TPACK regarding the standards included. Yet it has been defined as a structural competency model because of the focus on the relationship between the competency fields and areas and because there are no competency levels quantifying the proficiency or degree of competency of a person. However, there are hierarchical structures within the M³K competency aspects and in the standard descriptions based on Bloom's taxonomy, which is a common feature for competency level models. Hence, M³K unites characteristics of both approaches. To conclude, this structural analysis of the three models confirms that the distinction between structural competency models and competency level or development models is not fully selective.

The allocation of the models either to the groups of structural competency models or to competency level or development models leads to questions about the level of details inherent in the model. Hence, the grain size of the models will be focused in the following.

Level of detail

DigCompEdu can be interpreted to represent the category of high level of detail. There are six competency areas with three to five competencies each, and a non-exhaustive list of examples is included to suggest activities that express the according competence without delimiting it. What sets this model apart is also the proficiency scaling, as described above, specifying levels of competency from Newcomer to Pioneer. In Neumann's (2013) terminology, this means a comparably small grain size of competency levels.

In the distinction between low, medium and high level of detail, TPACK fits into the category of low level of detail. The three main knowledge domains are presented

on one level and are equally interdependent, which means there is no hierarchy in their arrangement. Their intersections are labeled, but the model itself does not offer explanations, specifications or sub-categories of the domains. Also, there is no scale to differentiate levels of knowledge.

M³K can be understood to have a medium level of detail. There are three competency areas, and each of them comprises five competency aspects. Two to four standards specify these competency aspects with increasing complexity. Two to four sub-standards further specify some of these standards in greater detail. Overall, the five competency aspects and the standards increase in complexity: e.g., the verbs of the competency aspects range from “understanding and assessing” in the first aspect to “implementing and evaluating” in the fifth aspect (cf. Bloom and Krathwohl 1956). Thus, the M³K competencies follow a certain hierarchy and partly build on each other, unlike the TPACK structure where all competencies are on one level and equally interdependent. This is also true for the formulation of aspects, which are equally oriented towards Bloom’s taxonomy. Yet M³K does not offer an elaborate proficiency scale for measuring competency levels in the way DigCompEdu does.

Notably, the distinction of levels of detail corresponds to the results of the structural analysis attributing a straight-forward structure to TPACK, a medium complex structure to M³K and a structure of comparably high complexity to DigCompEdu. These results feed into the overall impression of differing complexity of the three models, which had been evident at first sight but is now systematically clarified. While this conclusion is based on structural analyses, the level of content will be added in the next paragraphs.

5.2.5 Contents

Topic and terminology

On a general level, all of the models describe aspects that are considered important on the side of preservice and inservice teachers for technology-enhanced teaching, teaching in the context of media and other media-related educational processes. M³K and DigCompEdu focus on competencies, albeit with a different focus and terminology. In accordance with the context of preservice teacher education, M³K refers to the scientific basics of pedagogical media competencies that are or should be acquired in university teacher training and are necessary for coping with according situations in the teaching profession (Herzig et al. 2015). DigCompEdu, on the other hand, focuses on educator-specific digital competences that are required to effectively teach with digital tools and use digital tools for teaching (Redecker 2017). The TPACK framework does not describe competencies but knowledge domains of

technological pedagogical content knowledge of teachers and has been summarized as “the basis of good teaching with technology” (Mishra and Koehler 2006, 1029).

It is challenging to compare these different approaches on a terminological level. *Medienpädagogische Kompetenz* is obviously not congruent with *educators’ digital competence* and clearly even less so with *technological pedagogical content knowledge*. Additionally, the relationship between “competence/competency” and “knowledge” is an issue of concern, as argued in Chapter 2. In a narrow sense, and following the competency definition of Sampson and Fytros (2008) where knowledge is understood as a subset or constituent of competence or competency, it could be assumed that technological pedagogical content knowledge is merely a constituent of *medienpädagogische Kompetenz* or educators’ digital competence and not a comparable model. However, it was explained in Chapter 3 that these terms are strongly tied to their cultural, national and language background and not directly comparable. Hence, comparative conclusions need to focus on competency aspects, areas and fields to achieve a valid comparative perspective, instead of comparing terms especially in the context of different source languages.

Aspects, areas and fields

To contextualize the contents of the three models, it is useful to approach their competency aspects by means of superordinate categories in order to maintain an independent viewpoint and to follow the idea of a *tertium comparationis*. Hence, the following categories were derived inductively, i.e., based on findings from the models, to help summarize and categorize all main aspects of the three models: 1) Using media and ICT to enhance educational processes, 2) Teaching about media/facilitating learners’ media literacy, 3) Teachers’ own technological knowledge and ICT competencies, 4) Media-related professional development, 5) Media-related organizational development, 6) Content-related competencies, and 7) Further aspects without a direct reference to media.

1. Using media and ICT to enhance educational processes: in DigCompEdu, there are respective references particularly to the fields of “Digital Resources,” “Digital Pedagogy,” and “Digital Assessment,” e.g., in “Assessment strategies: To use digital technologies for formative and summative assessment” (Redecker 2017, 21). In TPACK, the knowledge required for applying ICT in a pedagogically sound way is referred to as “technological pedagogical knowledge” (TPK):

 this might include an understanding that a range of tools exists for a particular task, the ability to choose a tool based on its fitness, strategies for using the tool’s affordances, and knowledge of pedagogical strategies and the ability to apply those strategies for use of technologies. (Mishra and Koehler 2006, 1028)

This aspect is also important in M³K and represented in the main competency area of *Mediendidaktik* (teaching with media), as for example, in the competency standard claiming “preservice teachers are able to analyse media education activities considering different components of the theory-based development of teaching and learning processes and to evaluate these with regard to their appropriateness for a planned lesson” (Herzig et al. 2016, 14; own translation).

2. Teaching about media/facilitating learners’ media literacy: respective competencies are represented in DigCompEdu especially in the field of “Facilitating Learners’ Digital Competence.” For example, this field contains the aspect “responsible use,” which also means “to empower learners to manage risks and use digital technologies safely and responsibly” (Redecker 2017, 25). TPACK does not mention an according reference explicitly. From a systematic viewpoint, respective references would belong to the interplay of technology and pedagogy, i.e., into the field of technological pedagogical knowledge (TPK), because teaching about media and facilitating learners’ media literacy requires knowledge aspects from both of these fields but is not connected to content knowledge. The description for TPK offered by Mishra and Koehler (2006), however, focuses on the application of media and ICT to enhance teaching and learning processes solely. M³K, on the contrary, describes competencies in *Medienerziehung*/teaching about media as one out of three central competency areas. It refers, e.g., to teaching students to reflect on media critically and to understand conditions of media production, or to fostering responsible online behavior.
3. Teachers’ own technological knowledge and ICT competencies: both DigCompEdu and TPACK refer to skills that are needed to operate and apply ICT in lessons effectively. DigCompEdu shows references mainly with regards to the operation of digital media, as in “managing, protecting and sharing digital resources” in the field of “digital resources,” which means also “to effectively protect sensitive digital content. To respect and correctly apply privacy and copyright rules” (Redecker 2017, 24). It should be noted, though, that most of the references to educators’ own technological knowledge are closely linked to and concretized for educational contexts and purposes, as for example, in “analyzing evidence”: “to generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform teaching and learning” (*ibid.*, p. 25). Such concretizations suggest the assignment of the respective competency aspects also to category one in a majority of cases. For TPACK, technological knowledge is “knowledge about standard technologies, such as books, chalk and blackboard, and more advanced technologies, such as the Internet and digital video. This involves the skills required to operate particular technologies” (Mishra and Koehler 2006, 1027). This emphasis on the actual operation and use of technologies is

noteworthy because this is the only skill in TPACK that goes beyond the domain of mere knowledge and addresses operation and application skills. In contrast to that, M³K explicitly excludes the area of technological knowledge from media pedagogical competencies and describes it as a correlate, which has an influence on the shape of *medienpädagogische Kompetenz* but does not constitute it (Herzig et al. 2015).

4. Media-related professional development: DigCompEdu shows references to this category in the field of “Professional engagement,” especially with regards to “reflective practice,” which means “to individually and collectively reflect on, critically assess and actively develop one’s own digital pedagogical practice and that of one’s educational community” (Redecker 2017, 24), and to “digital continuous professional development.” TPACK does not indicate a corresponding aspect, although the authors acknowledge a need for professional and faculty development to ensure the acquisition of respective TPACK knowledge in the related publication (Mishra and Koehler 2006). Likewise, the M³K model does not include a specific reference.
5. Media-related organizational development: in DigCompEdu, competencies referring to media-related organizational development are also included in the field of “professional development,” as for example, with regards to “organizational communication”: “to contribute to collaboratively developing and improving organizational communication strategies” (Redecker 2017, 24). TPACK shows no explicit reference to media-related organizational development. M³K, however, lists *medienbezogene Schulentwicklung* [media-related school development] as the third main competency area beside media didactics and media education. It describes “the ability to co-design school reform development processes in the field of media, e.g., by assessing and designing staff, infrastructural, legal or organizational conditions for media pedagogical measures and their realization at school” (Herzig et al. 2015, 156; own translation).
6. Content-related competencies: in DigCompEdu, the notion of competencies with a reference to content or content knowledge comes into play in the descriptions of some aspects such as “digital continuous professional development,” which also means “to use the internet to update one’s subject-specific competences” (Redecker 2017, 40), or in “assessment strategies”: “to use digital technologies to enhance summative assessment in tests [...], using simulations or subject-specific digital technologies as test environments” (*ibid.*, p. 62). Thus, respective competencies and knowledge are inherent in the idea of a fully developed digital competence, according to DigCompEdu, but do not directly shape a specific competency aspect or field. For TPACK, on the other hand, content is at the core of the model, constituting the domains of Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and, most

centrally, Technological Pedagogical Content Knowledge (TPCK). It is a substantial characteristic of the TPACK model that content as one of the three main basic knowledge domains is closely connected with pedagogical knowledge and technological knowledge for any integration of technology into teaching and learning processes: “our model of technology integration in teaching and learning argues that developing good content requires a thoughtful interweaving of all three key sources of knowledge: technology, pedagogy, and content” (Mishra and Koehler 2006, 1029). Finally, M³K does not describe content knowledge by a distinct field or aspect. However, the notion of necessary content knowledge is inherent in a number of aspects that relate to developing, testing and evaluating media pedagogical actions, such as in the field of “developing own suggestions for media pedagogical actions based on theory”: “preservice teachers are able to outline examples of lessons or projects with media use with regards to teaching actions and learning activities, including contents, social formats and media [...]” (Herzig et al. 2016, 15). It is obviously necessary to have a certain content knowledge at one’s disposal in order to be able to outline a concept for a media-enhanced lesson. Yet content knowledge does not directly constitute *medienpädagogische Kompetenz* in the sense of the M³K model and can thus be understood to be a correlate, similarly to the role that technological knowledge plays in this regard.

7. Further generic professional teacher competencies: in DigCompEdu, a number of further competencies are addressed which are unique across the three models in the sample. These aspects can be characterized as constituents of general pedagogical professional competencies with a specification to media contexts. Some of these competencies are unique because they represent a high level of detail; this is the case, e.g., in the field of assessment describing digitally supported assessment strategies. Assessment is not explicitly mentioned either in TPACK or in M³K, but this may be connected to the fact that the descriptions in these two models are rather open compared to DigCompEdu: digitally enhanced assessment can be part of the wide range of knowledge aspects included in technological pedagogical knowledge, and it also relates to the idea of developing, testing and evaluating media-enhanced lessons or projects in classes as suggested by M³K. Similarly, further unique DigCompEdu competencies include those mentioned in the field of “empowering learners,” such as “actively engaging learners.” Also in this case, there is a specification of a generic pedagogical professional competence for a media-related context, and this, too, goes beyond the level of detail represented in TPACK and M³K.

This category-based overview of model contents reveals that there are peculiarities with all three models, each of them representing a unique focus. The field of “using media and ICT to enhance teaching and learning processes” is the only overlap

shared by all three models and thus represents a linking dimension. With regards to the facilitation of learners' media literacy, the TPACK model stands out due to the explicit focus on the educational use of media at the expense of media literacy aspects. Against the background of the disciplinary distinction between educational technology and media literacy common in the USA (cf. Chapter 4.2), the TPACK model is clearly advocating the educational technology perspective and thus employs a strict focus, whereas the European DigCompEdu model and the German M³K model consider and include both educational technology and media literacy perspectives as two central constituents of one interconnected construct of competence.

With regards to technological knowledge and ICT competencies, M³K takes on a special position. Technological knowledge is not considered a core constituent of pedagogical media competencies but a correlate and impactful variable, because it is understood as a responsibility of schools to provide students with basic technological knowledge and media literacy. Hence, preservice teachers should start their university education with a background of according knowledge, which then needs to be consolidated but not newly acquired (Tulodziecki, Herzig, and Grafe 2019; Herzig et al. 2015). Against the background of this assumption, it is consistent not to include technological knowledge in a model that intends to describe the competencies that should be acquired in university teacher education. DigCompEdu links to this perspective insofar as mere technological knowledge and application competencies are not a key competency within the concept of educators' digital competence. As argued above, references are included but mostly connected to educational usages, which corresponds to the concept of *Mediendidaktik* in M³K. In TPACK however, technological knowledge (TK) is a core constituent of the model and thus receives a different status compared to M³K and DigCompEdu.

The different notions of media-related professional development represented in the three models can be interpreted to be linked to the original target group of the models. Professional development is an important task for inservice educators, which helps explain why this aspect is important in the DigCompEdu model for inservice educators but is not explicitly mentioned either in TPACK or in M³K, both of which were designed in the context of initial teacher education. Media-related organizational development is, however, a key competency area in DigCompEdu and in M³K, and it emphasizes the different focus assumed by TPACK. Against this background, the conclusion is substantiated that the perspective postulated in the TPACK model is narrower than those represented by DigCompEdu and M³K, as it focuses on the educational implementation of technology only and consequently excludes further facets of teaching and learning and educational processes in media-related contexts.

As argued above, the three models also illustrate different approaches to the field of content knowledge, with TPACK emphasizing content as a core constituent of the model and DigCompEdu and M³K implicating respective facets primarily in application contexts. Given the prior conclusion of a narrow focus of TPACK on the educational implementation of technology, the very close view on educational media-enhanced teaching and learning processes goes in line with this explicit inclusion of content knowledge. This would be less suitable for the inclusive and one-dimensional structure of the TPACK model if other perspectives, e.g., on professional development or further media-related tasks, were part of the model as well. On the micro-level of teaching processes, however, the emphasis on content knowledge works well and appears consistent. Furthermore, this focus is congruent with the perspectives postulated in further sources from the US emphasizing the infusion of technology into content curricula instead of separating educational technology classes (Foulger et al. 2017 cf. Chapter 9.2).

In terms of further generic professional teacher competencies, the comparison revealed that the model elements which set apart DigCompEdu from the other two are to be found primarily in the area of “empowering learners.” As this framework was drafted deductively against the background of numerous other sources (Joint Research Centre [JRC] 2017), it is interesting to observe that there are yet considerable competencies which do not play an explicit role in TPACK or in M³K, although a facet like “empowering learners” may be inherent in the broad and universal description of pedagogical knowledge in TPACK:

“Pedagogical knowledge (PK) [...] is a generic form of knowledge that is involved in all issues of student learning, classroom management, [...] and student evaluation. It includes knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding. A teacher with deep pedagogical knowledge understands how students construct knowledge, acquire skills, and develop habits of mind and positive dispositions toward learning. As such, pedagogical knowledge requires an understanding of cognitive, social, and developmental theories of learning and how they apply to students in their classroom.” (Mishra and Koehler 2006, 1026–27)

All in all, DigCompEdu has been described to include a number of unique competency facets which are based on the level of detail assumed by the DigCompEdu model in terms of contents which differs from the rather broad competency aspects in M³K and especially from the considerably vague and non-specific knowledge domains in TPACK. Overall, it is noteworthy that the differences between the three models mentioned earlier in the context of the structural level of detail are replicated also with regards to the contents. The DigCompEdu model defines its competency aspects in

quite a detailed way. Compared to M³K and even more to TPACK, this makes the model very specific and presumably easy to apply because no further concretions are necessary.

5.2.6 *Theoretical versus Practical Orientation*

An aspect that sets apart DigCompEdu is its emphasis on skills of application of digital media in all stages, ranging from the assessment and selection of digital resources to a meaningful and successful use for a variety of purposes and its evaluation. Opposed to that, TPACK is focused primarily on theoretical knowledge and includes implementation mainly in the field of technological knowledge, as described above. In the case of M³K, three out of five competency aspects applying in the three main fields of *medienpädagogische Kompetenz* describe theory-focused competencies: the verbs are “understand” and “evaluate” in the first aspect, “characterize and evaluate” in the second aspect and “analyze and evaluate” in the third aspect. The fourth aspect merges theoretical and practical foci: “develop based on theory,” and the fifth aspect has a practical focus with “try out and evaluate” (Herzig et al. 2016). Hence, the M³K model unites theoretical and practical foci with a certain emphasis on theoretical facets. This emphasis needs to be seen against the background of the two phases within the German system of teacher education. The M³K model explicitly refers to German university teacher education, which is a unique system in the international context. While other systems sometimes merge the theoretical or academic and practical education of preservice teachers, the German system of teacher education is structured in two phases (for an overview of the German teacher education system, cf. Blömeke 2009; Kotthoff and Terhart 2013). In the first phase, preservice teachers are primarily educated at universities and acquire reflexive scientific competences based on scientific foundations and theory-based instructional knowledge, with the academic studies being enhanced by school placements (Van Barga 2014). These basics are connected to, and amended by, practical skills and procedural knowledge in the second phase of German teacher education, where, after about 5 years of studying at universities, preservice teachers are placed in schools and start their teaching career with support of seminars and other teachers, until their education is finished – approximately one and a half year to two years later. In this context, M³K focuses on the description of cognitive competencies that preservice teachers should acquire in the course of this scientific education at universities, with practical competencies included applying in scenarios where preservice teachers can test and evaluate media pedagogical actions.

To substantiate this observation, it is helpful to classify the competencies, e.g., by Bloom’s and Krathwohl’s taxonomy (1956), or its updated and improved version by Anderson and Krathwohl (2001). Based on Bloom and Krathwohl (1956), Anderson

and Krathwohl (2001) define the six levels of cognitive skills, in order of increasing complexity, as 1) Remembering, 2) Understanding, 3) Applying, 4) Analyzing, 5) Evaluating, and 6) Creating.

DigCompEdu has a strong focus on the level of “Applying.” Although some references to all other levels of cognitive skills can also be discovered, except for “Remembering,” most of the competence descriptors are concerned with application skills, as in “Actively engaging learners”:

“To use digital technologies within pedagogic strategies that foster learners’ transversal skills, deep thinking and creative expression. To open up learning to new, real-world contexts, which involve learners themselves in hands-on activities, scientific investigation or complex problem solving, or in other ways increase learners’ active involvement in complex subject matters.” (Redecker 2017, 74)

While single classifications might be disputable or ambiguous, the taxonomies indicate varying tendencies of the three models in question. They help to illustrate and ground the impression that the foci of the three models differ, because TPACK is mostly about declarative knowledge, M³K emphasizes cognitive competencies from understanding to evaluation, and DigCompEdu focuses on practical skills, i.e., skills of application.

As mentioned before, TPACK is concerned with knowledge. The model itself does not indicate verbs that could help draw inferences on cognitive skills, but the authors’ explanations of the domains of TPACK do (Mishra and Koehler 2006). Remarkably, the authors describe in detail the different knowledge aspects that preservice teachers need to be familiar with and understand, and the verbs are mostly limited to “know” and “understand.” For example, in the case of Pedagogical Knowledge (PK), it says: “A teacher with deep pedagogical knowledge understands how students construct knowledge, acquire skills, and develop habits of mind and positive dispositions toward learning” (*ibid.*, p. 1027). However, in the case of Technological Knowledge (TK), the knowledge-focused explanations are blurred with the more complex cognitive skill of “applying,” as in the following sentence: “In the case of digital technologies, this includes [...] the ability to use standard sets of software tools such as word processors, spreadsheets, browsers, and e-mail” (*ibid.*). Apart from this divergence, the relevant levels of cognitive skills in TPACK are “Remembering” and “Understanding.”

For M³K, it makes sense to consider the standards for an investigation of cognitive skills in addition to the competency aspects analyzed for their verbs above, as they operationalize the competencies. These verbs indicate that all levels of cognitive skills are addressed to varying degrees, with a remarkable emphasis on “Evaluating,” as for example, in standard A5.2: “The preservice teachers are able to assess, interpret and reflect upon collected data with regard to issues of teaching and learning with media” (Herzig et al. 2016, 16).

The focus on the reflexive and analytic competencies of the German M³K model is a distinctive feature which is not equally represented explicitly either in TPACK or in DigCompEdu. Van Ackeren et al. (2019) explain this focus on analysis and reflection within German research with a unique understanding of the concept of *Bildung*, which distinguishes the German perspective by targeting a reflexive relationship to the world, to social peers and to oneself. Naturally, this explanation offers only one perspective on a complex range of factors influencing the contents and foci within a specific research community.

In this context, TPACK is also mostly restricted to knowledge basics and is less about implementation. This is consistent because TPACK also comes from a university background, was developed in the context of teacher education and postulates an explicit focus on knowledge domains instead of competencies, as in the cases of DigCompEdu and M³K. Hence, both M³K and TPACK show fewer references to practical skills of application. However, the focus in regard to these facets in the M³K and TPACK models for preservice teachers does not reduce the relevance of respective competencies for inservice teachers. M³K and TPACK, on the one hand, and DigCompEdu, on the other, complement each other because it is equally consistent to include these practical skills into the DigCompEdu framework of inservice educators' competencies.

5.3 Conclusion and Discussion of Comparison Results

The in-depth analysis and comparison of three models reveals a new perspective on the competencies in question. It has become obvious why there is no universal definition of media-related educational competencies nor a common understanding. The three models in the study prove that there are divergent ways of approaching and describing the competencies in question. They share some central ideas and concepts, e.g., on the importance of a pedagogical use of media, but their contexts and foci differ, as illustrated above.

The considerations show the value of exploring the origins of the models. Given that M³K is strongly tied to its national background, it will need further investigations to find out if it can be used in other contexts as well, and if results can be compared adequately (cf. Tiede and Grafe 2016; 2019). On the other hand, TPACK has also been successfully used, researched and validated in multiple national and international contexts. It has been pointed out that TPACK has a very high level of abstraction and a low level of detail, as opposed to the more concrete competency specifications in M³K and DigCompEdu. Despite, or maybe even because of this less specific and rather general nature of the model, TPACK has proven successful and received a lot of attention. It is well-established and has been impacting various succeeding research works. From a research perspective, the low level of detail has been criticized not

only in terms of its partly inductive approach but also with regards to measurement, because there are no precise competencies, skills or knowledge aspects that could be operationalized for testing; thus, there is an inherent danger of its lacking validity in the sense of item-construct fit (Angeli and Valanides 2009; Cox and Graham 2009). However, the other side of the coin is a broad applicability and an appealing model that is easy to understand and open to interpretation and concretization for all kinds of cases. In future works on, and improvement of, existing models and in the development of new models, this bias of appeal and usability, on the one hand, and concretization and situational fit, on the other, will be important to consider.

All in all, the focus of the models is different, but they still complement each other. Generally, it has been observed that there is a considerable variety of existent models, and now it becomes clear that such a variety of approaches is necessary with respect to the various backgrounds and uses of competency models, as different approaches serve different purposes and have to be chosen carefully.

The study presented introduced a systematic and grounded deductive approach to assessing and comparing competency models. For future studies, it will be desirable to reproduce and refine the procedure and to extend it to more contexts and models. Such a careful synthesis and comprehensive consideration will be an appropriate way to look beyond borders in the sense of Blömeke and Paine (2008), to overcome ethnocentricity (Phillips 2006), and thus to make grounded decisions which will facilitate a successful exploration of media-related educational competencies.

With regards to the first research question, “Which central models of media-related educational competencies are there in German and US research, and what are their shared characteristics and differences?”, this first part provided an overview of competency models from different contexts. A range of important model characteristics, compliances and differences was introduced, and their functions were contextualized in the light of model backgrounds and purposes. The aspects considered necessarily represented an approach that can always be amended and extended in further studies; yet the perspective achieved is comprehensive and a useful basis to build on in the following considerations of measurements and practices of advancement, which will be subject of the next parts of this dissertation.

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Media-related Educational Competencies of German and US Preservice Teachers. A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

Part II: Measuring Media-related Educational Competencies

Jennifer Tiede

Measuring the media-related educational competencies of preservice teachers is important for the context of this dissertation because it functions as a link between the dimensions of modeling and advancing competencies: on the one hand, measurement instruments can validate and operationalize underlying models, which means concretizing and defining what a competency aspect comprises by observable and measurable behavior. On the other hand, measuring competencies is important in terms of evaluating practices of advancement, because it allows for grounded conclusions, e.g., on the success and outcomes of such practices. This evaluative perspective will be stressed below.

However, competency measuring is a complex and challenging task. The following part of this dissertation will give an overview of this context, apply the findings to the models analyzed in Part I and then introduce and discuss an example of a measurement with Paper 1, “Media Pedagogy in U.S. and German Teacher Education,” concluded by further considerations.

6. Competency Measurement in Teacher Education

It has been argued in Part I that competency models may function as a theoretical foundation for the advancement of media-related teacher education and the respective educational system, e.g., for purposes of orientation and curriculum development. However, there is a certain gap between the abstractive nature of competency models and the occurrence and traceability of competencies in practice, which increases with a decreasing level of model detail. Hence, measurement instruments are used to close this gap and to operationalize the competencies described in models to achieve a respective assessment. According to Schaper (2009), there are two main functions for such a measurement: on an individual level, the status of learning and development in educational processes can be determined to facilitate individual decisions regarding further advancement, placement and selection of participants. Measurements based on competency level models are also particularly helpful for assessing, comparing and interpreting academic achievements or performance, e.g., of students at school. On a systemic level, competency measurements are used to evaluate educational procedures and institutions (cf. also Hartig and Klieme 2006).

As Shavelson (2010) summarizes, based on National Research Council (2001), competency measurement in general terms relies on a triangle of construct, observation, and interpretation (Fig. 4): competence is a construct, i.e., it is a hypothetical idea and cannot be observed directly.

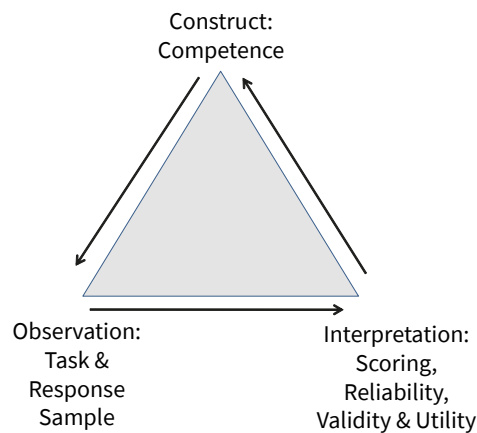


Fig. 4.: Assessment triangle (Shavelson 2010, 42).

This construct is often described by a theoretical competency model. On this basis, tasks or stimuli are developed to evoke the construct, i.e. to trigger observable performance. This performance needs to be scored first, for example, by a generic rating scale or a specific rubric. To confirm that an inference on the intended construct of competence is appropriate, the results then should be analyzed regarding reliability, validity and objectivity, as commonly accepted and classic criteria for methodological rigor in a measurement: it is considered reliable if the measurement and the results can be reproduced accurately; it is considered valid if it actually measures what is intended and if the theoretical construct matches the empirical phenomenon; and it is considered objective if the results are independent from the person who conducts the testing (Przyborski and Wohlrab-Sahr 2014). This way, conclusions are drawn regarding the presence or absence of the construct and its development or status.

It is important to note that this is a simplified explanation of central relationships in accordance with the triangle described by Shavelson (2010), providing a selective and accentuated overview. Performance, for example, does not only depend on the inherent competency but is influenced by other factors as well. According to Koenig and Sesink (2012), there are implicit and explicit demands evoking performance. The output which will occur as a reaction depends on the dispositions within the person, which again depend on his or her potential and knowledge and skills and further influences. The authors describe a blank spot within the transformation of disposition into performance and point out that in this so-called “middle sphere” (p. 299) further aspects come into play, as for example, tools and conditions of learning.

Despite its simplifying design, the triangle of construct, observation and interpretation is yet a useful starting point for considering the value of competency measurement for the overall context of a multifaceted analysis of media-related educational competencies. Against this background, the three dimensions can be specified

with regards to competency measurement in teacher education to clarify the methodological and conceptual requirements and challenges of this field. The research tradition of teacher professionalization offers a suitable starting point due to its systematic focus on competency measurement.

Part I of this dissertation analyzed the dimension of competence as a construct and emphasized the value of sound and valid competency models. Basing measurement instruments on such models is desirable because, according to Hartig and Klieme (2006), it is necessary to precisely define the competency in question first in order to specify the situations in which intrapersonal and interpersonal differences should occur, and in which way. Competency models offer a systematic answer to this claim. As discussed in Part I, some competency models such as M³K even offer standards which are an appropriate starting point for the definition of relevant situations.

The design of tasks depends on the overall approach and understanding of competencies and testing. In teacher education, there are two main angles from which this issue is approached, namely the perspectives of competency diagnosis and of traditional pedagogical diagnosis. Competency diagnostic approaches focus on assessing multi-faceted and complex performance dispositions. Thus, they are oriented towards complex and demanding situations and also take into account non-cognitive facets such as beliefs or motivational and volitional elements. Traditional pedagogical diagnostic approaches rather focus on clearly defined constructs which serve to describe or predict specific achievements (Schaper 2009).

Due to the complexity of the construct competence and its reference to, and dependence on, real-life situations, most measurement approaches in teacher education research focus on realistic simulations to confront participants with complex and real-life demands (Schaper 2009). In accordance with this, Shavelson (2010) suggests that tasks should “(a) be real-life in nature, (b) tap complex abilities and skills, (c) be amenable to practice and improvement, and (d) be amenable to standard setting” (p. 46).

These tasks can take different shapes and foci, depending on the overall context and purpose, and should be varied in their approach to ensure a multifaceted perspective. For example, there are items requiring objective responses and those that require subjective ones. Their application depends on the purpose; e.g., there are single choice questionnaires with one objectively correct answer and several distractors, i.e., wrong options to choose from. Such items are commonly used in the context of achievement or knowledge assessment in higher education. In contrast, subjective input is appropriate, for example, in the case of self-assessment surveys. Such surveys build on the honest assessment of participants and do not aim at right or wrong answers, as they investigate human experience, judgment, and feeling (Muckler and Seven 1992). Notably, they are quite common in the context

of competency measurement. As the following chapter and the considerations on TPACK will illustrate, this may also be due to the fact that it is quite challenging for researchers to determine unambiguously what is clearly right and wrong in the context of the construct competency in the way it would be required for an objective measurement. As Schaper (2009) points out, subjective self- or peer assessments are common and necessary in research on teacher education, especially in the context of non-cognitive facets such as social-communicative or perceived self-efficacy; but they are of limited validity due to bias and judgement effects (cf. also Hartig and Jude 2007; Tousignant and DesMarchais 2002).

Further differences between measurements and instruments include the degree of standardization. According to Leutner, Hartig, and Jude (2008), educational assessments can either follow standardized testing procedures which allow for quantification and comparison, or less standardized ones, which may appear, e.g., as portfolios or biographical surveys. Standardization in this context means that the demands are identical for each individual taking the test in terms of tasks, and administration (Shavelson 2010).

Measurement instruments can further be differentiated in terms of their quantitative or qualitative orientation. Quantitative methods are about the “gathering, analysis, interpretation, and presentation of numerical information” (Teddlie and Tashakkori 2009, 5). They proceed deductively and test theses derived from theory. A typical example of quantitative measurement instruments are single choice questionnaires, which are easy to automatically analyze statistically. This makes quantitative tests particularly appropriate for large numbers of participants and for research questions that can be answered by statistical analyses. By contrast, qualitative methods focus on the “gathering, analysis, interpretation, and presentation of narrative information” (*ibid.*, p. 6). Their nature is inductive, i.e., they generate theories based on the generalization of single cases. A typical example of qualitative measurement instruments are guided interviews, which can be recorded and analyzed, e.g., by a qualitative content analysis (Mayring 2015). Naturally, such a qualitative or thematic analysis of narrative material is more difficult to apply with large numbers of participants. There are also mixed methods approaches that combine quantitative and qualitative methods in an instrument or study (Teddlie and Tashakkori 2009).

The third point of the triangle introduced by Shavelson (2010) refers to the assessment and interpretation of data collected. Against the background of different measurement and item types pointed out above, Schaper (2009) notes that assessment and interpretation are again dependent on the overall testing approach: traditional pedagogical-psychological tests are usually evaluated against social criteria based on reference populations, while for competency measurement it is preferable to apply a criterion-based assessment to be able to interpret the competency levels achieved individually.

Overall, these perspectives illustrate the width and possibilities of competency measurement. However, there is also criticism expressed repeatedly towards practices of competency measurement, especially in the German context with its rich theoretical discourse on competency modeling and measuring. As Schaper (2009) points out, current practices neglect the development of competency level models and of competency development models. Furthermore, integrative strategies of competency modeling which successfully link empirically-inductive and normatively-deductive approaches are scarce. Also, the validation of measurement instruments is improvable. Moreover, according to Trültzsch-Wijnen (2016), current practices often neglect a consistent differentiation between the measurable performance and *Kompetenz* as a non-measurable construct.

Beyond such objections from a methodological viewpoint, there are also more general points of criticism related to the measurement of competencies emanating from the conceptual and terminological discourse about *Medienkompetenz* [media competence] and *Medienbildung* [media education]. As argued in Chapter 2, Tulodziecki (2010; 2011) points out that this discourse stems from the diverging and sometimes overlapping and inconsistent use of the two concepts. The author suggests referring to *Medienkompetenz* as an objective which describes a level for media pedagogical actions, while *Medienbildung* is the process in which *Medienkompetenz* can be advanced. Understanding *Medienkompetenz* as a target perspective which can be differentiated in levels consequently allows for and even demands competency measurement. However, this approach and the respective quantification and measurability of competencies have also been challenged repeatedly and are not agreed upon in current discourses (Schorb 2009; Hugger 2006; Schaumburg and Hacke 2010; Moser 2010).

Overall, as these examples of potential shapes and foci of measurement instruments show, the conceptual width of media-related educational competencies is reflected also in varying forms of operationalization in measurement instruments. Hence, it can be expected that the measurement instruments for the three models introduced in Part I, which are either developed, in development, or might be developed in future, assume different forms and are also heterogeneous. Against the background of this brief introduction, selected measurement instruments will be introduced in the following chapter to complement the previous model comparison with another important facet.

7. Competency Measurement Instruments Based on DigCompEdu, TPACK, and the M³K Model

In Part I, DigCompEdu, TPACK, and M³K and were introduced as three examples of models of media-related educational competencies from three different contexts, and their design and features were analyzed and compared. Against the background of the relevance of competency measurements as argued above, it is now consistent to amend the model analyses by a comparative perspective on competency measurement with DigCompEdu, TPACK, and M³K. Hence, an overview will be provided for each of the three models, including central measurement instruments which were developed to operationalize the three models. The selection of instruments included in this chapter follows the restricted availability with regards to DigCompEdu and M³K: it was pointed out earlier that both of these models are rather recent and so limited in their impact and related research so far, which also applies to their respective measurement instruments. By contrast, TPACK has been described to be received and operationalized extensively in multiple contexts. Against this background, instruments available will be introduced first and then discussed regarding their availability, their design and contents, and regarding their operationalization of the model at the foundation. This way, further important facets will be added to the analyses of the three models.

7.1 *Measurement Instruments for DigCompEdu*

In the case of the European DigCompEdu model, the “DigCompEdu Check-In” self-assessment tool is a freely available online tool. Its German version has been empirically confirmed to be reliable and valid (Ghomi and Redecker 2019). There are different versions of the Check-In tool for teachers in primary, secondary, and vocational education and training, for academics teaching in higher or further education, and for lecturers in adult education or continuous professional development. These tools are available in several languages. Their overall goal is to help educators of all kinds reflect and advance their digital competence. Participants taking this test have to answer 22 self-assessed items, each of them comprising five answer options, and receive feedback on the status of their competencies, as well as suggestions and milestones for further development (EU Science Hub 2019; Ghomi and Redecker 2019).

The tool claims a close relationship to the DigCompEdu model because the competency areas and aspects from the model are used as categories and items within the tool (EU Science Hub 2019). To illustrate the relationship between model and self-assessment tool, Table 1 lists one example of a competency aspect with its proficiency statements as formulated in the model and contrasts it with the respective self-assessment item from the tool.

DigCompEdu model: Competency aspect and proficiency statements. Aspect 3.3: Collaborative Learning	DigCompEdu CheckIn Tool, Teacher version: Item and answer options. Item: “When my students work in groups or teams, they use digital technologies to acquire and document evidence”
A1: I do not or only very rarely consider how students could use digital technologies in collaborative activities or assignments.	My students do not work in groups
A2: When implementing collaborative activities or projects, I encourage learners to use digital technologies to support their work, e.g. for internet search or to present their results.	It is not possible for me to integrate digital technologies into group work
B1: I design and implement collaborative activities, in which digital technologies are used by learners for their collaborative knowledge generation, e.g. for sourcing and exchanging information. I require learners to document their collaborative efforts using digital technologies, e.g. digital presentations, videos, blog posts.	I encourage students working in groups to search for information online or to present their results in digital format
B2: I set up collaborative activities in a digital environment, e.g. blogs, wikis, moodle, virtual learning environments. I monitor and guide learners’ collaborative interaction in digital environments. I use digital technologies to enable learners to share insights with others and receive peer-feedback, also on individual assignments.	I require students working in teams to use the internet to find information and present their results in a digital format
C1: I design and manage diverse collaborative learning activities, where learners use a variety of technologies to collaboratively conduct research, document findings and reflect on their learning, both in physical and in virtual learning environments. I use digital technologies for peer-assessment and as a support for collaborative self-regulation and peer-learning.	My students exchange evidence and jointly create knowledge in a collaborative online space
C2: I use digital technologies to invent new formats for collaborative learning.	

Tab. 1.: Comparison of DigCompEdu model competency aspects vs. Check-In Tool (teacher version) items (Redecker 2017; EU Science Hub 2019).

This contrasting juxtaposition of the original DigCompEdu competency aspect and proficiency statements and the item from the Check-In tool with its answer options reveals two striking conclusions. First, the model format was operationalized for the instrument: the abstract competency heading was turned into an activity statement, and the structure of the proficiency scale which is marked by steps from A1 to C2 is not explicitly mentioned in the tool. Second, the extent was clearly reduced. The DigCompEdu model describes each competency aspect in six proficiency stages, while the DigCompEdu Check-In tool uses five levels, an adoption that was

based on different implementation stages supposedly prevalent among current teachers. Hence, the five levels are based on the following six stages: “no use – basic use – diversification – meaningful use – systematic use – innovation” (Ghomi and Redecker 2019, 453).

The example in Table 1 illustrates the discrepancy between model and tool clearly. On the higher proficiency levels, the competencies described in the original model are quite complex and refer to the educator’s ability to design and manage complex learning activities and learning environments and to create and innovate. The verbs in the highest two proficiency levels include “design,” “manage,” “use,” and “invent.” In the Check-In tool, on the contrary, collaborative learning is understood in a narrower sense and the items refer to less complex actions.

It is remarkable in this context that not all of the Check-In tool-items directly relate to the educator’s competencies: the highest competency level is described as “My students exchange evidence and jointly create knowledge in a collaborative online space,” which emphasizes the effect of the educator’s competency on the learners instead of the competency itself. This effect, namely the learners’ reactions and resulting actions, is obviously impacted by numerous further influences that come into play beyond the educator’s competencies. To have students exchange evidence and create knowledge together in a collaborative online space, it is also necessary, for example, to have the appropriate technical equipment at hand, to work with a motivated and productive group of learners, or to have the curricular framework for integrating respective tasks. In other words, this means that an educator who would generally be capable of demonstrating the competency in question might not select this option in the Check-In tool, not because of a lack in his or her competencies but because other frame conditions are responsible for his or her students not exchanging evidence and creating knowledge together in a collaborative online space. Against this background, it appears questionable if a focus on the effects of competencies, as suggested by the Check-In tool in some places, is an appropriate means for achieving a realistic self-assessment of educators’ competencies. This problem is further enhanced by the changing format between the different answer options: option one, referring to the lowest level of competency, starts with “my students do not...,” while the third option inconsistently begins with “I encourage....” This overall inconsistency adds to the impression that the tool shows a tendency to both simplify and concretize matters even at the expense of conceptual precision.

7.2 Measurement Instruments for TPACK

In the course of the multifold and exhaustive scientific reception of TPACK, many instruments were developed. The first instrument that received greater recognition and was used as a basis for most of the succeeding instruments was published by

Schmidt et al. (2009) as a self-assessment scale. Further forms of TPACK-based measurement instruments include open-ended questionnaires (So and Kim 2009), performance assessments (Graham, Tripp, and Wentworth 2009), Interviews (Ozgun-Koca 2009), or observations (Suharwoto 2006; Koehler et al. 2014). Only recently, researchers began to measure knowledge by objective knowledge tests in subareas of TPACK as well (Drummond and Sweeney 2017). Apart from that, numerous developments of TPACK and adaptations to fit specific contexts brought along their own models and, consequently, measurement instruments. For example, Saengbanchong, Wiratchai, and Bowarnkitiwong (2014) suggest TPACK-S (Technological Pedagogical Content Knowledge appropriate for instructing students), thus adding the perspective of the students to the TPACK model. Bachy (2014) amends the classical model to inform TPKD (techno-pedagogical disciplinary knowledge), an interplay of pedagogical knowledge, technological knowledge, discipline (PCK) and personal epistemology. Sang et al. (2016) introduce CTPACK (Chinese preservice teachers' technological pedagogical content knowledge), which specifies the classic TPACK model for a certain cultural background. Benton-Borghi (2015) develops UDL infused TPACK (Universally Designed for Learning Infused Technological Pedagogical Content Knowledge), merging the idea of TPACK with a second educational framework.

As this brief overview demonstrates, the width and heterogeneity of approaches to measuring TPACK makes it difficult to abstract a core procedure or common approach. To provide a selective overview of different approaches, Table 2 presents a selection of items used in different self-assessment instruments to measure a comparable aspect within the same dimension of TPACK. The central dimension of Technological Pedagogical Content Knowledge serves as an example for illustrating ways in which different self-assessment surveys aim to capture the same knowledge. For reasons of comparability, all surveys included in Table 2 are self-assessment instruments.

Examples of items	Scale	Instrument focus	Type of measurement	Source
I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	5-point Likert: Strongly Disagree → Strongly Agree	TPACK of pre-service teachers	Self-assessment	Schmidt et al. (2009)
My teacher represents content with appropriate strategies via the use of various technologies.	5-point Likert: Strongly Disagree → Strongly Agree	TPACK of teachers as perceived by EFL students	Self-assessment	Tseng (2016)
Ability to integrate technology with math classes in a proper and effective way in order to make them easier and more comprehensible	5-point Likert: Incompetent → completely competent	TPACK of pre-service mathematics teachers	Self-assessment	Önal (2016)
I can combine appropriate methods, techniques and technologies by evaluating their attributes in order to present the content effectively.	5-point Likert: Strongly Disagree → Strongly Agree	TPACK-deep of preservice teachers	Self-assessment	Yurdakul et al. (2012)
I think I can use technology effectively to meet the pedagogical needs (teaching methods, instructional materials, classroom management, student learning...) when teaching a particular topic.	7-point Likert: Strongly Disagree → Strongly Agree	TPACK of pre-service teachers	Self-assessment	Kartal, Kartal, and Uluay (2016)

Tab. 2.: Selection of related TPACK items from different surveys. Example of TPACK dimension: Technological Pedagogical Content Knowledge.

This overview of examples shows a certain variety between different approaches even with regards to a comparable aspect. The scales reach from 5-point to 7-point, the perspectives include teachers' perspectives on their own TPACK and students' perspectives on their teacher's TPACK, and the items focus on different emphases. While all of them incorporate the idea of a combined knowledge of technology, pedagogy and content, they formulate quite diversely. An important notion in this context is the fact that, opposed to the idea of TPACK as a model of knowledge domains, all of the five examples aim at a competency instead of a knowledge domain; related verbs are "can teach," "represent content [...] via the use," "ability to integrate," "can combine," "evaluate," and "can use." In Önal's (2016) instrument, the scale even ranges from "incompetent" to "completely competent" and thus verbalizes the competency orientation of these measurement instruments. On the one hand, this observation

supports the formerly expressed presumption that TPACK is an appropriate reference for analyzing models of media-related educational competencies despite its focus on knowledge. On the other hand, the blurring of knowledge and competence as represented by these surveys adds to the conceptual imprecision with which central sources have been revealed to operate.

With regards to the differences between the five examples of approaches, parts of them might be explained by the fact that TPACK, as a structural competency model, is quite abstract. The descriptions of each knowledge area do not indicate specific competencies in the way DigCompEdu or M³K do by their standards. Hence, the development of items for measuring these knowledge fields is very open, as the precise scope of each knowledge area needs to be determined first and leaves considerable room for interpretation. This condition has been realized to be problematic, as summarized by Cox and Graham (2009):

“Thus far, the explanations of technological pedagogical content knowledge and its associated constructs that have been provided are not clear enough for researchers to agree on what is and is not an example of each construct. Mishra and Koehler and others have provided definitions of TCK, TPK, and TPACK that articulate to some degree the centers of these constructs, however, the boundaries between them are still quite fuzzy, thus making it difficult to categorize borderline cases.” (p. 60)

Consequently, it has been pointed out repeatedly that the psychometric features of the model and the nature of pedagogical knowledge remain challenging and problematic (Chai et al. 2011; Archambault and Barnett 2010; Valtonen et al. 2015).

7.3 Measurement Instruments for M³K

In the case of M³K no finalized and validated instrument has been published so far, but there is a measurement instrument which was developed in the course of the project and used in several pilot studies despite its non-finalized validation (Herzig et al. 2016; Tiede and Grafe 2016; cf. Chapter 8). Since this instrument is the only measurement operationalization of the M³K model available, it will be included in the following.

It has been described that the M³K model has been designed also as a contribution to the systematic improvement of teacher education programs (Grafe and Breiter 2014). Consequentially, the M³K measurement instrument is a standardized and quantitative instrument with a focus on items that are to measure competencies objectively. This design allows for the collection of easily comparable data in large numbers and, if applied in a representative sample, is theoretically suitable for drawing generalizable conclusions on the target group of German preservice teachers.

Hence, the measurement can help inform policy recommendations and, eventually, foster respective improvements.

In accordance with the structure of the M³K model of *medienpädagogische Kompetenz*, there are three main fields in the survey referring to “teaching with media,” “teaching about media,” and “media-related school reform.” Furthermore, “technological knowledge” is added in the sense of a correlate to account for the important role this factor plays for the development of *medienpädagogische Kompetenz* (Herzig and Martin 2018; cf. Chapter 4.3). Also, there are objective items to determine the participants’ competencies and additional self-assessments for media-related beliefs for each field (cf. Chapter 8.1.1). Table 3 illustrates how competency aspects have been operationalized to items for the measurement instrument. It shows two examples of M³K competency aspects and the corresponding item from the measurement instrument. The competency standards from the model are also included because these standards fulfill the conditions for developing empirical measurements as defined by Hartig and Klieme (2006): they precisely specify the competencies in question, they indicate relevant situations and define competent acting.

M ³ K competency area and aspect	M ³ K competency standard	M ³ K measurement instrument items
<p>Area: <i>Mediendidaktik/teaching with media</i></p> <p>Aspect: Understanding and Assessing Conditions for Media Education Activities</p>	<p>A1.1: The preservice teachers are able to describe the relevance of use of media outside of school for teaching and learning with media with the aid of examples by reference to theoretical approaches and empirical results.</p>	<p>Many students have a television set in their rooms and often watch early-evening series, films and other television entertainment programs.</p> <p>Do out-of-school television viewing habits influence the way in which students learn with video films in the classroom?</p> <p><i>Out-of-school television viewing habits...</i></p> <ul style="list-style-type: none"> influence learning with videos because students come to see the videos as easy media, which causes the effectiveness of their learning to suffer. influence learning with videos because students are familiar with movies and can therefore learn better with videos than with written texts. do not influence learning with videos because classroom learning with videos requires skills other than those used when watching TV for entertainment purposes. do not influence learning with videos because students are aware that classroom videos are for learning purposes while home TV is mainly about entertainment.
<p>Area: <i>Medienerziehung/teaching about media</i></p> <p>Aspect: Understanding and Assessing Conditions for Media Education Activities</p>	<p>The preservice teachers are able to describe the relevance of use of media outside of school for socialization, education and learning with the aid of examples by reference to theoretical approaches and empirical results.</p>	<p>In media effects research, there are numerous academic studies in the area of “media and violence.”</p> <p>Many findings have signified that the way in which violent content is presented has an influence on whether the consumption of that content promotes aggressive behavior.</p> <p>Which statement about the effect of media violence on children is the most accurate?</p> <p><i>Consuming violent media content is more likely to trigger aggressive behavior in children...</i></p> <ul style="list-style-type: none"> if the violent main character is punished for his/her behavior. if the act of violence is carried out by a main character with a high degree of identification potential. if negative effects for the victim of violence are explicitly presented. if the violence is presented as unjustified.

Tab. 3.: Comparison of selected M³K competencies and survey items.

These examples show how situations were formulated for the test items in order to operationalize the competencies described in the M³K model and specified by the standards. The first example relates to competency A1.1 from the field of “teaching

with media,” aspect “Understanding and Assessing Conditions for Media Education Activities,” which is about the relevance of extra-school media use for learning contexts. The corresponding item realizes this requirement through a specific scenario of private TV consumption and its effect on learning. Hence, it can be concluded, as in the case of DigCompEdu (cf. Chapter 7.1), that the item further concretizes the competency as defined by the standard. The same applies to the second example in Table 3 where the relevance of extra-school media use for socialization, education and learning is specified by a scenario on the effects of media violence on children.

The two typical items from the measurement instruments both start by a short scenario and thus employ the methodology of situational judgment. For this method, standardized situations or hypothetical scenarios are presented that require participants to analyze the situation and to develop appropriate behavior for solving the problem and to apply their knowledge in an appropriate way, depending on the situation. The competency in question is then inferred from the hypothetical actions participants chose (Seifert and Schaper 2012; Weekley and Polyhart 2006). This characteristic in the item construction points to a central issue in the objective measurement of competencies: as argued in Chapter 2, a competency comprises more than just knowledge, and it is therefore critical to attempt to measure a competency by a survey which ultimately requires knowledge to answer. The multiple-choice format makes the survey easy to upscale and enhances objectivity and comparability. However, at the same time it inevitably neglects important facets contributing to competence beyond knowledge, such as the situational reference and contextualization of competencies (Sampson and Fytros 2008), e.g., in terms of motivational, volitional and social willingness within a given situation (Weinert 2001). Against this background, the situational judgment format was applied to encourage participants to come to decisions with a certain reference to real-life situations and to activate a skillset and abilities beyond mere knowledge. Yet the format of objective measurement and standardized multiple-choice items remains challenging in the light of these characteristics of the construct of competency. The validation of the M³K measurement, which could not yet be completed with satisfactory values, adds to the impression of measurement challenges in this specific case, although there are multiple reasons potentially responsible in this context. Scarce learning opportunities in relevant fields for preservice teachers in the sample, for example, are assumed to have contributed to a weak internal consistency (Herzig et al. 2016). Eventually, the ongoing measurement instrument validation could be enriched by a triangulation of methods, e.g., by applying qualitative approaches with smaller samples to observe respective behavior in realistic scenarios directly and thus address the methodological challenges in assessing complex competencies with a standardized multiple-choice test.

7.4 Conclusions from the Analysis of DigCompEdu, TPACK, and M³K Measurement Instruments

With regards to the proximity of model and tool, the structure of DigCompEdu as a competency level model brings about a straightforward starting point for the development of a measurement instrument because of its precise proficiency descriptors for self-assessment. Hence, the development of items is less ambiguous and open, compared to the cases of TPACK and M³K, because the basis for self-assessment items is already provided. Instead, challenges in developing a DigCompEdu instrument include aspects like validation, i.e., the fit of statements and model will have to be confirmed for all language versions, as is conducted for the German instrument already (Ghomi and Redecker 2019), and feasibility, i.e., the instrument will have to be relevant for a considerably wide target group and applicable in terms of extent. Like M³K, DigCompEdu qualifies as a basis for a standardized quantitative instrument, which could help shape policy recommendations and have an impact on a European level. With its proficiency descriptors, it also suggests a self-assessment instrument to fulfill the purpose of fostering educators' individual professional development.

If the varieties and options for measurement instruments of DigCompEdu, TPACK, and M³K are contextualized and contrasted, TPACK stands out due to the considerable width and variety of instruments, which correspond to the popularity of this model. The relationship between model and measurement is noteworthy in this case. It was described in Part I that TPACK is a structural competency model, and for structural competency models related literature suggests measurements which explore and validate the nature and relationship of its dimensions (Hartig and Klieme 2006). This claim was met repeatedly (Archambault and Barnett 2010; Schmidt et al. 2009; Shinas et al. 2013). However, TPACK measurements have also been used for a number of further purposes, such as competency assessment and objective measurement, which leads to the conclusion that the shape, purpose and design of competency measurement instruments depend on a number of factors which may include, but are not limited to, the type and purpose of its respective competency model. The case of TPACK illustrates that a structural competency model can also serve, for example, as a basis for standardized measurement instruments which seek to objectively quantify and ultimately compare participants' competencies (Drummond and Sweeney 2017). However, based on the preceding analyses, on the comparison with competency level models and also on the criticism expressed repeatedly towards TPACK measurements (Brantley-Dias and Ertmer 2013; Cavanagh and Koehler 2013; DeSantis 2016; Graham 2011), it becomes clear that such measurement approaches face specific challenges and require respective additional considerations in terms of validation and item-model fit to make sure that this gap is bridged appropriately.

Out of the three measurement instruments introduced, the M³K measurement is the only instrument assessing competencies with an objective test with right and wrong answers. The approach aims at reliable data that are less influenced by factors such as subjectivity, unrealistic assessments of one's own abilities, or social desirability. Yet the issues in validation mentioned above substantiate the conclusion that each approach and method to measuring media-related educational competencies brings about specific advantages and challenges that need to be balanced.

Overall, the overview of measurement instruments of DigCompEdu, TPACK and M³K supports the conclusions drawn in Part I as regards significant differences between the three, which help fulfill the requirements of their unique contexts. Also with respect to measurement instruments, it is essential to consider the context and objective of the measurement application. For example, standardized and knowledge tests facilitate an objective comparison of participants and are easier to upscale for larger pilots, while measurements like systematic observations or interviews offer rich insight into the development and knowledge of individuals but are often less applicable for large-scale assessments. Furthermore, evaluating and assessing preservice teachers' competencies may have different implications and requirements than according considerations in the context of inservice teachers: both target groups have different prior knowledge, professional experience and requirements in terms of competencies and knowledge. As argued above, a competency measurement with German preservice teachers will necessarily have to focus on academic and theory-based knowledge instead of practical skills and competencies, while respective measurements with US preservice teachers might reveal a greater practical focus, given systematic differences in systems of teacher education. Hence, the suitability of models and instruments also varies, depending on factors such as cultural background or main purpose of the model implementation. Against this background, it seems beneficial that there are specific competency models and measurement instruments for various purposes and contexts. It has also become clear that well-grounded international models like DigCompEdu, building on various frameworks and summarizing a broad background, are valuable and applicable in many contexts but are not universally applicable or a replacement for the national and smaller-scale models they build on. The analysis of the connection between the theory-focused first phase of German teacher education and respective measurements putting less emphasis on practical skills of application offers an example for a context in which the applicability of an otherwise widely useable framework and measurement like DigCompEdu is limited.

This chapter provided an overview of different ways of measuring competencies, and the importance of considering the overall background and the underlying competency model was emphasized. It is now consequent to amend these theory-based conclusions through an analysis of the practical application of such a competency

measurement in an international comparative context. Hence, Paper 1 will be introduced in the following chapter describing a quantitative measurement of media-related educational competencies. The results of a main pilot in Germany will be compared with the results of a smaller exploratory study with preservice teachers in the USA, both of which were conducted in the context of the M³K research project. Hence, the M³K model and measurement instrument will be used as a basis for this measurement and comparison in the following.

8. Measuring Media-related Educational Competencies with M³K

8.1 Measurement Methodology

8.1.1 Measurement Instrument

The comparative study of media-related educational competencies of preservice teachers in Germany and the USA introduced in the following is based on the German M³K measurement instrument developed in the course of the M³K project (Herzig and Martin 2018; cf. Chapter 7.3). This development process included an iterative design circle with two major pilots and several smaller interim pilots with German preservice teachers and continuous processes of revision and improvement. There were three versions of test books with rotating contents to account for the length of the instrument. As mentioned above, the validation of the resulting instrument used in the following was not finalized during the project runtime. These German main pilots were amended by an exploratory study with US preservice teachers to consider and explore the international applicability and connectivity of the instrument. Table 4 lists the items included in the original German instrument in its final version and the items used in the US exploratory study.

Content category	Content areas	Item type	No. of items	Used in German main pilot study	Used in US exploratory study
Medienpädagogische Kompetenz/media-related educational competencies	<i>Mediendidaktik/</i> teaching with media	Objective, single choice (1 correct answer, 3 distractors)	16	Yes	Yes
	<i>Medienerziehung/</i> teaching about media		14	Yes	yes
	<i>Schulentwicklung/</i> Media-related school reform		10	Yes	No
Correlated knowledge	<i>Technisches Wissen /</i> Technological knowledge	Objective, single choice (1 correct answer, 3 distractors)	26	Yes	Yes
Correlated beliefs	... regarding teaching with media	Subjective, self-assessment (4-point	6	Yes	Yes
	... regarding about media	Likert scale: completely disagree → completely agree)	6	Yes	Yes
	... regarding media-related school reform		6	Yes	No
Correlated self-efficacy	... regarding teaching with media	Subjective, self-assessment (4-point	6	Yes	Yes
	... regarding teaching about media	Likert scale: completely disagree → completely agree)	6	Yes	Yes
	... regarding media-related school reform		6	Yes	No
Demographic data	Gender, Age	Single choice (male/female), open answers	2	Yes	Yes
Study biography	Degree Program, place of study, field of study, study section, semester	Single choice (yes/no), open answers	5	Yes	Yes
Learning opportunities	Experience in teaching strategies using media	Single choice (yes/no for 3 university settings)	1	Yes	Yes
	Experience in learning about media		1	Yes	Yes

Tab. 4.: Items in the German M³K main pilot and in the US exploratory study.

As Table 4 reveals, all items were used both in the German main pilot and in the US exploratory study except for the items in relation to the field of media-related school reform, i.e., 10 objective items, 6 self-assessment items on beliefs and 6 self-assessment items on self-efficacy. These items were omitted in the US exploratory study for reasons of extent and cultural fit. In terms of extent, the smaller sample

($n_{USA} = 109$; $n_{GER} = 914$) rendered a rotation of items in different test books impossible. As argued in Paper 1, the smaller size of this sample is due to the exploratory character of the comparative study which serves to amend and add a further perspective to the main study in Germany. With regards to the cultural fit, the previous chapters contributed from different angles to the conclusion that the national and cultural background is of fundamental importance for the competency measurements. While this fact necessitates a careful translation of the whole M³K instrument, it is critical especially in the context of media-related school reform, because this field is particularly dependent on the educational system and the role of educators in this system. Since it was considered insufficient to compensate for the significant differences between Germany and the USA in this context by minor semantic changes or adoptions, it was decided to leave out this field in favor of a targeted exploration of the other two fields of teaching with media and teaching about media.

8.1.2 Survey Translation Methodology

For the application of the German M³K instrument in the USA, an extensive adaptation process was necessary to ensure that US American participants shared the same conditions as the German participants when taking part in the study. As argued in Chapter 3.2.1, it is generally considered challenging to ensure test validity in international comparisons. Most centrally, two elements have to be considered when adapting an instrument for cross-national application, namely language and cultural fit. To respond to these claims, a five-step team translation approach was developed which mainly builds upon the Guidelines for Best Practice in Cross-Cultural Surveys (Survey Research Center 2010) and Harkness (2008).

First step: Translation

In the beginning, three independent translations were drafted. Two of these were prepared by two independent teams of translators fulfilling the following characteristics: (1) professional and experienced translators, (2) US American native speakers, and (3) familiar with the field of educational research. These two teams each worked in two steps: first, one translator produced a translation, and second, this translation was reviewed, critically evaluated and, if necessary, improved by the second translator. This way, two different professional and peer-reviewed translations were drafted.

A third translation was produced by the author of this dissertation as a member of the M³K project team fulfilling the following criteria: (1) experienced with German-English translations, (2) German native speaker, and (3) content expert because involved in the process of test instrument design.

Second step: Review

The first review process was conducted by the author of this work and a second member of the M³K team, who fulfilled the role of survey experts as they were experienced with translations and acquainted with the project including questionnaire, survey and background. In this review process, the two professional translations were compared thoroughly and combined in order to find the best translation. It was observed that one translation tended to be more colloquial while the other one was more formal. This difference turned out to be helpful in the process as there was a certain variety to build upon. Eventually, the more formal version was preferred in a majority of cases.

The professional translators were involved in this step and contacted if the comparison raised questions on translation matters. Additionally, the advance translation created by one of the survey experts in the first step was consulted in case of doubt. There were a few cases when both professional translations seemed inappropriate and the advance translation offered a new idea. As a result of this review, a preliminary translation was developed which served as a basis for the following stages of evaluation and improvement.

Third step: Adjudication I

In this step, decisions were made on issues which had been identified as controversial before. After the review process, which had focused on linguistic and translation matters, the first adjudication served to raise questions about content and cultural fit. An external expert was consulted for this purpose. Being of German origin, having lived in the US for several years and working as a media education professor in the US, she added a valuable point of view and helped improve the review version of the test instrument.

Fourth step: Pretestings

The translated version of the test instrument which resulted from the preceding steps was now tested in three pretestings in order to ensure its cognitive validity. At first, an elaborate cognitive pretesting was conducted with a US expert in media education. Karabenick et al. (2007) suggest such a cognitive pretesting as a means of adapting an established instrument to a new purpose, population, setting or language; this way, it is possible to identify how new populations could interpret items differently, which is helpful for informing efficient adaptations.

The cognitive pretesting was structured by help of the following four questions for each item:

1. Please read this question out loud,
2. What is this question trying to find out from you?,
3. Which answer would you choose as the right answer for you?,
4. Can you explain to me why you chose that answer?

This procedure was intended to identify problems at all three critical cognitive information-processing steps respondents are to complete successfully: interpretation of item meaning, recalling memories that are relevant for this item, and choosing an answer which correctly reflects these memories (Karabenick et al. 2007). In the process, it was discovered that the better part of items required further improvements, primarily on a semantic level. Based on the expert's comprehensive feedback and suggestions, a number of changes were accepted.

The current version of the questionnaire was now transformed into an online survey and filled in by a first exploratory pretesting sample of $n = 2$ US preservice teachers in order to support the validity of the latest version and to rule out potential remaining mistakes or problems. The participants' feedback did not indicate a need for further changes.

Fifth step: Adjudication II

Finally, the translation was discussed and reviewed by the internal team of survey experts once more. Changes that had been made were reconsidered, and the adapted version was accepted as appropriate for the upcoming explorative international survey. At that point, it was not perceived necessary to involve further experts, as the first small test survey had not indicated a need for further editing.

Overall, the translation and adoption procedure was accepted as appropriate for the given purpose. Disadvantages of the approach include high costs in terms of human and financial resources because of the involvement of professional translators, several staff members, experts and pretesting participants. However, the resulting translation can be considered reliable and valid. Thus, from a methodological viewpoint it is to be preferred to less complex translation approaches such as team translations with fewer experts or non-professional translators, relying on one single translation draft, or back translations (Harkness 2008).

The US version of the questionnaire was administered in two phases in 2015 with $n = 109$ participants: first, $n = 70$ preservice teachers of Wheelock College, Boston, filled in a pen and paper version, and in a second step, $n = 39$ preservice teachers from five US institutions of initial teacher education (University of Chicago, James Madison University in Harrisonburg, Rhode Island College, Ohio University and

Appalachian State University) completed the online version. The sample includes preservice teachers at undergraduate and graduate levels and from all kinds of school forms (i.e., primary and secondary). The results of the survey and its comparison to the German data collected in the course of the M³K project will be introduced in Paper 1.

8.2 *Paper 1: Media Pedagogy in German and U.S. Teacher Education*¹

8.2.1 *Introduction*

The relevance of pedagogical media competencies in teacher education

Given the omnipresence of media like TV, internet and mobile phones and their wide influence on the daily lives of young people (MPFS 2014; Lenhart 2015; EU Kids Online 2014), the relevance of these so-called “new media” for school and teaching has developed and increased over the last decades as well. On the one hand, they can be utilized as an appropriate means to support successful learning processes and to facilitate effective teaching; on the other hand, they have become a subject themselves since students need to learn about media education issues, like responsible behavior in online environments or ethical aspects of internet use, at school (KMK 2012; ISTE 2008). Hence, scholars and practitioners all over the world agree that teachers need specific knowledge and skills in order to integrate new media into their lessons successfully. While most works of research have focused on teachers’ and preservice teachers’ own media literacy skills or technological knowledge (Fry and Seely 2011; Oh and French 2004), further competencies are required for a professional inclusion of media into school. Teaching with media and teaching about media / media education are generally considered the two core areas in this context. However, there are varying concepts of the specific competencies and skills, which will be summarized under the term “pedagogical media competencies” here.

A well-known and established framework for defining these competencies in question was developed in the USA by Mishra and Koehler (2006) as TPACK (Technological Pedagogical Content Knowledge), which is based on Shulman’s work (1986). Shulman defined pedagogical content knowledge, content knowledge, and pedagogical knowledge as the core areas of competencies that teachers should be skilled in. Mishra and Koehler (2006) added the aspects of technological knowledge,

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technological content knowledge, technological pedagogical knowledge and technological pedagogical content knowledge and thus developed a comprehensive model of the skills needed to teach with media successfully.

Despite the existence of frameworks like TPACK, there is no common consensus about the precise shape of pedagogical media competencies, neither worldwide nor even within countries. Furthermore, their integration into university teacher education is also subject to discourse and has not been realized consistently, even though teacher training has been acknowledged to be a suitable and mandatory place for the acquirement of media pedagogical skills (Blömeke 2003). Hence, there are no binding curricula yet which could ensure a basic media pedagogical education for every preservice teacher, but there are non-binding standards and guidelines that make suggestions for such processes, as for example the UNESCO Media and Information Literacy Curriculum for Teachers (Wilson, Grizzle, Tuazon, Akyempong, and Cheung 2011).

This inhomogeneous situation, where efforts and ways to integrate media pedagogy into teacher education can be assumed to vary between countries and institutions, forms the background of this paper. This exploratory study aims to further explore the pedagogical media competencies of preservice teachers in Germany and the USA. Comparing two countries serves to overcome cultural boundaries, to counteract the danger of a narrowed perspective and to benefit from the background, research and knowledge of different viewpoints. Both countries share a rich culture of pedagogical discourse and research on teacher education, which provides a common background to build upon (Grafe 2011). Both countries share generally similar approaches to educational policy and structure, as strong state and local control of education is paired with high levels of federal influence on educational issues (Blömeke and Paine 2008; Tiede, Grafe, and Hobbs 2015). In the following, different models of pedagogical media competencies from both countries will be introduced and the extent to which these competencies have become part of teacher education programs and related studies will be summarized. Afterwards, methods and selected results of a study will be described where the skills in question were measured with students from both countries, based on a comprehensive model of pedagogical media competencies that connects German and international research in this field. The international comparative perspective will help broaden the viewpoint and understand similarities and differences. These data serve to identify different ways of integrating media pedagogy into teacher training and point to conclusions about the consequences these processes entail for preservice teachers and their pedagogical media competencies.

Pedagogical media competencies in German and U.S. teacher education

The issue of teacher competencies is a key factor in advancing the future of education both in the United States and in Germany (see for a detailed overview of the development and current state of media education in both countries for example Tulodziecki and Grafe 2012; Hobbs 2010; Tiede, Grafe, and Hobbs 2015).

The Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany has realized the need to include pedagogical media competencies into teacher training, as their according declaration on media education at school reveals (KMK 2012). Accordingly, there have been various attempts for such an integration over the last decades (Bentlage and Hamm 2001; Imort and Niesyto 2014). Nonetheless, there are no binding national obligations for institutions of teacher education as, due to the federal system in Germany, the responsibility for higher education institutions lies entirely with the individual federal states. Recently it can be recognized that in different federal states new educational policy guidelines and recommendations for media literacy have been published (for example in Bavaria: Stmbw 2016). As a result of these efforts, most German preservice teachers can but do not have to engage with media pedagogy in the course of their education. About 17% of all eligible German institutions of teacher education offer M.A. studies with an explicit focus on media pedagogy. The preservice teachers at these institutions can accomplish such studies in addition to their regular M.Ed. degree. With regard to contents, the focus of these media pedagogical studies varies. The field of teaching with media is addressed explicitly by most study programs (92%), followed by media-related school reform (33%) and media education (25%) (Tiede, Grafe, and Hobbs 2015).

In the USA, the new 2016 National Education Technology Plan lately issued by the U.S. Department of Education reinforced the call for a media pedagogical education of all preservice teachers, which is still not obligatory, and emphasized the responsibility of the institutions involved (p. 32-33). This plan refers also to the ISTE standards for teachers, issued by the International Society for Technology in Education, as a background. These standards describe a framework for the skills teachers should have regarding the educational use of media; they primarily address the field of teaching with media but also include media educational issues and professional development (ISTE 2008). Another important U.S. framework was developed by the National Association for Media Literacy Education, named the Core Principles of Media Literacy Education. These principles mainly focus on media educational aspects (NAMLE 2007). Like the ISTE standards, the NAMLE principles do not have to be adhered to mandatorily.

U.S. preservice teachers generally have few elective courses; hence, there is a larger number of mandatory courses with media pedagogical contents. Additionally, 52% of all eligible U.S. institutions of teacher education offer master's programs with

an explicit focus on media pedagogy. These focus on teaching with media (76%), media-related school reform (23%) and media education (2%) (Tiede, Grafe, and Hobbs 2015). Unlike in Germany, preservice teachers can decide for such master's studies as part of their initial teacher certification, depending on individual regulations for each state.

As these observations from Germany and the USA indicate, the circumstances of the two countries are comparable to some extent. Both of them generally support and promote the integration of media pedagogy into teacher training and yet lack according national binding obligations. Consequently, preservice teachers in both countries can but usually do not have to study media pedagogical topics in the course of their education. Media pedagogy is included into teacher training either as elective courses as part of the basic education, as additional courses and certificates or as specific graduate studies (Tiede, Grafe, and Hobbs 2015).

Obviously, there are also differences between the two countries from a systemic point of view. To substantiate this observation, first results of a study will be presented in the following which sought to measure the pedagogical media competencies of preservice teachers from Germany and the USA. The development of a test instrument will be outlined with particular regard to the special requirements of cross-national research. Then, initial data will be introduced and analyzed.

8.2.2 *Material and Methods*

The M³K model of pedagogical media competencies

A recent approach to defining pedagogical media competencies was made in the course of the German research project “M³K – Modeling and Measuring Pedagogical Media Competencies”, funded by the Federal Ministry of Education and Research. This M³K model of pedagogical media competencies serves as a basis for the following study. As a starting point for its development, a broad range of primarily German, but also international literature was reviewed, particularly the works of Tulodziecki and Blömeke (1997; see also Blömeke 2000; Tulodziecki 2012) and their follow-ups (Siller 2007; Gysbers 2008). A first model was deductively derived from this theoretical basis, structured in dimensions and facets of competencies. In order to assess this structure and to further differentiate the facets, media pedagogical requirements for preservice teachers were surveyed empirically and inductively by means of qualitative semi-structured interviews with national and international subject matter experts (n=14) based on the critical incident method (Flanagan 1954; Schaper 2009). All interviews were recorded and transcribed. Based on qualitative methods of content analysis (Mayring 2000), the relevant aspects of pedagogical media competences

were extracted and paraphrased. The next step emphasized the link between the identified elements of the paraphrased texts to the competencies dimensions previously identified deductively from literature research (Herzig, Martin, Schaper, and Ossenschmidt 2015).

		Competencies		
		Teaching with Media (MD)	Teaching about Media (ME)	Media and School Reform (SE)
Aspects of competencies	Understanding and assessing conditions			
	Describing and evaluating theoretical approaches		Standard ME2.1 Standard ME2.2	
	Analyzing and Evaluating examples			
	Developing one's own theory-based suggestions			
	Implementing and evaluating theory-based examples			

Tab. 5.: M3K Model of Pedagogical Media Competencies. Exemplary excerpt.

The model which was created this way defines pedagogical media competencies as an interplay of three main areas. The first one is media didactics, which means teaching with media or the design and use of media content for educational purposes. The second area is media education and addresses media-related educational and teaching tasks, such as ensuring the students' responsible behavior in online environments or teaching about ethical aspects of internet use. The third field is media-related school development; this refers to professional development and integrating media on a systemic level (Tulodziecki, Herzig, and Grafe 2010; Herzig, Martin, Schaper, and Ossenschmidt 2015; Tiede, Grafe, and Hobbs 2015).

The M³K model is designed as a matrix with the three main areas: media didactics, media education and school reform on the first axis. Five competency aspects form the second axis. These competency aspects are (a) understanding and assessing conditions, (b) describing and evaluating theoretical approaches, (c) analyzing and evaluating examples, (d) developing one's own theory-based suggestions, and (e) implementing and evaluating theory-based examples. Each field between the two axes is filled with two standards, as table 5 demonstrates.

The field between "Media Education" and "Describing and evaluating theoretical approaches" for example contains the following two standards: "Standard ME2.1:

Student teachers are able to describe concepts of media education and related empirical findings appropriately” and “Standard ME2.2: Student teachers are able to assess concepts from an empirical, normative, or practical perspective” (Tiede, Grafe, and Hobbs 2015).

Developing a measuring instrument of pedagogical media competencies

Following the development of the model, a test instrument was designed to measure the competencies as defined before. The first items were developed based on theory and on findings from the expert interviews (n=14) as operationalizations of the model facets and then tested for performance criteria (Herzig, Martin, Schaper, and Ossenschmidt 2015).

Further factors are understood to influence a successful educational use of media even if they are not defined as immediate constituents. This is true primarily for beliefs with regard to teaching with media, teaching about media and school development, perceived media related self-efficiency, and technological media knowledge (Blömeke 2005; Grafe and Breiter 2014). Test instruments were developed for these factors, too.

For the validation of the instruments, data were collected from students in teacher training programs at 11 different Germany universities. There were three major surveys with $n_1=591$ test persons, $n_2=434$ test persons and $n_3=919$ test persons; after the first and second survey, the results were analyzed in detail and the instrument was revised thoroughly. Additionally, extensive pretestings, expert interviews and minor studies helped improve and validate the items.

The final version contains 16 items on media didactics / teaching with media, 14 items on media education, 10 items on school reform and 26 items on technological knowledge. These items are amended by 6 items on beliefs for each of the three main areas, 6 items for each of the three main areas that assess the perceived self-efficiency and some demographic data.

The validation of these items is still work in progress, and further work on the test instrument will be required to achieve entirely resilient results. According to the reliabilities determined in the final survey, 11 out of the 16 items on media didactics are suitable for further improvements and should be retained ($\alpha=.56$), and the same is true for 12 out of 14 media education items ($\alpha=.60$), 8 out of 10 school reform items ($\alpha=.46$) and 19 out of 26 items on technological knowledge ($\alpha=.81$). The reliabilities of the beliefs were $\alpha=.64$ and the reliabilities of technological knowledge were $\alpha=.81$ (19 out of 26 items) and of self-efficiency $\alpha=.87$.

Adoption of the German M³K questionnaire to a US-American version

In order to use the M³K test instrument in an international context, a complex adoption process was necessary. As international sources were included in the process of developing model and instrument, the international connectivity was generally given; still, a number of steps had to be taken to guarantee comparable results. Their main goal was to ensure the same conditions for students of both countries. Therefore, a five-step approach was applied which mainly builds upon the Guidelines for Best Practice in Cross-Cultural Surveys (Survey Research Center 2011) and on Harkness and Schoua-Glusberg (1998): 1) Translation: two independent peer-reviewed translations were prepared by professional translators and a third advance translation was made by a competent member of staff; 2) Review: a preliminary translation was developed from the first drafts; 3) Adjudication I: an international expert was consulted, and decisions were made on issues which had been identified as controversial before; 4) Pretestings: an elaborate cognitive pretesting with another expert was made to ensure the cognitive validity of the translation, resulting improvements were applied to the translation and a first small test group of n=2 participants filled in an online version of the test; 5) Adjudication II: the translation was reviewed and discussed once more, changes were reconsidered and the adapted version was finally accepted as appropriate for the upcoming explorative international survey.

The German and US surveys: samples and method

For the international survey the following content areas were included: media didactics / teaching with media, media education, technological knowledge, beliefs and self-efficiency, and demographical data. It was decided to exclude school reform due to reasons of efficiency and manageability and to avoid potential difficulties with the cultural fit of this field which depends significantly on systemic aspects.

The study was designed as an “ex-post-facto” study since it was not possible to manipulate variables or randomize participants or treatments. Therefore, a descriptive, comparative and non-experimental, quantitative questionnaire-based approach was applied.

The US sample consisted of n=109 test persons who were aged 22 on average (SD=2.16). 11.21% were male. All of them were preservice teachers or students of related studies from one college and five public US universities. As for the procedure, the questionnaire was distributed both as a paper version and as an online survey between April and May 2015.

For the comparison, the data from the third major survey were included. This sample consisted of n=914 test persons aged 23 on average (SD=4.24). 35.52% were

male. All test persons were preservice teachers from six different universities. The survey was conducted as a paper version in summer term 2014.

The international survey was one aspect of a greater project, so it was designed as an exploratory study. It served to open up a new comparative view but was not intended to reach the same range as the German main study, which is why the German and US test groups differed in size.

8.2.3 Results

For the descriptive comparative analysis, simple T-tests were used to calculate the means for all items separately for both samples. These means were then summarized as one mean value for each field and sample. The confidence interval was defined as 95%. In the following, the results will be introduced descriptively. An interpretation will be provided in chapter 8.2.4.

	% of students with correct answers	
	Germany	USA
Media didactics	51.9% *	44.0% *
Media education	56.4% *	42.9% *
Technological knowledge	55.5% *	50.0% *

Tab. 6.: Overview of German and US results for media didactics, media education and technological knowledge. * CI 95%, * $p > .05$.

As table 6 illustrates, the German means for all three fields (media didactics, media education and technological knowledge) are significantly higher than the US means. The highest difference can be found in the field of media education.

In the field of media didactics, German students achieved higher results with items related to the following topics: films at school, the constructivist use of media in lessons, media didactic concepts, practice programs, computer simulations, computer learning programs, learning through films, behaviorism, and methods of empirical/quantitative research. Three items are opposed to this tendency, as US students achieved higher scores here. The first one requires skills in identifying and processing media influence (Tulodziecki 1997), the second one knowledge about using computer games for learning and the third one knowledge about the use of online forums for homework.

With regards to media education, German students had more success in answering a majority of the topics covered by the questionnaire. These topics are role models in the media, conservative pedagogical attitudes, age-specific media activities, consumption of violent media content, media use for the satisfaction of needs, developing media competencies and conditions of media production. One item contradicts

the tendency described. US students were 29.5% more accurate than their German counterparts, which is a remarkably high difference. This item describes a scenario which requires expertise in the area of understanding and assessing conditions of media production and media dissemination (Tulodziecki 1997).

Also in the field of technical knowledge, German students answered a majority of questions with higher success. These items were about general functions of social networks, types of data, Google functions, internet browser, hot spots, meta search engines, computer hardware and software. Given this tendency, five items do not correlate because the US test group achieved higher results here. The two that show the highest differences between the test groups (20.7% and 65.4%) are concerned with knowing and using different social media.

With regards to beliefs, the results show that the German means are significantly higher than US means both in the fields of media didactics and media education. This indicates that the attitudes German students expressed concerning using media for these purposes were more positive; for example, they indicated to be more convinced of the usefulness of a media integration which allows students to independently approach lesson content, or they agreed less with the statement that students are already aware of manipulations inherent in media, which therefore need not be further addressed in the classroom.

The difference in self-efficiency is not significant, meaning that the German and the US study participants showed comparable confidence to be able to teach with and about media successfully; for example, both groups estimated their abilities to evaluate the quality of digital learning programs approximately equally.

8.2.4 Discussion and Conclusion

For the interpretation of these data, it has to be considered that the reliabilities of the test instrument still require further improvement. Moreover, the numbers of participants in the two groups compared are rather disproportionate. The results must not be understood as sound proofs of pedagogical media competencies but rather as tendencies that pave the way for further research.

	Mean score (SD)	
	Germany	USA
Beliefs media didactics	3.05 (0.73) *	2.89 (0.80)*
Beliefs media education	3.40 (0.67)*	3.23 (0.76)*
Self efficiency	2.98 (0.78)	3.04 (0.80)

Tab. 7.: Overview of beliefs in media didactics and media education and of self-efficiency. Range: 1-4 with 1=very critical and 4=very convinced. * p>.05.

Media didactics / teaching with media

All in all, the data show that the sample of German students had higher competencies in the field of media didactics / teaching with media than the students in the US sample. A possible explanation could be more relevant learning opportunities during their studies, but the students' self-reports do not support this thesis: comparable shares of German and US students claimed to have learned about teaching with media during the course of their studies (78.8% of German students vs. 77.8% of US students). Assuming that no confounding factors like different perceptions of the item text came into effect, another interpretation is that the quality and topical focus of the studies both test groups experienced were heterogeneous and led to different shapes of competencies. Consequently asking for more details about the learning opportunities in future studies would be helpful for the interpretation of the differences in results.

With regards to an analysis on the level of items, some items oppose this trend of higher media didactical competencies on the part of the German participants, for example two of these items required competencies in using computer games for learning and in the use of online forums for homework. The results showed that the US sample achieved better scores with regard to these items, as they might have had more opportunities to gather experiences with computer games in class and forums for homework during their own schooldays. Empirical data on students' computer use support this assumption: in 2009, when a majority of the study participants was still at school, 88% of all US students were reported to use computers during instructional time in the classroom rarely, sometimes or often (Gray, Thomas, and Lewis 2010), while the percentage of German students who used the computer at school was as low as 64.6% (OECD 2015).

Media education

64.2% of all German participants indicated having had learning opportunities in the field of media education while the share of US students was 78.9%. Yet, German students had significantly more success in answering a majority of the media educational topics covered by the questionnaire. This observation substantiates the assumption made based on the findings in media didactics that the study content both test groups faced differs.

Noticeably, the two items with the largest difference in the answering pattern (with the means of German participants being 28.2% and 33% higher) contain the term media competencies. Despite the complex adoption process, terminology problems have to be regarded a possible explanation for these discrepancies: there are several ways to translate the German term "Medienkompetenz", and their precise definition differs according to their context. One team of translators decided on a

direct translation and chose media competencies, which was accepted for the final version. Other terms are also frequently used, as for example media literacy (as suggested by the second team of translators), digital competence, digital literacy, or computer literacy (Røkenes and Krumsvik 2014). As the remarkably high discrepancies suggest, terminological differences of key terms in the field of pedagogical media competencies are a great challenge for the development of instruments that could work internationally.

Technological knowledge

Also in the field of technical knowledge, the German students answered a majority of questions with higher success. It has to be considered that technical knowledge depends on everyday knowledge to a higher degree than the fields of teaching with media and media education, given the omnipresence of media and their being part of our everyday life. Acquiring media literacy and technical knowledge may be part of teacher training, but it also takes place in informal learning processes. Hence, the interpretation seems likely that German students interact with media in other ways than US students do. This thesis of varying media use is substantiated by empirical data, for example with respect to social media: in the US, 76% of young people aged 13 to 17 reported using social media in 2014/15 (Lenhart 2015), while in Germany only 68.5% of young people aged 14 to 17 reported using social media in the same period of time, and 57% if the age group from 12 to 17 is considered (MPFS 2014). Consequently a great challenge when evaluating the success of teacher education programs on the development of pedagogical media competences and its dependent variables is to measure the informal learning processes. For this study it can be concluded that the integration of further items on informal media use would be helpful for the interpretation of results.

Beliefs and self-efficiency

According to Redman (2012), the perceptions of the affordances of new technologies are also shaped by students' experiences with these technologies: it was found out that, once the students in this study became acquainted with certain media, their perceptions shifted towards a more positive assessment. However, the German students in our study did not describe more learning opportunities than the US study participants but still showed higher means in the according beliefs. Hence, the correlation of experience and beliefs as argued by Redman (2012) could not be confirmed here.

Differences in the perceived self-efficiency of both groups are not significant. This observation is noteworthy since there is evidence that TPACK knowledge may be predictive of self-efficiency beliefs about technology integration (Abbitt 2011). Due to overlaps of TPACK and the M³K model, comparable results could be expected here, meaning that according to Abbitt's results (2011), German students should show higher self-efficiency beliefs because of their higher pedagogical media competencies which were measured in the study. Hence, further research will be necessary here with regard to potential confounding factors and other influences that may have led to this contrary outcome.

Conclusion

One important goal of this study was the adaptation of a nationally developed instrument for further use in other national contexts taking Germany and the USA as examples. Results show that the international comparative approach adds a number of challenges: while an elaborate adoption process sought to ensure comparability of the German and the US version, the basis was still developed by German scholars and influenced by a German background in terms of fundamental terminology and literature. The possibility that this background has an impact on the results cannot be ruled out and is a great challenge for cross-national studies in the field of media pedagogy.

With respect to these limitations, the overall results of the study suggest that the selected sample of German preservice teachers has slightly higher pedagogical media competencies than the sample of US students. According to their self-reports, German students did not have significantly more learning opportunities; as the differences in the competencies measured are still significant, the learning opportunities both groups had must have differed to some degree and led to more or different competencies. Supposedly, the topics within the field of media pedagogy that are covered in both countries vary. It has been previously established that, considering media pedagogy as an interplay of the three fields teaching with media, teaching about media (media education) and school reform, a majority of US study programs with explicit reference to media pedagogy focus on teaching with media and neglect the other two areas, while the respective German study programs show the same tendency but put more emphasis on media education and school reform (Tiede, Grafe, and Hobbs 2015). A transfer of these conclusions to the results of the study described in this paper leads to the assumption that the media pedagogical contents within teacher education of both countries could also differ and include a larger variety of topics within Germany. Therefore further research on a core curriculum of media pedagogical topics in teacher education would greatly assist further cross-national research in this field.

Further research will be necessary to consolidate these assumptions and exploratory findings. Although a cross-national comparison inevitably holds a number of challenges (e.g., culture, history, focus, language, and background), it also has distinctive affordances, allowing for valuable insights by increasing the variety of viewpoints and providing a broadened, globally interconnected perspective. It opens up a variety of options for subsequent studies; elaborating on the differences between media pedagogy in German and US teacher training on the basis of the findings introduced here will bring about valuable insight into potential improvements of both systems. With regard to the varying focus of media pedagogy within teacher education, curriculum analyses and a comparative evaluation will help draw conclusions on the status quo. Based on the results introduced here, it can be assumed that there are in fact differences in the pedagogical media competencies of German and US preservice teachers, resulting from differences in the role, shape and focus of media pedagogy in the respective teacher education programs. However, taking into account that media pedagogy is not a mandatory part of teacher education in either country, both the USA and Germany are facing similar challenges and potentials for systemic improvement.

8.3 *Main Conclusions from and Further Perspectives on Paper 1*

A main outcome of the paper “Media Pedagogy in German and U.S. Teacher Education” is the conclusion that the German sample of preservice teachers has slightly higher “pedagogical media competencies” than the US sample. This conclusion builds on the observation that the overall results of the German sample in the survey presented were better than the results of the US sample. To enhance understanding, to contextualize and evaluate this conclusion and to draw valid conclusions for future uses, it is conducive to look at relevant results in greater detail. Hence, selected noteworthy items were analyzed again critically with regards to influential aspects such as translation and context. As a consequence of the results presented in the article, the following chapter amends these results and provides a broader perspective. For this purpose, another content matter expert was involved in a critical discussion, the findings of which will be presented in the following. The charts included for illustration purposes are based on data that were collected and analyzed jointly in the M³K project together with project partners.

8.3.1 *Mediendidaktik/teaching with media*

Out of sixteen items in the field of *Mediendidaktik*, German participants achieved better results in ten items. Three items were solved comparably well by German and US participants (difference < 5%), and US participants performed better in three items.

Figure 5 illustrates the shares of correct answers per cohort comparatively. As the chart shows, a few items stand out with regards to the number of correct answers and thus deserve further consideration.

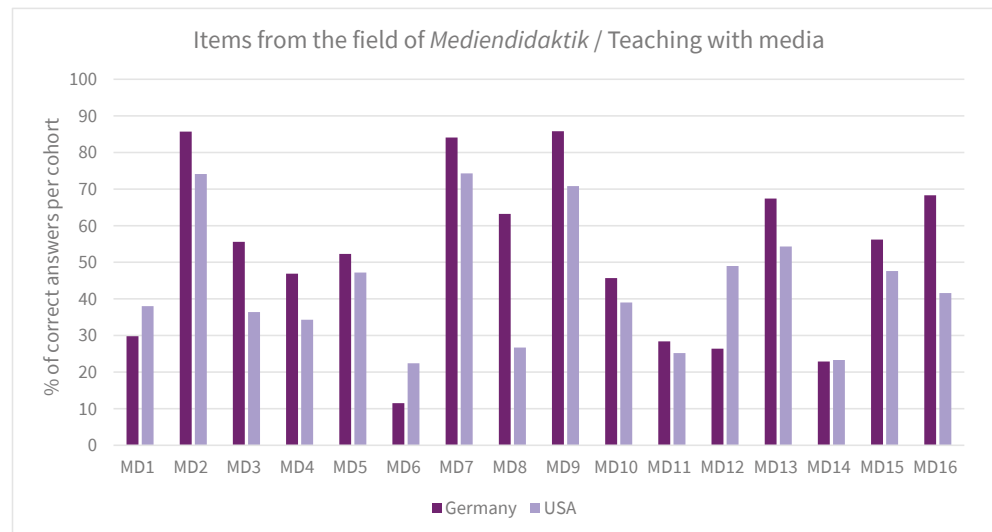


Fig. 5.: Mediendidaktik Items – Comparison GER - USA.

MD8	In a lesson on “Political Decisions and Their Effects“, a politics teacher uses learning software which simulates how the initial situation of a fictitious state changes when the students assume the role of a government commission and invest points in selected areas, e.g. productivity or quality of life, which in turn influence conditions in other areas, e.g. politics or environmental pollution.
What are the main learning requirements that the learners must meet in order to realize the lesson successfully?	
Knowledge of computer science	<input type="checkbox"/> 1
Argumentation abilities in political contexts	<input type="checkbox"/> 2
Knowledge of various forms of government	<input type="checkbox"/> 3
The ability to do networked thinking	<input checked="" type="checkbox"/> 4

Tab. 8.: Item MD8.

The share of German participants giving the correct answer here is about 36 % higher than the share of US participants (GER: 63.2 %; USA: 26.7 %). This is the largest difference between the results of German and US test groups throughout the whole survey. For German participants, this was one of the easier items, while it was obviously rather difficult for US participants. The feedback conversation which was conducted with a US expert after the survey administration revealed a possible explanation for this heterogeneity. The expert expressed that terminology in the

correct answer option, “the ability to do networked thinking,” was neither precise nor easy to understand. She herself had problems in comprehending and evaluating it, a problem which was not expressed with the German equivalent “*die Fähigkeit zu vernetztem Denken*.” Since it can be assumed that the expert, being a native speaker, has advanced language proficiency and reading comprehension skills, it is possible that the US preservice teachers in the study also had problems understanding this item. However, it is remarkable that this difficulty was not identified throughout the elaborate translation process (cf. Chapter 8.1.2). Instead, it was a verbatim suggestion by one of the professional translation teams which did not evoke comments or a need for further adoptions in the ongoing translation process. The second translation suggested was “ability to think laterally,” which is close to the idiom “thinking outside the box” and thus not totally congruent with *vernetztes Denken*, which led to the refusal of this alternative. This background leads to the assumption that the translation is correct but that the underlying concept is less familiar in the USA. In the German discussion, this concept was shaped, e.g., by Vester (1988; 1996; 2001). According to Ossimitz (2000), it is one of four constituents which make up systemic thinking, with the other three constituents being dynamic thinking, thinking in models, and system-appropriate acting (cf. Maierhofer 2001; Rieß and Mischo 2008). A corresponding deep exploration of this concept is not an equally established part of the US discourse, which might have led to the comparably low share of correct answers in the US sample.

Another peculiarity can be found with item MD16:

MD16	A teacher has used an educational software in a lesson unit. Before and after the lesson unit, she gathered empirical data about the student’s degree of educational success by testing their knowledge, which she then compared with a control group. She would like to use the results for future teaching situations.	
Which of the following statements is most accurate?		
	It is generally not possible to draw consequences for future activities from the data collected.	<input type="checkbox"/> 1
	If the data confirms a positive learning outcome, the teacher can conclude that the concept tested will also be successful in all other classes.	<input type="checkbox"/> 2
	From these results, the teacher can draw conclusions concerning the aspects of the teaching process that increased the students’ learning success.	<input type="checkbox"/> 3
	The data allow the teacher to evaluate whether the tested concept has led to learning progress for the students.	<input checked="" type="checkbox"/> 4

Tab. 9.: Item MD16.

The share of German participants giving the correct answer here is approximately 27 % higher than the share of US participants (GER: 68.3 %; USA: 41.6 %). The item requires declarative knowledge about methods of empirical research. Processes of translation and validation did not indicate problems with the translation here.

Hence, it seems a likely interpretation that German students had more chances to learn about methods of empirical research in their studies, compared to their US peers in the study. This assumption is substantiated by item 15, which is also about methods of empirical research and was solved correctly more often by German participants (difference: approx. 9 %; GER: 56.2 %; USA: 47.6 %). The research design of the study presented does not allow for conclusions regarding respective teacher education curricula. Hence, to verify this thesis it will be helpful to amend comparative curricula studies in order to achieve insight into the actual contents in teacher education with relation to empirical research.

8.3.2 Medienerziehung/teaching about media

Out of fourteen items in the field of media education, German participants achieved better results in eight items. Five items were solved correctly by comparable shares of German and US participants (difference < 5 %), and US participants performed better in one item. Also in this field, some items need to be reconsidered. Figure 6 displays the shares of correct answers per cohort in this field.

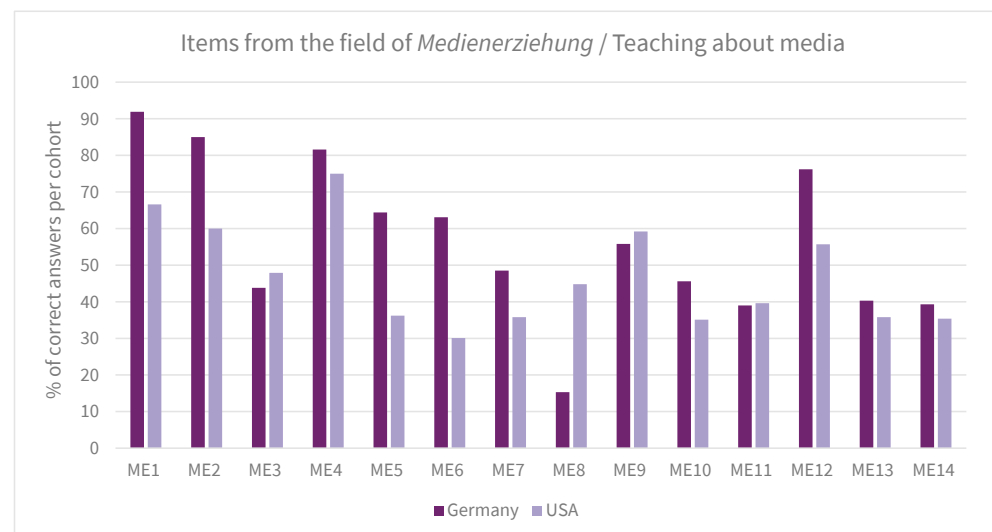


Fig. 6.: Medienerziehung Items – Comparison GER - USA.

Out of the eight items that were solved correctly more often by German participants, the largest deviations between German and US results were found in items 5 (approx. 28 % difference: GER: 64.4 %; USA: 36.2 %) and 6 (approx. 33 % difference: GER: 63.1 %; USA: 30.1 %):

ME5	Media education offers different approaches and basic attitudes to dealing with media. One of these approaches stipulates that children and youth should have largely unrestricted media access so that they can develop into competent media users either by themselves or with teacher assistance.	
Which of the following statements most closely reflects a comprehensive understanding of media competencies?		
<i>Media competencies mean that children and youth ...</i>		
... have knowledge about media that they have acquired from their parents or teachers.		<input type="checkbox"/> 1
... are able to successfully master various tasks in the area of media.		<input checked="" type="checkbox"/> 2
... possess the technical skills required to use media.		<input type="checkbox"/> 3
... have attitudes about media that are in accord with societal norms.		<input type="checkbox"/> 4

Tab. 10.: Item ME5.

<i>Continuation of scenario from ME5 (p. 10):</i>		
ME6	With regard to media competencies, which reason for providing largely unlimited media access is most accurate?	
<i>Largely unrestricted media access is a good idea because...</i>		
... youth protection measures to protect minors from harmful media are sufficient for ensuring that children and youth will not experience negative effects.		<input type="checkbox"/> 1
... children and youth have already developed sufficient standards and consume only un-problematic media offerings.		<input type="checkbox"/> 2
... parents should not control the developmental processes of children and youths by intervening in media behavior based on an adult's perspective.		<input type="checkbox"/> 3
... children and youth generally have the ability to make responsible individual decisions regarding media, and to develop competencies.		<input checked="" type="checkbox"/> 4

Tab. 11.: Item ME6.

It is noteworthy that both items contain the term *media competencies*. Against the background of the findings from the previous chapters, one interpretation is that terminology is problematic in these cases. As discussed above, *media competencies* is a term less common in the US context compared to *Medienkompetenz* in Germany, and concepts and understanding can be expected to differ between the two countries and languages. This conceptual ambiguity illustrates the challenges of international research and of cultural adaptations that go beyond the semantic level and delimit the informative or comparative value of these two items. It leads to the question of how to meet these challenges in order to achieve a comparable result. Hypothetical approaches in relation to the two items mentioned above might include a definition of “media competencies” or analyze options for exchanging “media competencies” with the concept of “media literacy.” Again, the concept of “media literacy” is not totally congruent with *Medienkompetenz*, but a respective change would do justice

to the methodological claim of prioritizing functional equivalence over literal translations (Peschar 1982; Harkness 2008).

Another striking item can be found with ME8 where there is a deviation of about 30 % in favor of the US survey participants (GER: 15.3 %; US: 44.8 %):

ME8	Students are addressing the topic of “news” in a school class. For this purpose, they form small groups that represent public and private television broadcasting companies. They are presented with specific background conditions about their broadcasting companies, and assume the role of broadcast editors. In this role, the students will decide which news report, among a variety of news reports, they will present as the top story for a particular day. They present their decisions, concepts and justifications to the class and compare them with news that has actually been broadcasted.	
Which media-educational goals are primarily addressed in this example?		
<i>Students should learn...</i>		
... to distinguish between serious and less serious design concepts for news reporting.		<input type="checkbox"/> 1
... to assess the economic, personal and organizational conditions of the production and distribution of news.		<input checked="" type="checkbox"/> 2
... to assess the subjectivity in the selection and distribution of news by journalists.		<input type="checkbox"/> 3
... to distinguish between the frequency of news about an event and its actual societal relevance.		<input type="checkbox"/> 4

Tab. 12.: Item ME8.

This item stands out because it is the only item from the field of media education showing this tendency. For German participants, it was the most difficult item while it was of medium difficulty for the US test group, compared to the other items in this field. Possibly, the scenario described in the item is more familiar to US preservice teachers, or that competency area of “understanding and assessing conditions of media production and dissemination,” which is addressed by this item, has been a topic of higher relevance in the past for the US participants in the study. It is noteworthy in this context that this thematic area is a central concern for the research field of media literacy, which, according to Culver and Redmond (2019), is achieving growing public awareness in the US. The authors describe increasing efforts within the US to integrate respective contents into initial teacher programs even though the status is still perceived as unsatisfying. Against this background, the higher success of US preservice teachers with this item can be read to indicate a successful education of preservice teachers with regards to this field of media literacy, which, as will be argued in Part III, might not have a direct equivalent in the German tradition of media education in teacher education. Further comparative studies would be helpful to substantiate this thesis.

Overall, these additional remarks on a number of noteworthy items point out challenges in the research methodology, for example with regards to equivalence of translations or equal conditions for understanding concepts. They also offer ideas for a more suitable evaluation of the study results on the microlevel of items in some cases. However, there are also major influences to be considered for an overall evaluation and conclusion. First of all, the informative value of the survey is restricted by the non-finalized validation of the measurement instrument. The challenges in validating the instrument are connected to Endberg's (2018) criticism of lacking empirical evidence in the German tradition of media pedagogical research. While the reasons for these problems are difficult to pin down, a first and obvious observation is that the complexity of media-related educational competencies as a construct poses serious challenges for objective measurement. Furthermore, missing learning opportunities for media-related educational contexts within the German system of teacher education are a central issue in this regard (Herzig et al. 2015; Herzig and Martin 2018; cf. Chapter 7.3), and the analysis of results from the US sample implies that this problem is not limited to the German context at all. To clarify the conditions and circumstances of these learning opportunities, the following third part of this dissertation will analyze respective practices in teacher education in Germany and the USA. Yet it remains a research desideratum to analyze in greater depth how far the German empirical research tradition from the perspective of media pedagogy can take benefit from professionalization research and if the critique brought up by Endberg (2018) does justice to the empirical research approaches provided by German media pedagogical research. After all, this critique appears questionable especially against the background of other respective studies e.g. from the field of *Medienkompetenz* in which specific aspects of *Medienkompetenz* have been operationalized successfully. Examples for such aspects include *Mediale Zeichenkompetenz* [i.e., the competencies required to understand symbolic representations in media such as pictures or auditive signals] (Möckel 2013; Nieding and Ohler 2008) or information and computer literacy (Bos et al. 2014; cf. Chapter 2).

As a result, to evaluate the results from the study, it is necessary to consider the study participants and to understand the role of learning opportunities within their study career. The conclusion proposed in the article, suggesting that the "pedagogical media competencies" of German students are slightly higher in comparison to those found in the US sample, was drawn against the background of assumed differing learning opportunities of students from both countries, which may have caused different occurrences of respective competencies. The exploratory study design adds to the challenges connected to the cohort, e.g., with regards to the clearly disproportionately sized two national samples for the comparison, or the non-finalized instrument as pointed out above. From these conclusions, a research desideratum has

to be deduced of optimizing study conditions and circumstances in future studies to enhance comparability and informative value of data collected in this regard.

The additional critical reflection and analysis of selected items reveal a new perspective on the overall context of measuring media-related educational competencies. A central outcome of the theoretical analysis of competency modeling in Part I was the conclusion that national models of media-related educational competencies are strongly tied to their national backgrounds. M³K in particular defines the competencies that German preservice teachers are expected to acquire in the course of their teacher education program. As described, this excludes certain facets and highlights others, corresponding to the characteristics of German initial teacher education. Obviously, applying such a model with its national implications to another national context can be critical because the circumstances of the respective comparative teacher education program must be expected to lead to other emphases, expectations and occurrences of media-related competencies. In Paper 1, this aspect is addressed:

“While an elaborate adoption process sought to ensure comparability of the German and the US version, the basis was still developed by German scholars and influenced by a German background in terms of fundamental terminology and literature. The possibility that this background has an impact on the results cannot be ruled out and is a great challenge for cross-national studies in the field of media pedagogy.” (Tiede and Grafe 2016, 26)

However, the conclusion drawn in the paper in the light of this limitation still assumes higher pedagogical media competencies on the side of the German sample. Now, taking into account the additional critical analysis presented above, this conclusion should be rephrased in favor of an important emphasis: the results of the study suggest that the selected sample of German preservice teachers has slightly higher *Medienpädagogische Kompetenzen*/media-related educational competencies *in the sense of the German M³K model* than the sample of US students. This addition points to the central role that the underlying model and measurement instrument play for the conclusion.

Based on these considerations, the applicability of the German measurement instrument to a US context appears questionable. However, it has been pointed out that there are other national models which are successfully applied and operationalized by respective measurement instruments in a number of different national settings. TPACK, for example, which has been suggested to be rather basic in terms of level of detail and depth, has been successfully used as a reference, applied and measured all over the world (Crompton 2015; Martin 2015; Schmidt et al. 2009; Tondeur et al. 2017; Sang et al. 2016). Hence, it will be beneficial for international comparative studies to select model and measurement instruments with care and to consider

their potential for transnational applicability as a selection criterion. Furthermore, international competency models such as DigCompEdu should be considered in this context. As described in Part I, the development process of such models takes into account models, guidelines and frameworks from multiple countries. Obviously, they are geared towards consent and exclude peculiarities of single countries. As a result, models like DigCompEdu are explicitly intended for an international application and might be more appropriate to apply in such a context.

These considerations go beyond the scope of Paper 1, which was written in the course of the M³K project. Its intention was to expand and add a further perspective to the German main pilots and to learn more about the applicability of the M³K measurement instrument. To this degree, the results also can be read to suggest that the instrument apparently depicts media-related competencies acquired in German teacher education more appropriately than those acquired in US initial teacher education programs. With regards to the measurement of competencies as suggested by the M³K competency model, a triangulation of methods, e.g., by combination with further qualitative measures, would be desirable. Furthermore, it would be worthwhile to amend these conclusions by further studies with measurements based on TPACK, DigCompEdu and other suitable instruments to confirm actual differences between the media-related competencies of German and US preservice teachers.

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Media-related Educational Competencies of German and US Preservice Teachers. A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

Part III: Advancing Media-related Educational Competencies

Jennifer Tiede

In the first part of this dissertation, selected models and standards from Germany and the USA were introduced, based on a literature review and thus revealing what is considered relevant for practice in a variety of sources and which competencies preservice teachers should acquire, according to these sources. In the second part, methods and selected results of competency measurements were introduced, thus demonstrating ways to operationalize the models and to assess the outcomes of respective processes of such a model integration. Complementary to these theoretical and measurement-focused perspectives on media-related educational competencies, it is important to extend the viewpoint to practices of media-related education of preservice teachers: the objectives both of competency models and of competency measurements ultimately include impacting the respective practices in teacher education and offering a grounded basis and stimuli for improvements and enhanced practice. In accordance with this, various sources emphasize the importance of research on the integration of ICT and respective competencies into initial teacher education (Enochsson and Rizza 2009; Krumsvik 2014; Tondeur et al. 2017).

Hence, in the light of the previous two parts, it is now consistent to explore how far the theoretical basics and measurements, with their results, find their way into actual practice. Naturally, there are factors impacting current practices beyond research and measurements, even though a majority of the respective literature tends to focus on specific competencies and to neglect the influence of broader contextual conditions (Pettersson 2018). To acknowledge this desideratum, the following question will be explored: “How are media-related educational competencies advanced in German and US American study programs of teacher education?” This question will guide the focus of the following chapter to shed light on current practices and trends in German and US practice of teacher education in the context of advancing media-related educational competencies comprehensively, first from a theory-based and then from an empirical perspective. Thus, it will be illustrated first how media-related educational competencies are integrated into initial teacher education programs, and central stakeholders will be outlined systematically to identify the network of influences responsible for the ways in which competencies are advanced in initial teacher education. Afterward, a study will be introduced that sought to further explore these practices and influences by expert interviews, which are also the subject of Paper 2, “The Integration of Media-Related Studies and Competencies into US and German Initial Teacher Education. A Cross-National Analysis of Contemporary Practices and Trends,” that will be included subsequently to complete the comprehensive analysis of practices of advancing media-related educational competencies in initial teacher education in Germany and the USA.

9. Current Practices in the Advancement of Media-related Educational Competencies in Germany and the US: Empirical Evidence

Generally, there are different options for integrating models and respective efforts of competency advancement into teacher education. Integration can basically happen either obligatorily (all students within a certain target group have to take respective courses), or voluntarily (there are offers which students can opt to take). According to Oliver and Townsend (2013), formats include preservice training, long-term courses, short-term workshops and institutes, coaching/mentoring, learning communities, and product/assessment approaches. The applicability or reference frame of respective regulations can vary from local, e.g., binding for specific cohorts of students at a university, to state-wide or even national.

9.1 Germany

Considering the German situation, there are numerous references in research, political documents and further sources pointing out the deficiency of the integration of respective contents into initial teacher education. Already in 2003, Blömeke stated that teachers are not adequately prepared with regards to media pedagogy because the respective qualification was only integrated into professional development, if at all. She concluded that the integration of these contents into initial teacher education has been marginal to this point (cf. also Tulodziecki and Herzig 2002; Spanhel 2001) but described a current shift in public perception (Blömeke 2003). This shift, however, seemed not to lead to systematic improvements everywhere. Kammerl and Mayrberger (2011) summarize the situation of the integration of media-related educational competencies into German initial teacher education from the perspectives of structural and educational policy and empiricism. The authors still conclude that the systematic advancement of media-related educational competencies in German teacher education is scarce and that the development and advancement of respective competencies is hardly noticed in research on teacher education. Hence, the theoretical foundation and empirical research on media pedagogical professionalism as an objective of teacher education and as a professional characteristic of teachers is called a research desideratum.

In more recent sources, there is evidence of an ongoing heterogeneous integration, but binding regulations on different levels are increasingly being mentioned. For example, Aufenanger (2014) describes the example of Rhineland-Palatine as one of a few states which have obligatory study contents with reference to media pedagogy. Niesyto (2014) mentions the *Pädagogische Hochschule Ludwigsburg* as the first German institution of higher education to make introductory courses about media pedagogy obligatory for all preservice teachers. Overall, several sources from different backgrounds demand for a systematic and obligatory integration into initial teacher

education for every German preservice teacher (e.g., Spanhel 2001; Tulodziecki and Herzig 2002; Blömeke 2003; Kammerl and Mayrberger 2011; Imort and Niesyto 2014; Schmid et al. 2017; Kultusministerkonferenz [KMK] 2016; Bundesministerium für Forschung und Bildung [BMBF] 2016; van Ackeren et al. 2019).

Related literature also introduces a number of relevant studies in this context. To learn more about the structural and formal integration of media-related studies into German teacher education, Schiefner-Rohs (2012) presents a review of 90 documents primarily from three universities as examples; they include examination regulations, study guidelines, course catalogs, and standards. The references to *medienpädagogische Kompetenz* identified are structured in accordance with the competency aspects suggested by Blömeke (2000; cf. Chapter 4.3), i.e., media didactical competence, media educational competence, socialization-related competence in media contexts, school reform competence in media contexts, and own media competence. Against the background of methodological limitations, especially with regards to the concentration on document analyses only, the author concludes that the formal integration of *medienpädagogische Kompetenzen* into documents of teacher education on federal and university levels is deficient, scarce and considerably heterogeneous with regards to references to the five competency aspects and to extent and frequency. However, she also emphasizes that such an integration into respective documents does not allow for conclusions on how media-related educational competencies are *actually* addressed and realized in practice, because it only illustrates the *formal* relevance. To meet this critique, she recommends enhancing her study by further methods, such as lesson observations or interviews (Schiefner-Rohs 2012) – a claim that will be responded to in Chapter 11.

A recent study in this context was also conducted by Bertelsmann Stiftung et al. (2018). In the project *Monitor Lehrerbildung* [monitor for teacher education], German states and institutions of higher education were surveyed on the ways in which respective study offerings are integrated into curricula of initial teacher education. With regards to the acquisition of media-related educational competencies, the two main categories analyzed in this study are handling digital media and the methodological-didactic implementation of digital media in school. In terms of the classification of media-related educational competencies suggested in Chapter 5.1.3, “handling digital media” refers to “teachers’ own technological knowledge and ICT competencies” while “the methodological-didactic implementation of digital media in school” can be assigned to the category of “using media and ICT to enhance educational processes.” The survey results with regards to respective study offerings are summarized in Table 13.

Obligatory courses in ITE curriculum for the acquisition of professional competencies for ...	School form	Yes, in all subjects	Yes, in some subjects	Planned in all subjects	Planned in some subjects	No	n/a
		n institutions of HE	n institutions of HE	n institutions of HE	n institutions of HE	n institutions of HE	n institutions of HE
... handling digital media	ITE for Elementary school (n = 45)	5	21	1	2	8	8
	ITE for Secondary school, level I (n = 49)	6	22	1	3	10	7
	ITE for Secondary school, level II (general education) (n = 60)	7	24	1	4	13	11
... the methodological-didactic implementation of digital media in school	ITE for Elementary school (n = 45)	2	23	1	3	8	8
	ITE for Secondary school, level I (n = 49)	4	23	1	4	10	7
	ITE for Secondary school, level II (general education) (n = 60)	7	24	1	6	11	11

Tab. 13.: Obligatory courses with relation to media-related educational competencies in curricula at the institutional level (Bertelsmann Stiftung et al., 2018).

A first observation from the data presented in Table 13 is that, both in the case of the acquisition of own digital media competence and in the case of the acquisition of competencies in teaching with media, more than 50 % of the institutions of higher education in the study indicated having installed respective obligatory study offers in their curricula of initial teacher education for all school forms listed here. However, the predominant format is an inclusion in *some* subjects. Hence, a potential conclusion is that the combination of subjects a preservice teacher selects can have an influence on his or her exposure to courses advancing media-related educational competencies.

Overall, the data from *Monitor Lehrerbildung* indicate that an integration of media-related content into all subjects and disciplines in all 16 German states has not

yet been achieved. On the state level, in a majority of states there are no binding regulations for the advancement of professional competencies in the handling of media and in their methodological and pedagogical integration into school (cf. Chapter 10.2). A core conclusion of the study is that overall there is not enough obligation for German preservice teachers to deal with digital media in their studies. In many places, they can still graduate without ever having to take courses on this topic, and even voluntary offerings are not guaranteed in all places.

Naturally, obligatory course offerings as assessed by *Monitor Lehrerbildung* are not the only way for institutions of higher education to integrate respective contents into their curricula. The collection of data focused solely on obligatory study offerings neglects further developments and efforts in terms of elective study offers. Other ways of structurally establishing elective study offers are described by various further sources from practices in German institutions of teacher education. Specifically, such ways include elective courses within regular programs of teacher education, extended or supplementary studies, and study foci and study emphases.

Elective courses within regular initial teacher education curricula are courses preservice teachers can opt to take from a range of suggested courses. Opportunities for making own selections were reduced in the course of the Bologna reforms in the German system of higher education (cf. Kotthoff and Terhart 2013, for an overview of the effects of the Bologna reforms on the German system of teacher education). Yet a certain flexibility still allows students at some places to actively decide for media pedagogical courses according to their own interests. Some institutions of initial teacher education also offer extended or supplementary studies in the field of interest. These courses are taken on top of the regular coursework (Niesyto 2014; Goertz and Baeßler 2018). Finally, there are also institutions offering preservice teachers to define a focus or study emphasis on media pedagogy, which means taking a range of respective classes in their regular teacher education program (Herzig, Aßmann, and Klar 2014). Sometimes, such study foci are also combined with an additional certificate to be achieved (Kammerl and Mayrberger 2014).

It can be concluded from these sources that there is an established awareness of the need for advancing media-related educational competencies in teacher education, and various efforts show approaches to a successful integration of respective contents. Yet, the current *status quo* in German teacher education has been and is still being characterized largely by heterogeneity and inconsistency.

9.2 USA

As has been pointed out before, the need for advancing the media-related educational competencies of preservice teachers has also been seen in the USA (cf., for example, American Association of Colleges of Teacher Education [AACTE] and Partnership

for 21st Century Skills [P21] 2010; Hobbs 2010; International Society for Teaching in Education [ISTE] 2017; U.S. Department of Education, Office of Educational Technology 2016; 2017). An early study in the US context has been published by Milken Exchange on Education Technology (1999) to gather information on the IT preparation that preservice teachers receive. Key outcomes of this study include a technology infrastructure widely perceived as adequate but offering little integration of IT skills into teacher education. According to the study, most teacher preparation programs in the US in the late 1990s did not have a “written, funded, regularly-updated technology plan” (p. 9), which implies that respective study experiences for preservice teachers were rather unsystematic at this early stage.

Less than ten years later, Kleiner, Thomas, Lewis and Greene (2007) published a new national study on the integration of educational technology into US teacher education programs, based on a survey with nearly all US Title IV degree-granting 4-year institutions of teacher education. All the institutions in this sample reported integrating technology into instruction and teaching about the use of internet resources and communication tools for instruction in all or some of their teacher education programs. Additionally, “the majority of institutions offering teacher education programs for initial licensure reported that they had prepared their teacher candidates (to a moderate or major extent) to use educational technology for a variety of purposes [...]” (*ibid.*, p. 17).

With regards to the integration of these contents into teacher education programs, the study finds that about half of the institutions offer stand-alone courses in educational technology and many of them also integrate educational technology within methods courses (93 %), within field experiences (79 %), and within content courses (71 %). An interesting conclusion in this context refers to the low variation by institutional and program characteristics between the institutions, which indicates “a fairly common approach to educational technology across the nation’s teacher education programs for initial licensure” (*ibid.*, p. 17). This seems surprising against the background of the heterogeneous findings from Milken Exchange on Education Technology (1999) and shows the progress and increase of importance of technology in teacher education in the early 2000s. However, the statistical analyses neither inform about causal relations nor offer conclusions regarding quality and outcomes, focusing instead on the course and content offerings.

Further related empirical evidence has been presented by Gronseth et al. (2010). A survey was sent out to all 1,283 four-year teacher education programs in the US offering an initial teaching licensure in general, elementary, and/or secondary education received $n = 407$ responses. Major outcomes of this study include the notion that 60 % of the institutions had a required standalone educational technology course in all teacher licensure programs, and an additional 20 % had such a required course in some teacher programs. The share of institutions requiring technology-related projects or activities in teaching methods courses was at 44 %.

Despite this seemingly comprehensive integration of ICT into teacher education, US researchers have been pointing out repeatedly that teachers do often not effectively use media and ICT in their teaching and that the advancement of media-related educational competencies is far from satisfying (Belland 2009; Ertmer and Ottenbreit-Leftwich 2010; Sang et al. 2010; U.S. Department of Education, Office of Educational Technology 2017; Riegel and Tong 2017). A frequently discussed topic in US research in this context is the question of how to best integrate the respective contents, and there has been a considerable consensus recently to foster an inclusive approach and to infuse media and ICT-related teacher education into subject courses and contents as opposed to standalone courses on educational technology, which could then be abolished (Polly et al. 2010; Hur, Cullen, and Brush 2010; Slepko 2013; Bakir 2016; Foulger et al. 2017; Foulger, Wetzell, and Buss 2019).

Notably, these studies on the integration of ICT into teacher education and respective considerations on an optimized integration into teacher education programs tend to focus on the educational technology perspective, i.e., on those competency aspects related to teaching with media or the pedagogical use of media and ICT. The perspective of media literacy offers a different picture: in 2016, Redmond called it “unclear if or how MLE [media literacy education] is included in teacher education programs and training” (2016, 33), and Gretter and Yadav point out a “lack of teacher preparation in teaching media and information literacy skills” (2018, 104), although the need for such an education has been realized widely (Center for Media Literacy [CML] n.d.; Torres and Mercado 2006). Redmond (2016) summarizes five studies in this context which all lead to the conclusion that media literacy is important in teacher education but deficiently integrated (Schwarz 2001; Goetze, Brown, and Schwarz 2005; Flores-Koulish 2006; Flores-Koulish and Deal 2008; Flores-Koulish et al. 2011). Single recent sources claim an improvement of this matter, with the notion that media literacy could – and should – be integrated into the rest of the curriculum, as opposed to standalone courses, just like educational technology (Meehan et al. 2015). This claim corresponds to the technology infusion approach described above in the context of educational technology.

9.3 Germany and the USA: Comparative Conclusions

Comparative sources on current practices of the advancement of media-related educational competencies in German and US teacher education are scarce. Tiede, Grafe and Hobbs (2015) conducted a comparison of German and US educational study programs with a relation to media pedagogy beyond teacher education. Institutes of Higher Education in Germany and the USA were analyzed in a broad online research to identify respective study programs. Based on a first online inquiry about such programs, and with the intention of narrowing down the broad field of respective

offerings, the following criteria were defined for including a study program: 1) Master's programs/graduate studies with a direct reference to media pedagogy (excluding initial teacher education), additional certificates and extended studies; 2) offered by institutions of higher education (i.e., universities and universities of applied sciences in Germany, excluding US colleges); 3) public institutions only.

The research was conducted independently for both countries by internet research, mainly based on several comprehensive listings of all universities within a country. This way, it was possible to identify $n_{\text{GER}} = 24$ study programs from $n_{\text{GER}} = 17$ German institutions and $n_{\text{USA}} = 183$ study programs from $n_{\text{USA}} = 163$ US institutions. The relevant study programs identified were then listed, including information on (1) the institution, (2) the study program, (3) the degree, (4) the focus, (5) a program chair, coordinator or similar, and (6) an online link. To collect these data, online resources like webpages, study program descriptions and study handbooks were consulted. To draw comparative conclusions, the study programs identified were assigned one or several main foci which were defined in advance, deductively, based on the M³K model of *Medienpädagogische Kompetenz*. These three main categories are media didactics/teaching with media, media education/teaching about media, and media-related school reform. Core outcomes of the study include the conclusion that there are peculiarities, but also shared characteristics of each system: e.g., media-related educational competencies can be acquired in both countries by (a) optional and elective courses during teacher education, (b) additional certificates and additional studies, or (c) graduate studies. Differences between the two systems relate, for example, to the role of school libraries and educational leadership graduates. With regards to the main foci of the study programs, there are comparable tendencies in Germany and the USA: media didactics is relevant in a majority of study programs of both countries, followed by school reform, while media education is subject to the study programs in the smallest number of the cases analyzed. Overall, both Germany and the USA are described to share comparable challenges, e.g., in terms of a comprehensive and nation-wide inclusion of media-related content into respective study programs.

Bearing in mind this overview on the status of integrating media-related content into initial teacher education in Germany and the USA, a number of consistencies and differences between the situations in both countries can be noted. A contextualization illustrates the overlaps between the media pedagogical discourses in both countries described, e.g., by Grafe (2011) and Blömeke and Paine (2008): both in Germany and the USA, the scientific communities (and further stakeholders, e.g., from a political context) emphasize the need for a systematic and obligatory inclusion of respective contents into initial teacher education and advance research to optimize processes in this regard. Yet the sources introduced above lead to the impression that there are slightly different viewpoints. German research, even from very recent

sources, suggests a deficient and unsystematic inclusion of media-related contents and of media-related educational competencies into German initial teacher education, and a systematization of processes and further advancements to achieve a nation-wide obligatory inclusion appear as a dominant and reoccurring theme throughout sources from different backgrounds. In the US, it is necessary to differentiate between educational technology and media literacy, which are both included in the concept of media-related educational competencies but mostly treated separately in US research. Educational technology as a discipline was found to be integrated into virtually every teacher education program already in 2007, while the status of media literacy seems comparably uncertain but of increasing interest. Consequently, the interest of US research, particularly over the last few years, is less in improving the integration especially of educational technology on a structural level but rather in improving existing structures of integration and outcomes, which are described as equally deficient. Hence, the focus on infusing respective contents into methods classes and subject areas, as opposed to the stand-alone courses which were an efficient means of reliably ensuring a nationwide implementation in the first place but are now considered more critically as a second step.

Notably, such considerations are sometimes also suggested in German research, less in the sense of a replacement of respective focus courses but rather as an additional infusion (Sektion Medienpädagogik 2017; Spanhel 1997; 2017). In this context, Herzig et al. (2014) argue that, against the background of their capacities and content foci, chairs of subject didactics cannot be expected to systematically integrate media pedagogical contents into their curricula, which is why the task of a media pedagogical basic education for preservice teachers needs to be a task for educational science, even if an exploration and concretization within subject didactics is desirable. On the level of schools, such an integration into subject courses instead of distinct courses is claimed also from German political stakeholders (Bayerische Staatskanzlei 2017; Kultusministerkonferenz [KMK] 2012; 2016). This relates especially to the subject of computer science, which has an often discussed but overall close relationship to the field of *Medienpädagogik*. Based on a number of shared presumptions and objectives, computer science and *Medienpädagogik* approach the topics of media and IT from different angles. The establishment of a distinct subject “computer science” in schools is widely acknowledged, and a close cooperation between the occasionally competing research fields of computer science and *Medienpädagogik* is considered valuable in numerous sources to provide both students in school and preservice teachers in initial teacher education with competencies from both fields (Hauf-Tulodziecki 1999; Reiter 2010; Engbring 2018; Bayerische Staatskanzlei 2017; Herzig 2016; Tulodziecki 2016).

It was found already in the context of theoretical competency models from Germany and the USA that “content” as a distinct area has a different role in both

countries. Also, the link between media pedagogy and media-related educational competencies, on the one hand, and subject or contents studies, on the other hand, was described to differ. Now, these differences are discernible also in practices of integrating media-related educational competencies into initial teacher education programs in Germany and the USA to a certain extent. In the USA, the established TPACK model emphasizes the importance of content as a core area of media-related knowledge. Consequently, practices of integrating respective models and competencies in the USA also focus on a content-integrated approach. In Germany, content is not integrated explicitly in central models of media-related educational competencies, and the special role of educational science within German teacher education comes into play and shapes the practices in advancing media-related educational competencies through a certain focus on distinct courses with media reference as, e.g., in the case of computer science.

The examples introduced in the overview on current practices in initial teacher education in Germany and the USA reveal different approaches to integrating media-related educational competencies on a university level, as there are obligatory and voluntary courses, profile-focused studies, certificates, extended or additional studies, or electives in content-matter courses. With regards to the German situation, it is noteworthy that there are many implementation modes that depend on preservice teachers' voluntary participation and elections. In combination with the obligatory study offerings in some places, these additional offers seem valuable in terms of the individualization of study paths and with regards to the chance for students to set their own foci and to specialize in their individual areas of interest. The non-binding nature of such offerings also gives considerable power to the universities as stakeholders because they are comparably flexible in the design of respective study offerings within their framework conditions given. However, from the voluntary approach a question arises about what this means for preservice teachers with less interest in media pedagogy, who are thus sometimes given the chance to avoid respective courses, although these students in particular can be expected to benefit from courses with a media pedagogical focus. Therefore, it becomes clear that the comparably large flexibility within the German system brings about certain challenges for the education of generic but non-obligatory study contents such as media pedagogy. A comparative view to the USA reveals that a system with fewer opportunities for electives and thus more fixed courses still leaves a certain freedom to the universities in their role as stakeholders: while the overall goal of the media-related education appears clear, there is still flexibility on the level of universities to set specific foci on the topics of educational technology and/or media literacy. To conclude, universities appear as a powerful stakeholder in the advancement of German and US preservice teachers' media-related educational competencies. However, there are also other stakeholders having an impact, central groups of which will be explored in the following.

10. Stakeholders in the Advancement of Media-related Educational Competencies in Germany and the US

Analyzing the current German system of initial teacher education, Kotthoff and Terhart (2013) summarize pointedly:

“Teacher education in Germany is not only torn between the sometimes rather exaggerated and even contradictory demands of the different professional and non-professional actors involved (e.g. teachers, universities, ministries of education, teacher unions, parents, students etc.), but also between the various interests on local (e.g. institutional), regional (e.g. Länder), national (e.g. KMK) and European (e.g. ‘EUROPEAN COMMISSION’) levels.” (p. 86)

Indeed, the state of literature reviewed in the previous chapter regarding practices of advancing media-related educational competencies in Germany and the USA, as well as the previous considerations, suggest that a dense network of stakeholders and influences shapes practices in initial teacher education not only in Germany but also in the US. The interest groups mentioned by Kotthoff and Terhart (2013) can be restructured and amended by further stakeholders.

Generally, there is the societal context as a basic frame. It has been argued above that research and practices in teacher education are always culturally shaped and influenced, which is why the society shapes expectations, experiences and the overall background of any practice in initial teacher education. Furthermore, related research and practices come into play as a background and reference for the decisions taken by actors in the advancement of the respective competencies. On the level of a more direct influence, Kotthoff and Terhart (2013) point out the role of institutions and political stakeholders. It has been mentioned above that there are binding regulations for the processes in question on the level of single states, and there are claims for regulations on a national level (cf. Chapter 9). Linked to this, organizations and societies have also been described above to have an impact on practices, e.g., by guidelines or standards, as in the case of ISTE and NAMLE (cf. Chapter 4). Finally, researchers and teacher educators play a central role as developers and users of concepts for the advancement of media-related educational competencies.

Considering these stakeholders on different levels, the roles of society and cultural background are quite general and inform decisions and practices indirectly. Hence, these influences are not of detailed interest for the following deeper analysis, even though the impact on a superordinate level is acknowledged. Likewise, the influences that local institutions of higher education and researchers and teacher educators can have on practices of advancement are comparably straightforward and were addressed in the previous chapter on current practices and the *status quo*. However, the level of policies and of professional organizations is not yet as clear. To systemize the ways in which influence is taken on political and institutional levels,

the following chapter will summarize and analyze the respective facets in Germany and the USA. The examples selected for this purpose are not exhaustive and cannot illustrate their whole respective fields comprehensively. Their function is to highlight certain aspects and tendencies and to present national cases of practice with the overall aim of unraveling the network of influences and identifying key players.

The analysis is based on a broad database literature review on the related topics of policy regulations and institutional influences on initial teacher education and technology in teacher education. Additional internet sources, especially from governmental institutions and professional organizations, were added to the data to achieve a comprehensive picture of the practices in question.

10.1 Educational Policy: Federal Level

10.1.1 Germany

The German system of teacher education has a long history, which is characterized by long-lasting stability and hesitance towards reformation (Blömeke 2009; cf. *ibid.* for an overview of the historical, socio-economic and political characteristics of the system). It is also a vital element of this historical formation that the responsibility for education is largely with the 16 states. The influence of the federal government on education is rather low, because the long-established system of educational federalism, which dates back to the 19th Century, is fixed in the Basic Constitutional Law and grants the states cultural sovereignty (Hepp 2013). Remarkably, there are recurring and recently targeted attempts to adapt the respective law in order to loosen this strict division of power and to grant more influence to the federation by means of direct funding and cooperation with states in educational contexts (Deutscher Bundestag 2018).

An important stakeholder, which functions at the intersection of federal and state policies, is the *Kultusministerkonferenz* (KMK; Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany). Comprising the 16 ministers of education and cultural affairs, the KMK has the main task of self-coordination of the states, which is supposed to ensure unity, commonality, and comparability (Hepp 2013). An important outcome of the KMK are resolutions on a variety of topics, which have a high impact for all states. Against this background, the KMK has been repeatedly addressing the topic of media pedagogy, as several related resolutions prove. The overall message of these resolutions highlights the importance of media pedagogy in teacher education and schools and suggests an obligatory and extensive integration. For example, as early as 1983, the KMK declared media education a part of school lessons to enable students to use

media responsibly and to develop and apply respective value-oriented attitudes (Kultusministerkonferenz [KMK] 1986; Tulodziecki 2016). In the 1990s, the concept of media education was increasingly linked to information technology approaches and included the idea of *Medienkompetenz* [media competence] (Kultusministerkonferenz [KMK] 1997; Tulodziecki 2016). This perspective was further developed in the 2000s by an additional focus on educational standards (Kultusministerkonferenz [KMK] 2005; Tulodziecki 2016). A resolution from 2012 was of particularly high impact, as it was agreed by all states that a sufficient and obligatory integration of media pedagogy into educational science and into subject-specific teacher education in the first and second phase of teacher education is necessary and needs to be included in examination regulations (Kultusministerkonferenz [KMK] 2012, 7; cf. also 1995; 1998; 2004; 2012; 2016, for further related resolutions). However, the role of the KMK resolutions remains an advisory one, and it is within the responsibility of the states to put them into practice, as will be outlined in Chapter 10.2.

Despite the cultural sovereignty of the states, the federation does have a certain influence on higher education policy beyond the KMK, because the states depend on financial aid from the federation (Hepp 2013). The coordinating main stakeholder in this field is the *Bundesministerium für Bildung und Forschung* (BMBF; Federal Ministry for education and research), representing the federation in cooperation with the states and on a European and international level. The BMBF has taken various steps in researching and fostering media-related educational competencies in teacher education. Examples for this engagement include the report “Kompetenzen in einer digital geprägten Kultur” (competencies in a digitally influenced culture; Bundesministerium für Forschung und Bildung [BMBF] 2010), where the explicit and unfiliated integration of media pedagogy into all fields of pedagogical education is considered obligatory; the research program “Kompetenzmodellierung und Kompetenzerfassung im Hochschulsektor” (Modeling and Measuring Competencies in Higher Education), which also funded the development of the afore-mentioned M³K model of *Medienpädagogische Kompetenz* (Herzig et al. 2015; Zlatkin-Troitschanskaia et al. 2017); or the “Qualitätsoffensive Lehrerbildung” (quality initiative for teacher education), an initiative funded by the federation, as represented by the BMBF, which invests up to 500,000,000 Euros in institutions of teacher education for innovative projects and recently added a focus on digitalization in teacher education after an interim evaluation (Bundesministerium für Forschung und Bildung [BMBF] 2016; 2019; Brümmer et al. 2018; van Ackeren et al. 2019).

In the past, criticism has been expressed towards the focus of federal politics as represented by the BMBF. With regards to the coalition agreement between the leading parties of CDU/CSU and SPD from 2014, there was criticism that a state-wide fostering of students’ media competence was not included, and that politics put too much emphasis on the digital economy, informatics, temporary supportive

measures, and digital infrastructure, at the expense of structural changes in media education practices or effects on teacher education (Gesellschaft für Medienpädagogik und Kommunikationskultur [GMK], & Keine Bildung ohne Medien [KBoM] 2014). However, recent developments, like the emphasis of digitalization in teacher education in the funding line *Qualitätsoffensive Lehrerbildung* by the BMBF and the inclusion of opinions from experts in the field of related research (van Ackeren et al. 2019), illustrate an increasing awareness of the necessity of advancing preservice teachers' media-related educational competencies systematically.

10.1.2 USA

The influence of the US federal administration on education is generally subordinate, because the responsibility for schools and colleges, for the development of curricula, and for enrollment and graduation requirements is primarily with the states, local communities and with public and private organizations, according to the US Department of Education. As the Department describes, the federal role in education rather functions as a kind of “emergency response system” (U.S. Department of Education 2017b). Yet there are two core missions of this federal department. The first mission is leading on and facilitating a national dialogue about improvements in the educational system, and the second mission is financial support (*ibid.*). This financial support is primarily aimed at students, with the purpose of ensuring equal conditions (U.S. Department of Education 2017a).

However, the perception and appreciation of the role of federal influence on education and its actions and measures are dependent to a certain degree on the current administration. As US Secretary of Education Betsy DeVos recently declared, “President Trump is committed to ensuring the Department focuses on returning decision-making power back to the States, where it belongs” (U.S. Department of Education 2017b). In April 2017, President Trump initiated a review of federal education policies to identify and rescind regulations and guidelines that interfere with local or state authority in education matters (Green 2017). This Education Federalism Executive Order is targeted at former administrations' efforts to impact, improve and shape teacher education nation-wide, within the boundaries given.

Since the creation of the Department of Education in 1980 under president Jimmy Carter as a key representative and instrument of federal influence on educational state policies, there were repeated attempts, mostly from the Republican Party, to abolish it (Baumann and Read 2018). The latest of these attempts was represented by a bill in Congress which suggested terminating the whole Department of Education on December 31, 2018. President Trump approved of this step (GovTrack.us 2017). This bill was not enacted but has been updated to terminate the department on December 31, 2020 (GovTrack.us 2019).

Within this restricted frame, valid means for taking governmental influence on education are declarations, acts, and national plans. Examples of significant impacts include the No Child Left Behind Act (NCLB) of 2001 or the Race to the Top (RTTT) grant program of 2009. In practice, NCLB led to colleges and schools of education rethinking their existing programs and giving a stronger emphasis to subject matter preparation in teacher education. RTTT had a strong impact in terms of accountability and achievement measurement (Wiseman 2012).

The Department of Education has also shown interest and engagement in media-related issues in the past. The Office of Educational Technology published several relevant documents, with visions and recommendations included in the 2017 National Education Technology Plan (U.S. Department of Education, Office of Educational Technology 2017). This plan includes a chapter on “rethinking teacher preparation” and highlights the importance of a comprehensive inclusion of technology into teacher education (p. 35). This topic is explored in greater detail in the “Advancing Educational Technology in Teacher Preparation: Policy Brief” (U.S. Department of Education, Office of Educational Technology 2016), which serves to

“identify key challenges and solutions to the effective integration of technology in teacher preparation, provide guiding principles on how to move the field toward effective integration of technology in teacher preparation programs, and identify areas of opportunity and collaboration for stakeholders across the field.” (p. 6)

Hence, it can be summarized that the role of the US federal administration in teacher education is controversial and subject to change, depending on the respective administration and governmental stakeholders. The overall influence is rather low and limited to non-binding recommendations and plans, and to financing.

The comparison between the German and the US system reveals wide overlaps. In both cases, the influence of the federal government on educational practices, and for that matter on the advancement of media-related educational competencies, is existent but limited to financing and recommendations, plans, etc. A difference can be noted with regards to the public perception of this role of the federal government, which is established in Germany but of less certain status in the USA.

10.2 Educational Policy: State Level

10.2.1 Germany

Within the 16 states, the *Kultusministerien* (ministries of education) are the authorities responsible for education. Thus, the state governments have a say in the curricula of teacher education, which includes some general regulations for every study program and final exams to ensure comparability (Blömeke 2009). In accordance with the scope and intention of this work, this chapter will focus on state regulations for the first phase of German teacher education, which is the university-based scientific and academic education. Yet it should be noted that the influence of the *Länder* is not limited to this dimension: in the second phase (*Referendariat*), where teachers start teaching while being mentored, the training institutions are organized by the state governments. Representatives of the government also enact regulations and monitor exams (*ibid.*).

The principle of cultural sovereignty grants autonomy to the states in educational matters, as outlined in Chapter 10.1. All in all, a system characterized by heterogeneity of educational state policies developed out of educational federalism (Brautmeier 2013). Consequently, there are also individual regulations in the 16 German states with regards to the role of media pedagogy and media-related educational competencies in initial teacher education programs. To achieve an overview of these regulations within the 16 states, the *Monitor Lehrerbildung* offers a comprehensive source. In the context of this nation-wide project, Bertelsmann Stiftung et al. (2018) introduce relevant data from a survey concerning the preparation of future teachers for working and teaching with digital media. 63 institutions of higher education and all of the 16 German states participated in this survey (*ibid.*).

According to Bertelsmann Stiftung et al. (2018) and KMK (2016), there are basically two major measures German states can implement to force the inclusion of media-related educational competencies into initial teacher education programs, even though the actual implementation is in the responsibility of institutions of teacher education. These measures include respective aims in objective agreements or contracts between state and institutions of higher education, on the one hand, and establishing the respective competencies as a precondition for entering the practical phase of German teacher education, or including them into state regulations for final exams, on the other. Out of 10 states that answered this part of the survey, two states discussed including the topic in objective agreements or contracts between state and institutions of higher education, and two other states confirmed planning this measure. Five states indicated acknowledging the topic in state regulations for final exams, and three states announced planning respective measures. One state also

stated applying other measures, and two states indicated planning other measures (Bertelsmann Stiftung et al. 2018).

Table 14 lists selected results from the survey to contribute to a comprehensive picture of respective curricular regulations. The data illustrate the shares of states with state-wide obligations regarding media-related educational competencies, structured according to school forms, and thus indicate how much the influence of state governments has led to an obligatory advancement of these competencies in current practices.

State-wide obligation to offer courses for the acquisition of professional competencies for ...	School form	Yes	Planned	No, but other measures	No	n/a or school type not offered
		n states	n states	n states	n states	n states
... handling digital media	ITE for Elementary school	5	4	3	1	3
	ITE for Secondary school, level I	5	3	3	1	4
	ITE for Secondary school, level II (general education)	4	4	3	3	2
... the methodological-didactic implementation of digital media in school	ITE for Elementary school	4	5	1	2	4
	ITE for Secondary school, level I	4	4	1	3	4
	ITE for Secondary school, level II (general education)	4	5	1	4	2

Tab. 14.: State-wide regulations for the acquisition of media-related educational competencies (data retrieved from Bertelsmann Stiftung et al., 2018).

As Table 14 indicates, state-wide regulations on media-related educational competencies are indeed implemented heterogeneously. With regards to the implementation of digital media into initial teacher education and the advancement of competencies in handling media, some states, such as Saxony, do without respective regulations for all school forms, while others have or plan obligatory regulations for some or all school forms, or describe “other measures” (*ibid.*).

Also, in the case of the obligatory advancement of professional competencies for the methodological-didactic implementation of digital media in school, there are states without regulations for all school forms, states with respective regulations for some school forms enacted or planned, and states applying “other measures.” It

is important to note that an assignment to the category “no regulations” does not automatically mean that there are no respective activities. The state of Hesse, for example, did not indicate having obligatory courses. Yet there are efforts there to advance media-related educational competencies with preservice teachers. As early as 2003, a working group named “Neue Medien in der universitären Lehrerbildung” (new media in teacher education at universities) was established, led by the ministry of education in Hesse (HKM) and the ministry of research and arts (HMWK), to develop a concept for media competence in the first phase of teacher education (Bremer 2011a), including the definition of competency standards (cf. Chapter 4.3). A recent development in Hesse based on these efforts is a portfolio for media education competence, an instrument for state-wide application which allows preservice and in-service teachers to voluntarily track and visualize their competency development in five competency areas: media theory and society, didactics and methodology of implementing media, media use, media and school reform, and the role of teachers and personal development (Hessisches Kultusministerium 2017; Pleimfeldner 2017). Hence, it can be summarized that, though there may not be obligatory regulations, there are still supportive measures, even though Hesse did not indicate “other measures” in the *Monitor Lehrerbildung* (Bertelsmann Stiftung et al. 2018).

This finding leads to the conclusion that it is challenging to summarize and abstract the unique approaches every state has to the advancement of media-related educational competencies by fixed categories. However, there is value in a comparative and necessarily abstractive approach like *Monitor Lehrerbildung* due to its comprehensive perspective on practices in Germany, and due to the challenges and recommendations derived by the approach. There are five core challenges identified from the data introduced above and further survey results:

1. The strategic steering by the states is insufficient so far;
2. Digital media are mostly just optional study contents;
3. A practical testing of digital media is scarcely provided obligatorily;
4. Institutions of higher education act too isolated and network too little;
5. The use of digital media in ITE courses is not facilitated consequently enough by strategic design processes (Bertelsmann Stiftung et al. 2018, 15–18).

To meet these challenges, recommendations are formulated in the *Monitor Lehrerbildung* on different levels. With regards to the structural level, the recommendations include establishing digital media as an obligatory topic, anchoring it on an institutional level, and creating appropriate supportive structures. In terms of networking practices, better connections of theory and practice in ITE are suggested and the support of networks of institutions of higher education and networks with external actors. Considering the increase of motivation, effective incentives should be installed for respective developments (Bertelsmann Stiftung et al. 2018, 19–23).

These recommendations comply with respective claims from the literature mentioned above, e.g., by Blömeke (2003), Kammerl and Mayrberger (2011), or Imort and Niesyto (2014).

It will be analyzed below how far these practices identified in Germany relate to US practices.

10.2.2 USA

As pointed out above, the departments of education in individual US states are responsible for the education of future teachers, and every state has unique state-level requirements and tests for graduates of teacher education programs seeking licensure. The political engagement at the state level is coordinated by state departments and commissions (e.g., Connecticut State Department of Administrative Services 2019). Beyond obligatory or elective study offerings, as in the examples mentioned, the efforts of state-level political stakeholders include recommendations and general directive advice, which often refer to schools and media literacy education and educational technology instruction at schools. This can be seen in several bills, such as Bill No. 2128 in Massachusetts acknowledging the need for media literacy education in the context of sexual health education (General Court of the Commonwealth of Massachusetts 2017), or Bill No. 194 in New Mexico suggesting appropriating a media literacy program for school teachers (Cisneros 2019).

In contrast to Germany, where there are formal frame conditions for teachers to work in any state once they have been certified, US teacher certification is usually tied to the states to such an extent that teachers who want to work in another state have to apply for certification there (Watson, Murin, and Pape 2014). This structure brings about a high autonomy in the states, creating a direct impact on the contents and outline of teacher education programs. Universities have to make sure that their teacher candidates comply with state requirements and are well-prepared for exams. The requirements for initial teaching licensures are usually regulated by state standards to fulfill the requirements imposed by the Council for the Accreditation of Educator Preparation (CAEP).

No comprehensive studies could be found comparing the status of educational technology and media literacy education in teacher preparation curricula or respective state standards in a way comparable to the systematic German *Monitor Lehrerbildung*. Yet there are a number of related publications and findings that highlight the implementation of respective competencies and contents, either with regards to educational technology or to media literacy in related contexts, and thus emphasize the importance of advancing these competencies in initial teacher education. Such findings will be presented in the following section. It focuses on educational technology in state policies, educational technology and media literacy in K-12 education,

and on further state-wide approaches to advancing competencies in relation to educational technology and media literacy at the level of teachers.

With regards to educational technology, the map “Digital Instructional Materials Acquisition Policies for States” provides “state and territory policies and practices related to the acquisition and implementation of digital instructional materials in K12 education” (State Educational Technology Directors Association [SETDA] 2019). It reveals an overview of policies about digital instructional materials as one specific aspect from the field of competencies in educational technology, and it gives a first impression about the ways in which these aspects are relevant across US states in relation to inservice teachers and practices in K-12 education. Table 15 lists selected aspects with a reference to educational technology in an overview.

Topic	Aspect	No. of states where the aspect applies
Guidance and Policies	Guidance Accessible Digital Instructional Materials	30
	Guidance Accessible Technologies	28
	State Statute – Allows Implementation of Digital Instructional Materials	32
	State Statute – Instructional Materials Adoption – Digital Materials Included	18
	State Statute – Instructional Materials Adoption – Online Content Included	17
	State Statute – Instructional Materials Adoption – Software Included	15
	State Statute – Online Course Requirement	8
	State Statute – Requires Implementation of Digital Instructional Materials	3
Professional Learning	Development of OER	16
	Implementation of Digital Instructional Materials for Learning	20
	Selection of Digital Instructional Materials for Learning	22
	Technical Assistance – Accessible Instructional/Educational Materials	25
	Technical Assistance – Accessible Technologies	20
Digital Learning	Digital Learning Plan	32
	Digital Learning Standards for Students	29
	State Requirements for District Digital Learning Planning	19

Tab. 15.: Selected aspects from the Digital Instructional Materials Acquisition Policies for States (data retrieved from SETDA, 2019).

The table reveals that certain aspects from the context of educational technology are important in several US states and have state-wide importance for K-12

educational contexts. The aspects concerning state statutes in particular are revealing, as they show, e.g., that there is a requirement to implement digital instructional materials in three states, or a requirement for online courses in eight states. This is tangential to the dimension of media-related educational competencies in educational technology because teachers need specific competencies to cope with these tasks successfully. Likewise, the other aspects mentioned in Table 15 either require or support the acquisition or advancement of media-related educational competencies, as in the case of “Selection of Digital Instructional Materials for Learning” (*ibid.*) which clearly relates, for example, to DigCompEdu competency “Selecting digital resources” (Redecker 2017, 16). However, the numbers of states where aspects identified by this map apply show, again, large heterogeneity and limited consent across the 50 states.

Focusing on the K-12 student perspective, the Common Core Standards are another relevant source, as they outline the knowledge and skills in mathematics and English language that arts/literacy students should have acquired at the end of each grade. These standards have been adopted in 41 states (Common Core State Standards Initiative 2019) and are an important reference for K-12 teachers, as they have to make sure their students comply with the requirements. The Common Core State Standards show multiple references both to the fields of educational technology and media literacy. For example, students who are college and career ready are expected to “use technology and digital media strategically and capably” (Common Core State Standards Initiative n.d., 7), and grade 5 students have to be able to “analyze how visual and multimedia elements contribute to the meaning, tone, or beauty of a text (e.g., graphic novel, multimedia presentation of fiction, folktale, myth, poem)” (*ibid.*, p. 12). These references, too, highlight the importance of teachers integrating educational technology and media literacy systematically on a state level and thus claim respective competencies on the side of teachers. However, with regards to media literacy, related literature has been critical of the focus of the Common Core State Standards as too limited. This is because it does not specifically refer to critical analysis or the production of different media offers, nor does it foster critical analysis of media messages and representations (Beach and Baker 2011). Based on a 1999 study, the authors conclude that elements of media literacy were already found in almost every state’s teaching standards – but their focus may be narrow because they widely rely on the Common Core State Standards (*ibid.*; cf. also Cooper Moore and Bonilla 2014, for an extended analysis of the relationship between media literacy education and the Common Core State Standards). Consequently, the NAMLE Core Principles of Media Literacy Education amend and redefine desirable learning outcomes in the field of media literacy (cf. Chapter 4.2), but they are not implemented as a state-wide standard by state regulations or governments. However, it has been pointed out recently that “a growing number of states [...] have introduced or passed

bills and amendments to address media literacy education and digital citizenship in school based curricula” (Culver and Redmond 2019, 1).

Beyond these K-12 requirements, there are also single state-wide approaches and concepts in relation to educational technology and media literacy that extend the focus to preservice and beginning teachers in single cases. Findings from these approaches are summarized in Table 16.

Target group	Approach	Source/example
Preservice teachers	State-wide educational technology endorsement program as an elective study offer	Utah Education Network (uen; n.d.)
Beginning teachers	Inclusion of standards with reference to educational technology and media literacy within state-wide examinations of beginning teachers	Texas Education Agency (2019)
Inservice teachers	Alignment of state standards for teachers with ISTE standards	MissouriState (n.d.); Post (2004)

Tab. 16.: Selected state-wide approaches in relation to media-related educational competencies.

In terms of obligatory state-wide regulations, the example of Texas is particularly interesting because of the proximity to the regulations described in Germany. In the state of Texas, there are seven standards within the Technology Applications EC-12 Standards with requirements expected of all beginning teachers and included in the obligatory Texas Examination of Educator Standards (TExES) Pedagogy and Professional Responsibilities (PPR) test (Texas Education Agency [TEA] 2019). These standards include the following: standard II: “All teachers collaborate and communicate both locally and globally using digital tools and resources to reinforce and promote learning” (Texas State Board for Educator Certification 2016, 2); standard III: “All teachers acquire, analyze, and manage content from digital resources” (*ibid.*); and standard V: “All teachers practice and promote safe, responsible, legal, and ethical behavior while using technology tools and resources” (*ibid.*). To this degree, these standards are closely related to competencies described by DigCompEdu or M³K.

In conclusion, it can be summarized that state policies in Germany and the USA share characteristics, especially from a systemic viewpoint, with regards to legislative autonomy and responsibility, but they differ in aspects of realization. With regards to legislative systems, both countries have a system of cultural sovereignty within a certain framework that allows states to shape and impact practices in initial teacher education with regards to the advancement of media-related educational competencies. The impact state legislatures can take in this context is comparable in certain regards. As described above, there are state-wide graduation exams in both countries where the responsible state authorities can – and sometimes do – prescribe

an obligatory examination of graduates for aspects related to *Medienpädagogische Kompetenz*, educational technology, or media literacy.

The status of the advancement of media-related educational competencies in initial teacher education in German states, as proposed by state policies, is well-documented, especially by the *Monitor Lehrerbildung*, and it is clearly regulated in several cases. In the US, the situation appears less consistent. There are multiple references to state regulations at the K-12 level and some with regards to inservice teachers. Both indirectly influence initial teacher education in terms of the expectations for graduates. However, direct regulations concerning the advancement of media-related educational competencies in initial teacher education are scarce and less well-documented.

In the light of these conclusions, it can be noted that both Germany and the USA yet face comparable challenges. There is an increasing awareness of the necessity to advance media-related educational competencies with preservice teachers in both countries, but the autonomy of states in educational issues results in heterogeneous realizations of state-wide regulations. Hence, the impression is substantiated that there are stakeholders working on levels other than states and policy, which will be explored in the following.

10.3 Institutions and Initiatives

Beside political stakeholders, there are established non-governmental institutions and initiatives which aim to impact the advancement of media-related competencies in initial teacher education in a number of ways. These stakeholders can be grouped roughly into professional societies and associations, on the one hand, and industry-based or commercial stakeholders on the other. There are of course cross-references between the two groups.

10.3.1 Germany

Professional societies and associations

A key player in this context is the Division 12, Media Education, of the *Deutsche Gesellschaft für Erziehungswissenschaft* (DGfE) or German Educational Research Association (GERA). The GERA is an association of German educational researchers that generally aims to promote study, research and education in the area of educational theory and science (Deutsche Gesellschaft für Erziehungswissenschaft [DGfE] n.d.). It is structured by 14 divisions, each focusing on a specific topic within the field of interest. Activities of division 12, Media Education, include conferences, support for

young academics, annual books, and the facilitation of discussion and information amongst members. Among other achievements of this division, there are two particularly relevant outcomes in the context of media-related educational competencies. They are the “Orientierungsrahmen für die Entwicklung von Curricula für medienpädagogische Studiengänge und Studienanteile” (Framework for the development of curricula for media pedagogical study programs and study contents; Sektion Medienpädagogik 2017) and the initiative “Keine Bildung ohne Medien!” (No education without media!).

The framework “Orientierungsrahmen für die Entwicklung von Curricula für medienpädagogische Studiengänge und Studienanteile,” published in 2017 by Sektion Medienpädagogik, is highly relevant in the context of media pedagogy in educational study programs. In response to current discourses in educational policy, it offers comprehensive guidelines for the design of (new) media pedagogical study programs. It builds on and continues the national discourse about an obligatory basic education in media pedagogy, which was initiated and advanced by a number of national stakeholders (Sektion Medienpädagogik 2017).

The “Keine Bildung ohne Medien!” initiative is a joint initiative of several organizations and persons from the field of media pedagogy. Its main goal is the large-scale, systematic and sustainable inclusion of media pedagogy into all educational fields in society, which also comprises a claim for an obligatory basic education in media pedagogy for all pedagogical study programs. Activities of this initiative include various publications, e.g., recommendations and commentaries on current topics, conferences, and political engagement (Kommer 2019).

A selection of further important stakeholders in the field of media pedagogy includes the JFF (Institute for media pedagogy in research and practice), the GMK (Professional Association for Media Education, and Media Literacy and Communication Culture), the GFD (Association for *Fachdidaktik*), and the GMW (Society for Media in Science). The JFF highlights a connection of research and practice for the purpose of fostering media competencies and media literacy, and it conducts and offers various activities like evaluation studies and projects – but also pedagogical practical offerings for recipients of all kinds (JFF – Institut für Medienpädagogik 2018). The GMK describes itself as both the largest professional umbrella association for institutions and individuals and a platform for discussion, cooperation and new initiatives. Like the JFF, the GMK also fosters media pedagogy and media literacy and highlights an interplay of research and practice. It also plays an active role in the consultation of educational policy (Gesellschaft für Medienpädagogik und Kommunikationskultur [GMK] n.d.). The GFD has a slightly different focus, as this association is concerned with *Fachdidaktiken*, i.e., subject didactics. From this perspective, the GFD highlights the role of media pedagogy in relation to subject didactics and postulates a close collaboration and merging of the two disciplines (Gesellschaft für Fachdidaktik e.V.

[GFD] 2018). Finally, the GMW is a professional association for the implementation of media in higher education. It assumes a media didactical viewpoint by researching and supporting the application and use of media in research, teaching at university and further university-related fields (Gesellschaft für Medien in der Wissenschaft e.V. [GMW] 2019).

Industry-based and commercial stakeholders

Relevant stakeholders with a relation to industry and commercial backgrounds in Germany include the *Netzwerk Digitale Bildung* [Network for Digital Education], the *Initiative D21*, and the *Deutsche Telekom Stiftung*. The Network for Digital Education explicitly aims to transfer the dialogue about the digitalization of the educational system from restricted professional associations to a broader audience. It fosters debates about digital education and the innovative design of future-ready learning scenarios and links funding parties from industry with non-commercial cooperation partners, pedagogues and experts from research (Netzwerk Digitale Bildung n.d.). As a nonprofit network, the initiative D21 even extends the range of partners to include policies, industry, research and civil society. It addresses all sorts of societal challenges related to the digital evolution by fostering debates and supporting and publishing research and solutions – this includes questions of initial teacher education (Initiative D21 e.V. 2019). Finally, the *Deutsche Telekom Stiftung* is one of the larger German company-related foundations supporting projects and research around the field of digitalization and education, such as the Forum Bildung Digitalisierung or the *Monitor Lehrerbildung* (Deutsche Telekom Stiftung 2019). These examples can be amended by a range of further foundations and initiatives active in this field with differing foci. A list of the largest German foundations is provided by *Bundesverband Deutscher Stiftungen* (n.d.). It includes the *Bertelsmann Stiftung*, which is another impactful stakeholder in the context of media-related educational competencies. It funded a project which then led to the development of a model of *Medienpädagogische Kompetenz* (Tulodziecki 2012), and it is also involved in the systematic evaluation of practices in advancing media-related educational competencies in German initial teacher education (cf. Chapter 9). This example illustrates the importance foundations can have for the context of modeling and advancing media-related educational competencies.

10.3.2 USA

Professional societies and associations

There are a number of institutions and initiatives in the US which impact the facilitation of media-related competencies in teacher education in several ways. The International Society for Technology in Education [ISTE] is of central relevance in the context of educational technology. ISTE is a nonprofit organization of educators that aims to foster the integration of technology in schools. As the core objective is summarized on their homepage, the “ISTE inspires educators worldwide to use technology to innovate teaching and learning, accelerate good practice and solve tough problems in education by providing community, knowledge and the ISTE Standards, a framework for rethinking education and empowering learners” (International Society for Technology in Education [ISTE] n.d.). On a national level, ISTE has become widely acknowledged and well-established (Siller 2007, 95). They offer practical guidance, opportunities for professional learning, virtual networks, events, and the ISTE standards (International Society for Technology in Education [ISTE] n.d.). These standards address and provide a framework for all levels of the educational system and for all stakeholders: currently, there are ISTE standards for students, educators, administrators, coaches, and computer science educators (*ibid.*). They define what the respective target group should know and be able to do in the context of handling and using information technology (cf. Chapter 4.2). Through the ISTE standards, ISTE has a high impact on technology in teacher education; they are widely recognized and used in multiple ways across the US, affecting all other levels of stakeholders. The US Department of Education encourages using the ISTE standards (U.S. Department of Education, Office of Educational Technology 2016; 2017). Some states, such as Ohio, align their curricula and standards with the ISTE standards (Post 2004) or even prescribe state-wide inclusion into teacher education, as in Texas (Randles 2017). Several universities (as well as a range of educational resources) have been granted the ISTE seal of alignment to confirm that they correspond to the principles of the ISTE standards. For example, some institutions installed ISTE•T certification programs, offering a certificate for students who fulfill the requirements as proposed by the ISTE•T standards (e.g., the James Madison University) or have accordingly designed study programs (e.g., the online Master’s program in Educational Technology at California State University Fullerton; International Society for Technology in Education [ISTE] n.d.).

A second influential society is the Society for Information Technology and Teacher Education [SITE]. Describing itself as “the only organization solely focused on integrating technology into teacher education” (Society for Information Technology and Teacher Education [SITE] and Association for the Advancement of Computing in

Education [AACE] 2019) and thus oriented towards a narrower focus than ISTE, the SITE contributes to the discourse on educational technology in teacher education primarily by developing and disseminating knowledge and research through conferences, books, projects, and a related journal (*ibid.*).

Davis (2003) adds the following organizations to this category: the Association of Teacher Education (ATE), and the American Association of Colleges of Teacher Education (AACTE), both of which form networks in their fields related to teacher education.

In accordance with the twofold focus in the US on educational technology and media literacy, multifold activities in the field of media literacy are organized by a distinct association, the National Association of Media Literacy Education [NAMLE]. While there are further interest groups playing a role in media literacy education in the US (e.g., <https://medialiteracynow.org>; <https://www.medialit.org>), NAMLE is particularly relevant for the advancement of media literacy competencies in initial teacher education by means of their publication of the NAMLE Core Principles of Media Literacy Education (cf. Chapter 4.2). NAMLE is a nonprofit organization with the mission “to be the leading voice, convener and resource to foster critical thinking and effective communication for empowered media participation” (National Association for Media Literacy Education [NAMLE] n.d.). Respective activities include conferences, leadership councils, publications, summer institutes and research to live up to the aspired objectives and lead on the evolution and spread of media literacy across the US.

Furthermore, teacher accreditation agencies, which are non-profit organizations, are influential institutions in this context; through their accreditation of teacher education programs and providers, they directly impact the competencies future teachers will acquire. Two core institutions were the National Council for Accreditation of Teacher Education [NCATE] and the Teacher Education Accreditation Council [TEAC] who merged to create the Council for the Accreditation of Educator Preparation [CAEP] in 2013. There are CAEP standards for the accreditation of educator preparation providers; they are partly based on the ISTE standards and hence include references to fostering preservice teachers’ media-related educational competencies, such as in standard 3.4: “Providers present multiple forms of evidence to indicate candidates’ developing content knowledge, pedagogical content knowledge, pedagogical skills, and the integration of technology in all of these domains” (Council for the Accreditation of Educator Preparation [CAEP] 2019, 2).

Industry-based and commercial stakeholders

According to Bakir (2016), further interest groups with an industry background and business collaborations come into play as influential stakeholders with initiatives in the US context of advancing media-related educational competencies. Among them are the CEO Forum on Education and Technology, the Milken Exchange on Educational Technology Group, who partnered with ISTE (Milken Exchange on Education Technology 1999), and the Partnership for 21st Century Skills, all of which contribute to the current practices in teacher education by research, recommendations, core principles, etc.

The overview of key institutions having an impact on practices of advancing media-related educational competencies in initial teacher education in Germany and the USA is necessarily selective. It can only give a first impression into the complex network of institutional stakeholders. However, it serves to illustrate two main points. First, groups of institutional stakeholders share certain characteristics in Germany and the USA: both comprise nonprofit associations and initiatives contributing to competency advancement, as they foster dialogue through conferences, publications, etc. They influence practices in teacher education through guidelines or standards of different kinds. Industry-based stakeholders come together and work with politicians, researchers and civil society in networks and initiatives. Remarkably, these industry-based stakeholders and initiatives often follow a nonprofit-approach, which does not, however, exclude marketing purposes, political objectives and an overall dense network of interests inherent in the multifold activities. A difference between German and US stakeholder groups can be noted with regards to the accreditation of study programs. In the US, CAEP was mentioned as a stakeholder because of its direct effect on the contents of initial teacher education, which is put into practice also through respective standards. In Germany however, there is less influence of accreditation institutions on curricular contents. Here, the Stiftung Akkreditierungsrat (foundation accreditation board) functions as a central decisive committee and has been responsible for accepting or declining the accreditation of study programs for all 16 states, including initial teacher education programs, since 2018. The full members currently comprise representatives from institutions of higher education, political representatives of federal states, industry representatives, students, and representatives of international universities and thus form a consortium of stakeholders from different contexts (Stiftung Akkreditierungsrat n.d.). However, their impact primarily refers to the quality and feasibility of study programs and less to a content level, which is why the German Stiftung Akkreditierungsrat has not been included in the previous list of stakeholders. Yet it remains a shared characteristic of German and US academic systems that teacher education programs have to meet formal requirements and complete an accreditation process, which is, therefore, an important condition for the implementation.

The overview presented further provides a background to the respective sources introduced in Chapter 4 and contextualizes the results. This outcome is linked to the second conclusion from the overview, referring to the separation of educational technology and media literacy research in the USA. The systematic differentiation in US concepts is mirrored in the relevant organizations that have an impact on advancing respective competencies in initial teacher education. It is noteworthy that this concentration is to a certain degree also observable with German associations and societies. Despite the comprehensive German concept of *Medienpädagogik* comprising both facets of *Mediendidaktik* (teaching with media) and *Medienerziehung* (teaching about media), some of the societies mentioned focus on only one of these dimensions. Examples are the GMK, with its orientation towards *Medienerziehung*, and the GMW and industry-based initiatives, with their emphasis on *Mediendidaktik*.

This summary of selected practices of advancing media-related educational competencies in German and US teacher education shows that both countries share many comparable preconditions, for example in the context of political influence on federal and state levels. Yet there are also differences, as in the case of the federal institutions of education policy, which have limited influence in both countries mainly due to funding; in terms of reputation and perceived usefulness, federal governmental institutions are stable and well-established in Germany but of less secure status in the US. Discourses about ways of integrating the respective competencies into initial teacher education also differ in some cases: in the US, the current focus is on infusing educational technology into curricula and on rendering educational technology courses unnecessary, while the German research discourse often suggests combining both formats, even though opinions vary across stakeholders, interest groups and research foci. All in all, the special role that educational science plays in German teacher education offers a frame for the integration of respective educational technology courses. This is unique to the German system of teacher education.

This chapter on the *status quo* in German and US teacher education has reached its conclusions based on related literature and research of publicly available resources. However, the juxtaposition of conditions also implies certain blank fields, as in the case of empirical comparative evidence. To substantiate and amend these findings it is necessary to achieve comprehensive and subject-specific conclusions by utilizing measures of empirical research, especially against the background of missing empirical evidence on German and US practices of advancing media-related educational competencies in initial teacher education. To fill this gap, a respective study will be introduced in the following.

11. Comparing Practices in German and US Teacher Education

To explore and confirm the theory-based findings from Chapters 9 and 10 in greater depth, and to add a substantial comparative perspective, a study based on expert interviews was selected. This approach is supported by Schiefner-Rohs (2012), who suggests researching practices of advancing media-related educational competencies in initial teacher education by methods such as interviews.

11.1 Expert Interview Methodology

Expert interviews, a special type of guided interview, are a common category of research tools in qualitative social research. They can be defined as a systematic and theory-based approach for data collection, put in practice as interviews with persons who have exclusive and specialized knowledge in a specific field of interest (definition translated and adapted from Kaiser 2014, 6; cf. also Collins and Evans 2007). According to Kaiser (2014; cf. also Bogner, Littig, and Menz 2009; Brenner 2006; Flick, Kardoff, and Steinke 2004), this definition implies three central concepts, which relate to the criteria of good quality established in social sciences, i.e., objectivity, validity, and reliability. First, the requirement of a systematic procedure seeks to ensure intersubjective traceability of the methods of data collection and data analysis as far as possible. Such intersubjective traceability cannot fully be achieved in the context of qualitative expert interviews because the measurement tool does not offer a sufficient degree of standardization; yet the processes of data collection, analysis and interpretation should be explicated in order to allow for an external review. To do justice to this claim, the following chapter on methodology will explain in detail how the expert interviews were prepared, conducted, and analyzed.

A second implication of the definition is that the research approach needs to be theory-based, meaning that preparation and analysis of the interview materials should refer to existing related research sources (Kaiser 2014). In the case of the study described, this claim is met by a broad integration of related literature in two ways: on the one hand, the contents of the interview were selected on the basis of, and grounded by, respective research, as for example with regards to relevant models or stakeholders in the context of initial teacher education. On the other hand, the research methodology was designed in accordance with related methodological literature to ensure a sound and valid research approach.

The third implication relates to the kind of knowledge or expertise that is to be evoked by the interview. This expertise requires neutrality and open-mindedness in the face of new aspects, differing relevance attributions and interpretive patterns on the side of the researcher. This requirement is necessarily restricted by the respective research process, which demands decisions and selections in favor of certain aspects and interpretive preferences (*ibid.*). Yet, in the present study, neutrality is

aimed at by means of a carefully prepared interview guideline which leaves room for open and unbiased contributions and excludes suggestive or loaded questions.

Against this background of genuine research preconditions, expert interviews have a number of more specific and practical characteristics. As guided interviews, they are usually semi-structured (Bogner, Littig, and Menz 2014), which means that there is a set canon of interview questions requiring open answers. Hence, the interview is pre-structured but also demands flexibility because the expert's contributions are to be included and reacted to, for example by changing the order of questions according to the direction the interview takes.

It is the role of the expert that determines the unique characteristics of expert interviews. According to Przyborski and Wohlrab-Sahr (2014), experts can either have expertise in institutional contexts, i.e., they are representatives of an institution and knowledgeable about procedures, rules and mechanisms in these contexts; or they can have interpretive expertise, i.e., they are able to analyze and interpret things in a predefined context; or they have a special context knowledge about areas which are of interest for the study (Kaiser 2014). For the following study, the experts selected were required to have all three kinds of expertise. In detail, the criteria for the selection of experts in the study were: 1) an affiliation with a German or US institution of initial teacher education and experience in teacher education, and 2) scientific work and relevant publications in the fields of technology or media pedagogy in teacher education, educational technology, media literacy, media-related competencies or related fields. The first of these two requirements was defined to ensure an adequate background and working experience, and thus a suitable reference frame for the interview, while the second requirement served to make sure that the participants had adequate expertise and scientific reliability and were established researchers in the field of interest. This field was defined broadly to account for varying concepts and foci within the area of media-related educational competencies.

The interviews in this study were developed, conducted and analyzed according to the first seven steps of Kaiser's (2014) methodology. In detail, this includes the following stages:

1. Developing an interview guideline: based on the preceding literature review, central steps for the development included brainstorming, structuring of contents, sequencing and phrasing questions and estimating timing (Krueger and Casey 2015).
2. Pre-testing the interview guideline: both the German and the English version were pre-tested with persons who met the criteria for the expert selection. The German pre-testing did not yield any potential for improvement of the guideline. The results were considered meaningful and relevant in the aftermath, so it was decided to include the pre-testing into the study as regular data. This decision was made based on the high quality of the experts' information, which were assumed

to enrich the overall data, and it is consistent with the methodology suggested by Kaiser (2014). The English pre-testing revealed several starting points for improvement to enhance clarity and quality of language, which were then realized to inform the final guideline.

3. Selecting and getting into contact with interview partners: the experts were identified according to the criteria mentioned above, based on a combination of established contacts, internet research, and snowball sampling. Contact was established via emails, and interviews were planned for $n = 10$ experts, i.e., $n = 6$ from the USA and $n = 4$ from Germany. The slightly uneven numbers account for the heterogeneous size of both research communities and limited availability and accessibility of German experts.
4. Conducting the expert interviews: the interviews were realized by online video-conferences from June to August 2018.
5. Recording the interview situation: the interviews were video recorded by a screen capture software.
6. Saving the results (record or transcription): the recordings were transcribed by student assistants (German) and professional transcriptionists (English) and double-checked at random. Both versions were peer-reviewed.
7. Coding the material: the transcribed material was coded using the coding software MAXQDA (Mayring 2015). The category system applied was prepared deductively and in advance based on the literature and related sources, which were also used for the design of the expert interviews and amended iteratively by inductively derived additions in the process.

For data analysis and further steps, Kaiser (2014) suggests identifying central statements, extending the data basis, and creating theory-based generalizations and interpretations. Instead of following this procedure, the data analysis was performed by a deductive qualitative content analysis, following Mayring (2015). This combination of approaches was chosen because Mayring's (2015) approach to qualitative content analysis is established in social sciences research and has been acknowledged as a standard for respective studies (Kohlbacher 2006), while Kaiser (2014) refers to the context of political research. The step of extending the data basis, in particular, is less common in social sciences. Mayring's (2015) methodology offers a more suitable approach. Hence, the following steps, 8 and 9, were added instead:

8. Content analysis: the coded material was analyzed qualitatively following Mayring (2015). The structure predefined by the codings facilitated a meaningful and systematic analysis, which led to a number of insights and conclusions.
9. Presentation of results: the results were then summarized, presented in Paper 2 (cf. Chapter 11.2) and at SITE conference 2019 in Las Vegas, USA, and amended by further considerations in Chapter 11.3 of this dissertation.

11.2 Paper 2: The Integration of Media-Related Studies and Competencies into US and German Initial Teacher Education. A Cross-National Analysis of Contemporary Practices and Trends²

11.2.1 Introduction

It is an important and valuable observation that for some years now, considerable efforts have been made to include media-related studies into initial teacher education - a process which has been recognized as highly desirable and necessary (Redmond 2016; Gronseth et al. 2010). There are a number of stakeholders taking influence on these developments: for example, there are national plans and lines of funding published by federal governments (in Germany: BMBF 2016; in the US: U.S. Department of Education, Office of Educational Technology 2017). Also, several associations and initiatives publish guidelines and standards intended to shape the contents of teacher education curricula (Sektion Medienpädagogik 2017; ISTE 2017).

Against the background of these efforts, there is a large variety between the ways in which institutions, states and countries take influence. So far, there is no clarity about these processes in research, although the value of respective considerations e.g. for schools and policy makers has been acknowledged (Redmond 2016). To achieve a comprehensive exploration of media-related preservice teacher education and to understand the ways in which this important task is realized, the study introduced in the following considers factors that impact the field of interest in different ways. There are four main perspectives which contribute to the overall picture: (1) theoretical foundations, (2) external influence and conditions, (3) practices of implementation, and (4) outcomes. From the theoretical perspective, models of media-related educational competencies from both countries will be included to illustrate the foundations and basic assumptions about competencies that preservice teachers should achieve. External influence and conditions will be addressed by considerations about stakeholders who actually impact and shape media-related teacher education. With regards to current practices, the ways in which respective study offerings are integrated into teacher education, e.g. by voluntary or obligatory courses, will be considered, and finally, the outcomes of these processes will be discussed. Since neither Germany nor the US have binding regulations for the integration of media-related educational competencies into teacher education, the overall status appears heterogeneous and inconsistent, and this paper has the purpose of

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clarifying respective processes to provide a sound basis for further research and developments in this important area.

11.2.2 Approaching Media-Related Studies from a Cross-National Comparative Perspective

For the following study, it is beneficial to take on a cross-national comparative perspective and to include more than one country to avoid cultural and national bias and a narrowed perspective. As Blömeke and Paine (2008) point out, cross-national research helps take advantage of the experiences and perspectives of different countries, and it facilitates researchers to overcome the constraints of their own cultural background and to include various points of view. This is particularly appropriate for a topic with such a strong cultural commitment as education, because respective processes in teacher education are dependent on a network of factors such as cultural identity and history, the demands and influence of society, or the respective pedagogical research discourse and tradition. The cross-national comparative research aims to take advantage of such individual contexts and to overcome their constraints by contextualization. Taking into account new perspectives will be beneficial for a realistic and possibly new perception of one's own background, and it is valuable for efforts of reform and improvement.

Against this background, Germany and the USA have been selected because they offer a valid background for respective comparative considerations. Their systems of teacher education, which is central for the topic, shows structural similarities: both countries are federal systems with a relatively high autonomy of the states in educational matters, and both the USA and Germany have a rich tradition of pedagogical discourse and critical debates about the system of teacher education. They also share basic Western values of democracy and the role of education (Tiede and Grafe 2016).

11.2.3 Media in US and German Teacher Education: State of the Art

In the US, media-related studies are integrated into the fields of educational technology and media literacy education. The concept of educational technology shows references to the German understanding of 'teaching and learning with media' or *Mediendidaktik*. As Mayrberger and Kumar (2014) point out, the study fields of educational technology and *Mediendidaktik* are clearly related but cannot be used as synonyms or translated due to differences in their conceptualization, background, institutionalization etc. (cf. also Grafe 2011). Likewise, the field of media literacy education is related to the German concept of 'teaching and learning about media' or *Medienerziehung*.

In the German educational research discourse, *Mediendidaktik* and *Medienerziehung* are understood as two central aspects of the construct of *Medienpädagogik*, defined as “the entity of all pedagogically relevant, action-guiding considerations in relation to media, including their media technological and media theoretical or empirical and normative foundations” (Tulodziecki, Herzig, and Grafe 2010, 41; own translation). There is no equivalent term in English, since the concepts of educational technology and media literacy education tend to be understood as distinct fields of study rather than as two aspects of a superordinate concept (Grafe 2011). According to Bereday (1964), finding a neutral superordinate category or term instead of applying terminology or concepts from one of the objects that are to be compared is essential for a neutral and unbiased perspective in international comparative research. Hence, in the following the fields of educational technology, media literacy education and *Medienpädagogik* will be referred to as media-related studies in teacher education in the sense of a *tertium comparationis* (Bereday 1964).

German education has a robust tradition of competency orientation, which has led to numerous research works that consider, define and measure competencies and competency models in higher education (Zlatkin-Troitschanskaia, Pant, Toepper, Lautenbach, and Molerov 2017). Within this tradition, various approaches to modeling and measuring *Medienpädagogische Kompetenz* have been developed. *Medienpädagogische Kompetenz* literally translates as ‘media-pedagogical competence’ and describes the competencies which teachers should have in the outlined field of *Medienpädagogik*. Beside competencies in *Mediendidaktik* and *Medienerziehung*, the construct also includes further aspects depending on the source, such as media-related school reform competency (Herzig, Martin, Schaper, and Ossenschmidt 2015; Blömeke 2000), socialization-related competency (Blömeke 2000) or own media competency (Blömeke 2000). In the following, the term *media-related educational competencies* will be used as a *tertium comparationis* for the competencies that teachers should have in the context of media-related teaching and learning.

Models of media-related educational competencies from the German national context are e.g. the approaches by Tulodziecki (2012) and Blömeke (2000), and the M³K model (Herzig, Martin, Schaper, and Ossenschmidt 2015; Tiede and Grafe 2016). In the USA, a well-established model in the field is the TPACK model (Mishra & Koehler, 2006). Apart from TPACK, there are numerous US guidelines and standards which serve to define competencies or skills for teachers in relation to media and assume functions comparable to German competency models. Two popular examples from this field are the ISTE standards (ISTE 2017) and the NAMLE Core Principles of Media Literacy Education (NAMLE 2007).

It has been described a central condition for optimizing educational processes and for ensuring and developing quality in the educational sector to model and measure competencies (Fleischer, Koeppen, Kenk, Klieme, and Leutner 2013), but

there is a gap between claims of research and actual practices in teacher education. Several research works have pointed out a deficient and unsystematic integration of *Medienpädagogik* or *medienpädagogische Kompetenzen* into German initial teacher education, e.g. by Schiefner-Rohs (2012) and Kammerl and Mayrberger (2014). Respective findings for the US situation in relation to media literacy education have been formulated e.g. by Redmond (2016) and Flores-Koulish (2006). Educational technology has been described as better integrated: as early as 2007, Kleiner, Thomas, Lewis, and Greene summarized that 100 % of all US teacher education programs provide instruction on technology integration. The contents, foci and outcomes of these instructions however are heterogeneous (Gronseth et al. 2010).

With regards to comparative studies, Tiede, Grafe and Hobbs (2015) comparatively analyzed educational study programs with a distinct media-related focus in Germany and the USA and summarized that the study programs are quite heterogeneous and do not represent the aspects of *medienpädagogische Kompetenz* equally. In an international survey on curricula of media literacy education completed by n=65 experts from 20 countries, Fedorov, Levitskaya and Camarero (2016) researched productive sources of media literacy education curriculum, content and learning outcomes of media literacy education curriculum, assessment strategies of students' media literacy competence, and main challenges for media literacy curriculum design and implementation. A qualitative consideration of curricula and practices in media-related studies from an internationally comparative perspective has not been published so far.

11.2.4 Research Methodology

It is the aim of the study presented in the following to explore current practices and trends in German and US media-related initial teacher education by gathering and analyzing experts' opinions qualitatively. Hence, the data were collected by expert interviews. Criteria for the selection of experts in the study were: 1) an affiliation with a German or US institution of initial teacher education and rich experience in teacher education, and 2) scientific work and relevant publications in the fields of educational technology and/or media literacy education or *Medienpädagogik* in teacher education, media-related educational competencies or related fields, and 3) agreement to participate in the study. The number of potential experts in this field was found to be limited especially in Germany, and the number of US experts was adjusted to approximately match the German equivalent. Hence, in accordance with these criteria a sample of n=11 experts, i.e. 5 experts from Germany and 6 experts from the USA, was included into the study. These two groups are understood to give an appropriate insight into the situation of their respective country due to the width of their expertise and research foci: the sample includes experts from the fields of

educational technology, media literacy and *Medienpädagogik*. Also, the experts come from different states and thus account for the educational federalism within their respective country. As the design of this study follows a deductive approach, the sample was determined in preparation of the study, based on a literature review, grounded theoretical considerations and in consideration of the total population of appropriate experts and of the breadth and scope of research questions (Bryman 2012). The fact that a certain theoretical saturation was achieved after the interviews (Fusch and Ness 2015) supports the assumed appropriateness of the final sample for this research.

The deductive approach of the study included an initial literature review and theoretical groundwork as a basis for the interview guideline. This guideline was then pre-tested and, in case of the English version, improved with regards to terminology to enhance precision and clarity. Then, appropriate interview partners were identified by a combination of literature review, internet research and snowball sampling, and contacted. The interviews took place via video conferencing tools (i.e., Skype and Zoom) and were recorded and then transcribed (Kaiser 2014). For the content analysis as suggested by Mayring (2015), the transcribed material was coded using the coding software MAXQDA, following a deductive category system which was prepared in advance based on theory. In accordance with the research interest, the main categories were “Relevant models, guidelines, standards etc.”, “Aspects of media-related educational competencies / outcomes”, “Integration into ITE”, “Stakeholders”, and “Subjective assessment”. This way, the experts’ statements were analyzed and then summarized and described, which will be subject to the following chapter.

11.2.5 Findings from the Expert Interviews

Theoretical Foundations

One essential part of the interview served to identify central models, guidelines, standards and other sources which are the foundation for integrating media-related studies into initial teacher education.

With regards to models and guidelines, the source which was described most often within the sample of US experts to have an impact on practices in teacher education were the ISTE standards, which seem to be relevant for a significant number of teacher education programs across the United States (ISTE 2017). Some experts with a focus on media literacy mentioned the NAMLE Core Principles of Media Education as a reference for their work in teacher education (NAMLE 2007). Also, TPACK (Mishra and Koehler 2006) was perceived as important and widely established, although there were also critical voices calling this model too “abstract” or “problematic” and

“a deficient model” due to the separation of knowledge domains which the expert prefers to understand as one interconnected domain. Such criticism is in accordance with concerns also raised in related literature, e.g. by Graham (2011).

Asking the US experts about models and competencies also brought about insights into the general attitudes about this field. As the literature review revealed, modeling media-related educational competencies is not as an established practice in the USA as it is in Germany. Some experts supported this conclusion by stating that they do not work with the term *competencies* at all, and that they do not necessarily favor using scientific models or standards as a background for teacher education.

The German experts mentioned several models and sources which they considered a foundation for fostering media-related educational competencies of German preservice teachers, repeatedly pointing out that there is no consensus or standard in this regard. However, they frequently referred to the works of Blömeke (e.g. 2000) and Tulodziecki (e.g. 2012), and several experts also mentioned the M³K model (Herzig, Martin, Schaper, and Ossenschmidt 2015). Furthermore, in terms of international references the TPACK model (Mishra and Koehler 2006) and DigCompEdu (Redecker 2017) were mentioned as relevant. Also in the sample of German experts, some opinions revealed a critical reflection of the suggested usage of models as a foundation of teacher education. They consented that teacher education study programs are mostly not tied to a model or designed with a theoretical model as a reference explicitly, but rather geared to the implications and requirements of current practices in schools.

External Influence and Conditions

Teacher education is a practice which is dependent on numerous stakeholders and influences, including policy, culture, history, society, economy, schools, and many others (Blömeke 2009). The following section highlights actors which are of particular importance for the experts interviewed.

Policy: While the US experts disagreed on the importance of federal policy – some rejected any federal influence on their work, while others pointed out the impact especially of federal funding, initiatives and the Common Core Standards –, there was agreement that the states significantly impact the practices in teacher education by standards, regulations, accreditation and certification, to a varying extent and depending on the state. The German experts agreed consistently that one of the most important political stakeholders in the German context is the *Kultusministerkonferenz* [KMK; Standing Conference of the Ministers of Education and Cultural Affairs of the Länder]. As further political stakeholders, the German experts identified the *Bundesministerium für Bildung und Forschung* [BMBF; Federal Ministry of Education and Research], primarily taking influence by funding, and the 16 German *Länder*,

which specify and implement the KMK resolutions and are autonomous enough to uniquely shape the media-related teacher education in their sector.

Associations and initiatives: US experts agreed that institutions, associations, initiatives and similar are also significantly impacting practices in teacher education. As pointed out before, ISTE and NAMLE play a predominant role in this context mainly through their standards or core principles, but also through building communities and promoting knowledge, research and communication. Further stakeholders mentioned are Common Sense Media, the National Council of Teachers of English (NCTE) Media Literacy Now, and the Association of College and Research Libraries (ACRL). Likewise, the German experts assigned some importance to societies and associations, even though they tended to be more critical and questioned their role. Central players mentioned were e.g., the *Deutsche Gesellschaft für Erziehungswissenschaft* (DGfE; German Educational Research Association), teachers' associations or the initiative *Keine Bildung ohne Medien!* (KBoM!; No education without media).

Companies: The US experts acknowledged the fact that companies and the technology industry, e.g. Google, Apple, Intercall, and Pearson, also have an interest in impacting teacher education practices and offer according resources and solutions. The engagement of such companies was perceived as problematic due to their focus on selling products, but some experts also mentioned good examples such as the New York Times learning network and appreciated funding and initiatives, e.g. by Google. Even beyond their products, companies and the industry are described as important stakeholders because they have requirements for future technically savvy employees who have to be educated in schools, which claims appropriately educated teachers. The German experts described the impact of companies as focusing on expectations and interests in future employees with high digital skills, which requires an according education and thus also claims appropriately educated teachers.

Schools: Schools and their students were mentioned in the context of stakeholders because they have requirements and expectations for future teachers, which teacher education has to satisfy. The same can be said about the wider **society**, which similarly has expectations and requires teacher education to deliver certain results in terms of media literate and technology-savvy teachers. Digitalization has become a society-wide catchphrase and infuses all areas of education. These observations were shared by experts both from the USA and Germany.

Beyond external influences, there are four dimensions of stakeholders at the **university**, according to US experts. The first dimension is the university administration, which is described to have only a subordinate influence. It is rather at the second level, which is boards, committees etc., where trend-setting decisions with regards to curricula are made. However, the US experts agreed that there is a significant and large autonomy of teacher educators, who are among the most important stakeholders and form the third dimension. In many cases, teacher educators

have a considerable amount of flexibility in terms of the contents they teach and in their teaching methods and focus. Finally, the fourth group of stakeholders at the university is the group of preservice teachers themselves. In a way, they impact their own media-related education by feedback and by the choices they make in terms of courses and course projects, if they are given a choice, which is rarely the case in US undergraduate teacher education. They also shape their teacher education programs by the experiences and attitudes they bring along. Beyond the proceedings at single universities, US experts described that the universities also influence each other, which is due to the strongly hierarchical structure of US universities: what happens at the universities with the highest reputation “will be kind of aspirational for the other, smaller teacher education programs around the country”.

Also in Germany, the role of the universities is central. The universities’ administrative bodies may shape a general orientation towards media, but it is at the level of chairs and most significantly of the teacher educators where important choices are made and where the integration or fostering of *Medienpädagogik* happens. This impact was perceived as even more important than regulations and obligations, because the teacher educators decide about the ways in which they implement such elements, and about the competencies they want to foster and the ways in which they assess the outcomes. This autonomy is beneficial in a way, because it allows teacher educators to follow their convictions and to set foci as preferred. At the same time, it is risky because teacher educators also have the power to decide against the inclusion of *Medienpädagogik*, and because an engaged inclusion of respective contents depends on single persons with according interests. According to the German experts, the role that German preservice teachers play is also vital. Due to the unique characteristics of the system of German teacher education (cf. Blömeke 2009, for an overview), which allows for great flexibility and autonomy in selecting courses as compared to the US, the preservice teachers in many cases have a say in the courses they take and therefore in the *Medienpädagogik* they encounter. Again, this is beneficial for preservice teachers who have respective interests and are media savvy, but it is problematic for those that are negligent of or critical towards media, which seems to be the case with peculiarly many German preservice teachers according to the experts.

Practices of Implementation

Based on former research, it was assumed that the respective study contents can either be integrated as obligatory courses, as electives, or as parts of other courses and content areas. While in the US study sample obligatory educational technology courses were described to be widely established, media literacy courses seem to be rare. However, the experts’ opinions revealed that distinct and obligatory educational

technology or media literacy classes may not be the best way to integrate according knowledge at all: “In a perfect world, there would be no need for an education technology course on the pre-service level. We would see instructors integrating digital technologies quite naturally with their own instruction”. In accordance with this, several experts described that these fields are integrated rather often into other courses such as methods classes or subject-specific or discipline classes. However, this apparent heterogeneity within the system also led to the conclusion that students could at some places complete their teacher education without ever learning about media literacy or, in fewer cases, about educational technology. Voluntary offers or electives for media-related studies were described to be very rare at the level of pre-service teacher education due to fixed curricula without electives and also due to a heavy workload preservice teachers face.

The German experts also pointed out that the ways in which *Medienpädagogik* is integrated into German teacher education are not standardized and thus highly heterogeneous. There are university-wide or even *Länder*-wide obligatory courses, which are required for all preservice teachers at some places and range from single courses to more comprehensive modules. Against the background of the flexible German preservice teacher education system which allows for a number of individual choices, it is a common procedure also to offer voluntary courses which preservice teachers can opt to take. This heterogeneity again leads to a situation in which preservice teachers at some places can graduate without ever learning about *Medienpädagogik*. The German experts repeatedly mentioned a significant third practice for conveying respective contents, which is the integration into subject-specific courses. There is a growing number of teacher educators in subject-specific courses employing contents and methods from the field of *Medienpädagogik* – a practice which the experts generally approved of, even if they pointed out a bias due to the unsystematic approach. This is in accordance with some US experts’ claim for a natural integration of media-related studies into other courses instead of specific educational technology or media literacy courses.

Learning Outcomes and Competencies Acquired

The experts were asked for the outcomes of media-related teacher education in their country, i.e. the aspects of media-related educational competencies preservice teachers acquire, and the things they learn from the domains of educational technology and media literacy education, or *Medienpädagogik*. In this context, in the US interviews it became obvious that the distinction between educational technology and media literacy education is disputable. While it was confirmed that the two are understood as two separate domains, which are interrelated and overlap at some point, some experts approved of this separation and others criticized it. Also, the US

experts avoided the term *competencies*, sometimes explicitly explaining that it is not common and in other cases describing skills, knowledge or outcomes rather than competencies.

The preservice teachers' learning outcomes described by US experts are shaped again by heterogeneity and depend on the focus of the experts. Competencies in "teaching and learning with media" or educational technology mentioned included for example strategies for using videos in class, digital pedagogy, how and which media to use in class, and reflective practices. Outcomes in "teaching and learning about media" or media literacy education included e.g. student empowerment, teaching for social justice, teaching about social media and fake news, critical evaluation, and responsible behavior online. It was also described that students acquired practical and technological competencies, such as operating and applying specific tools, websites, blogs etc., or recording videos. The degree to which these different aspects of competencies are achieved differ. The experts were confident that a majority of preservice teachers are provided with basic technological skills, but the acquisition of deep knowledge with regards to educational technology and even more with regards to media literacy education seems to be unsystematic and dependent on numerous factors, including the conditions and stakeholders as described above.

Some German experts also put into question the acquisition of proper competencies in initial teacher education. Instead, they repeatedly highlighted the importance of conveying attitudes, beliefs and an increased awareness of the field of *Medienpädagogik* and of its implications and importance for school. Against this background, the main outcome described in the field of "teaching and learning with media" or *Mediendidaktik* was reflecting on the reasonable inclusion of media into teaching and learning processes, with some experts confirming this outcome and others challenging it. Outcomes in the field of "teaching and learning about media" or *Medienerziehung* included e.g., a reflection on different perceptions of *Medienerziehung*, the relation of media and identity, or cyberbullying. Further comments referred to the field of media-related school reform or organizational aspects, which was described to be of subordinate importance but sometimes addressed. German preservice teachers were also described to acquire practical skills such as using apps or devices.

11.2.6 Discussion and Implications

The results described above offer relevant insights into practices of teacher education in Germany and the USA. There are several differences between both systems which became obvious in the interviews and deserve further research. A first observation in this context is that media-related teacher education in Germany and the USA is based on different assumptions about competency modeling. In Germany, modeling and measuring competencies is well-established and considered important for a

systematic inclusion of central facets (Fleischer, Koeppen, Kenk, Klieme, and Leutner 2013; Blömeke, Zlatkin-Troitschanskaia, Kuhn, and Fege 2013). However, the German experts' experiences show that such a systematic approach is not a common standard, and that current practices of media-related teacher education employ heterogeneous ways of fostering respective competencies. Yet, the German experts pointed out references of the practices they described to models and theoretical approaches, most centrally from Germany, but also with regards to international approaches. The US experts in the study on the other hand explicitly or implicitly rejected the term *competencies*. This finding questions the appropriateness of the *tertium comparationis* of *media-related educational competencies*, which was thereby discovered to carry a predominantly German tendency and will thus need rethinking for further related studies.

The US experts also challenged the role of theoretical models, preferring practical guidelines like the ISTE standards or the NAMLE core principles and referring to the US background only. The rather subordinate role that scientifically sound and well-researched models of media-related competencies play for actual practices, certainly in the USA and in many cases also in Germany, leads to questions of the genuine role that such competency models can and should play in teacher education. It has been pointed out in related German literature that competency modeling and measuring can be a vital contribution to establishing, maintaining and improving quality in higher education systematically, but the expert interviews from Germany and even more so from the USA convey the impression that there are other factors more powerfully guiding actual practices. Given the value that research-based competency models can have for practice, further research in this field will have to intensify efforts not only in investigating and developing respective models but also in considering their potential for and actual implementation into practices in teacher education to ensure a closer connection of research and practice.

A second implication to be learned from the expert interviews is connected to the role of teacher educators. Both in Germany and the USA, teacher educators turned out to be a key stakeholder for the facilitation of media-related educational competencies. This is true for teacher educators in educational courses, but also for teacher educators from all other fields including content-specific courses in particular. The experts in the study described that media-related studies are not tied or limited to educational classes, and this leads to two conclusions. First of all, it is desirable to strengthen the collaboration between educational experts in media-related fields and teacher educators from other fields, and to develop approaches which allow for a more systematic and grounded inclusion of media-related studies into content-specific courses. As the experts pointed out, this connection is already established to a certain point because also teacher educators from other fields use media in their classes, but it needs support, research and innovative approaches to support

the comprehensive and genuine integration of respective contents into teacher education and to resolve the limitation to distinct educational courses. The second conclusion is that teacher educators are an important, but sometimes neglected target group for media-related competency research. The interviews revealed that teacher educators play a central role, and that the decisions teacher educators take with regards to e.g. contents and methods are amongst the most decisive factors in the network of facets determining the media-related education that preservice teachers receive. Research has only begun to consider what this means for the teacher educators' attitudes and competencies (Krumsvik 2012; Foulger, Graziano, Schmidt-Crawford, and Slykhuis 2017), and further research will be beneficial for supporting and enhancing all teacher educators' willingness for and skills and competencies in integrating media into their classes.

It is an important observation that these conclusions are true both for the German and the US context, and this supports the initial assumption that the cross-national comparative perspective can be beneficial and point out global and superordinate tendencies. For future considerations, it will be helpful to build on the strength of a cross-national perspective and to include more countries and backgrounds to enhance understanding about global requirements and overall tendencies. Researchers and practitioners alike should encourage collaboration and combine efforts for fostering and improving the systematic integration of media-related studies into teacher education, which has turned out to be a process only at its beginning and characterized by heterogeneous conditions and requirements, but also full of potential and supported by qualified researchers and teacher educators who are working on improving the current practices with great engagement.

11.3 Main Conclusions from and Further Perspectives on Paper 2

Paper 2, "The Integration of Media-Related Studies and Competencies into US and German Initial Teacher Education. A Cross-National Analysis of Contemporary Practices and Trends", amends the perspectives offered so far by including perspectives on current practices in initial teacher education in both countries investigated. These perspectives include the fields of 1) theoretical foundations, 2) external influence and conditions, 3) practices of implementation, and 4) learning outcomes and competencies acquired. In terms of the theoretical foundations at the basis of media-related efforts in teacher education in Germany and the USA, the expert interviews revealed that in the USA the ISTE standards are widely established as a theoretical background for orientation, with the NAMLE Core Principles of Media Education and TPACK as more controversial sources. The German experts referred to a number of research-based models of *Medienpädagogische Kompetenz*, including the works of Blömeke, Tulodziecki and M³K, and to international approaches like TPACK and

DigCompEdu. The identified external influences and outer conditions which determine processes and contents in teacher education could be classified into policy, associations and initiatives, companies, schools, and different levels of stakeholders at universities. With regards to practices of implementation, media-related contents were found to be integrated either as obligatory courses, as electives, or as parts of other courses and content areas to differing degrees: e.g., electives were found to be a comparably rare phenomenon in US teacher education, at least at undergraduate level. Finally, media-related learning outcomes and competencies that students acquire in the course of their teacher education were described as quite heterogenous, including technical skills or knowledge in the pedagogical implementation of digital media into lessons.

Key conclusions of the paper refer to a different notion and treatment of the term *competencies* and of the role of theoretical models, to the important stakeholder position of teacher educators, and to the applicability and advantages of cross-national comparative research in general.

With regards to the different notion of *competencies*, it has been mentioned in the conclusion of Paper 2 that a certain terminological variety concerning this term, and sometimes even its rejection, could be observed. Considering competing terms, in some statements, *competencies* was circumscribed or interfused with *skills*, *understanding* and comparable terms, as in the following:

“In my role facilitating what I would call media education or media literacy with preservice teachers, I would describe these skills I’m trying to build as more thinking skills, critical thinking skills, ways of understanding media technology that position them beyond just a value-neutral device [...]” (expert US6)

“Students are coming out of Ed schools without a good understanding of how to use technology and media and that they bring their media skills that they’ve learned as growing up as young people.” (expert US1)

From a terminological point of view, these statements substantiate the claim that *skills* are sometimes used as synonyms for *competencies* (Sampson and Fytros 2008), and they show that the experts sometimes focused on skills as one component of the wider concept of competence (Tulodziecki and Grafe 2019; Weinert 1999; Blömeke, Gustafsson, and Shavelson 2015; From 2017; cf. Chapter 2). Hence, such a focus on distinct elements from the wider concept of competence can be read to substantiate the impression of diverging conceptions and foci within one extensive field.

Furthermore, the interpretation of an “explicit rejection” of the term *competence* is based on statements like the following:

“When you were asking about competencies, I’ve been thinking a lot about this because it’s a term that I don’t use in my work. I think one of the things that we see happening, there’s so much influence in the US of neoliberal policies that are trying to quantify everything and only valuing something that you can put a number [on] and quantify.” (expert US2)

Overall, this explicitly dismissive statement reveals a narrow understanding of competencies as a means of quantification, testing and standardization and implies a negative connotation. From an international comparative viewpoint, it is remarkable that this point made by a US expert shows references to the debate around the questionable quantification and measurability of competencies which is a reoccurring theme in the German research debate (cf. Chapter 6), even though the expert expressing this criticism does not question the theoretical construct of competence and its quantifying dimension, but only practices of quantification. This relates to an aspect from the interviews which had to be neglected in the paper for reasons of length but is of high relevance for the context of this dissertation, namely the issue of measurement. Part II was concerned with different aspects of measurement and pointed out difficulties of measuring competencies, particularly with regards to the M³K measurement instrument, model fit, and the international perspective and underlying cultural backgrounds. The expert interviews, however, brought forward a new dimension through criticism targeted at the measurement of competencies in general. Notably, this criticism was shared by voices from the USA and Germany alike:

“Testing and scripted standardized curriculum for teachers is becoming very, very popular and is one of the things that we’re trying to push back on.” (expert US2)

“I think what is relevant [...] is the question of what we can actually measure. I feel that most people think a model is a good model if I can operationalize and measure it. [...] This is less specific about media, but related to our standardized and measurement society in which we are from my point of view: everything needs to be evaluated, everything needs to be measured, everything needs to be quantified and I consider this a hazard especially for *medienpädagogische Kompetenz*, that we measure in schools only what is assessed in some way in PISA or in ICT competence. Everything else falls by the wayside.” (expert D2, own translation)

Hence, according to some experts consulted, the measurement of media-related educational competencies does not only have to be considered from a methodological and content perspective but also with regards to its implications for students

and society. There are repeated comments about both German and US societies, which increasingly tend to measure, quantify and standardize competencies. It will be a challenge for the future of the measurement of media-related educational competencies to define a position within this network of factors and to address the gap between what is demanded by, and helpful for, outer circumstances, such as society, and what is useful from a research and educational perspective. The study presented and the experts' comments quoted point to standardized and quantitative measurement instruments, but it is important to note that competency measurements can also have other purposes, such as individual feedback and subjective assessment of achievements, or supportive information for the orientation and improvement of processes and study programs. In accordance with that, the measurement of competencies is not limited to standardized quantitative instruments, as criticized above, but can also take on the shape of, for example, video-based observations and reflective evaluations to facilitate individual feedback. Naturally, such qualitative measures still imply a quantification of competencies; but the suggested negative sides of competency measurements will need a careful juxtaposition with benefits like those outlined above to come to a comprehensive judgment of the value of competency measurement beyond the implications of a "measurement society."

From a methodological perspective, the method of expert interviewing applied here does not allow for conclusions on the entity of the target group, i.e., US experts in the relevant field, because all statements represent single persons' subjective opinions and are therefore not representative of a specific group. Yet the examples of using other terms and presumed synonyms and of explicit rejection of the term *competence* hint at the conceptual vagueness which surrounds the field of *media-related educational competencies*, at least from a US viewpoint, and add to the impression of differing perceptions and concepts connected to *competencies*. In this context, it is worth considering that other US experts did, in fact, use the term confidently:

"I liked ISTE for the fact that it was focused on particular competencies and wasn't prescriptive about particular brands of tools or machines and devices, but rather competency-oriented, which I thought was appealing." (expert US5)

"I also think there needs to be a greater focus on particular competencies by educators and by schools to ensure that there are certain wider skill sets that are being learned and then like problem-solving and collaboration, as opposed to just ensuring that you've checked the box and students know how to use PowerPoint." (expert US5)

To conclude, the varying confidence in using the term *competencies* adds to the conceptual heterogeneity which characterizes the field of media-related educational competencies. This ties in with the initial observation that the term *literacy* is

preferred within US research and that there is an established research tradition in the USA focusing on media literacy (cf. Chapter 2; see also Grafe 2011). Only recently, a shift towards an increasing US coverage of *competencies* can be observed as well, stimulated by the efforts and dissemination linked to the TETCs competency model of teacher educators' technology competencies (Foulger et al. 2017). It will be a promising objective for future comparative research to follow this development and to analyze what this will mean for the systematic distinction of educational technology and media literacy, which are now increasingly separated also by the differing concepts of technology competencies and media literacy. It is conceivable that these two will consequently contribute to an enhanced divisiveness. At the same time, the European research context shows how to integrate and synergize the concepts, thus offering innovative approaches for the US research context.

Another aspect which was discussed in the expert interviews but not included in Paper 2 for reasons of length are the experts' subjective assessments of the status of media-related teacher education in their respective countries. In the German context, the assessments range from optimism to clear pessimism. An example of an optimistic statement can be found in the interview with expert D0:

“To be honest, an anticipated future leaves me quite optimistic with regards to the question how we can successfully convey media pedagogical skills in higher education to future teachers.” (expert D0; own translation)

It is based upon a retrospect view of the increasing spread of practices of advancing media-related educational competencies and of growing chances for preservice teachers to become prepared with the media-related competencies they will need for their professional practice. At the same time, there are also pessimistic statements, such as the following:

“All stakeholders, so to speak, consider the advancement of *medienpädagogische Kompetenzen* important, it is considered worthy of advancement everywhere and I think there are enough models for the implementation, but the realization is the weak point.” (expert D4, own translation)

“At the moment, I would assess the nationwide situation as bad. Simply because there is no systematic advancement of *medienpädagogische Kompetenz* of preservice teachers. Admittedly, there is no common understanding of media pedagogical advancement.” (expert D1, own translation)

Both of these quotations share a criticism towards current practices of advancing media-related educational competencies. The first one acknowledges that important predicaments, such as theoretical models and common awareness, are provided for but attributes a problem to the implementation. The second quotation sees

inadequate practices of implementation rooted also in an insufficient theory base and understanding. The US experts also took on both positions. For example, a positive statement was expressed by expert US5:

“Given what we are at right now with US education, I think we’re doing a solid job.” (expert US5)

This positive confirmation stems from the context of unsatisfying conditions within the US educational system. Hence, the focus of the positive aspect is on the work teacher educators perform against the background of sometimes difficult or inadequate conditions. This opinion is opposed by expert US4 who says:

“I don’t think we’re doing enough. We’re not doing nearly enough. What we’re doing is reactive rather than proactive.” (expert US4)

A reoccurring motive within the US experts’ pessimistic statements corresponds to the quotation from expert US5 emphasizing difficulties within the US educational system, such as in the following:

“Some people really get it, but at the same time, so much of education is structured not to go there, to just basically, control and keep doing what we’ve always been doing. It’s very well designed not to change. That’s our experience.” (expert US2)

All in all, these positions from Germany and the USA point at local efforts and successful developments, but at the same time they emphasize the long struggle necessary to ensure a comprehensive and systematic inclusion of media-related competencies into teacher education. It also becomes evident, against the background of the previous stakeholder analysis, that experts from both countries attributed difficulties and challenges both to external or contextual factors, such as society and superordinate educational systems, and to internal factors, especially with regards to the community of teacher educators and researchers working on this topic. This interpretation is substantiated in numerous statements. An example connecting these two central issues of systematic challenges and problems emanating from the group of teacher educators can be found in this statement about the German situation:

“The situation is heavily impacted by coincidences. As a preservice teacher, you can be lucky and come across a teacher educator who finds [media pedagogy] interesting and wants to do it. You can also have bad luck [...] and come across someone who completely rejects it, so if I assess this subjectively, it is too random for me and too much dependent on coincidences.” (expert D2, own translation).

This criticism of the group of researchers and teacher educators is also echoed by the German expert D4:

“In [German] media pedagogy, we have maybe not overlooked it, but we have not worked on it intensely and left many questions of teaching and learning with media, if you consider it from a research perspective, to the pedagogic psychology, so you see that many professorships for *Mediendidaktik*, which should be staffed by media pedagogues, are held by pedagogic psychologists, and I consider this a realization problem.” (expert D4, own translation)

In this context, expert US3 even prioritizes the level of teacher educators over systematic and mandatory change:

“Rather than having it come through some policy mandate or dictate, what I would like to see is that teacher educators throughout the country would take up, as part of their professional obligation and service to preservice teachers, to say, “We must be better at teaching media literacy. Therefore, we are going to make time and space in our curriculum to do this in both an explicit way, through one dedicated media literacy course, and also more implicitly, we will thread it throughout the rest of our undergraduate preservice education courses. We’re going to do that voluntarily, we’re going to do that with intent, and we’re going to do that immediately.” [...] I don’t think that’s going to happen right away. Not because people are resistant to it, but because change is hard with everybody, “I’ve got my class, I’ve got my assignments. I’ve got my curriculum, it’s already too crowded, I don’t have enough time.” That is the classic problem in education. Of course, you don’t have enough time. We never have enough time. You better start making time for this because if you do not, we are going to be in an even worse situation than we are right now.” (expert US3)

The expert interviews also reveal interesting differences between US and German viewpoints on a systemic level with regards to the discipline of what is called *Medienpädagogik* in Germany. It has been argued before that the German concept of *Medienpädagogik* can generally be defined as a subdiscipline of educational research. According to the included German literature review, there is a certain consensus to understand teaching *with* and teaching *about* media as two key subdomains of *Medienpädagogik*, even though this duality has been challenged in some cases (e.g., Ruge 2017; Kerres and De Witt 2011; Kerres 2007). Yet all German experts, despite usually having a certain focus on one of these aspects in their work, answered mostly in relation to both fields. In the USA, however, according considerations about the two distinct disciplines of educational technology and media literacy are less common, as has been described by Grafe (2011). The US experts in these interviews strictly

differentiated between educational technology and media literacy. The ratio of these two main fields and their relevance for initial teacher education across US teacher education programs was described controversially:

“A few years ago, I would have said they’re all about the EdTech. Now, I would tell you they’re all about media literacy and that the technology is simply a way to gain access to people and access to content.” (expert US4)

“Media literacy I feel fairly confident is quite rare in teacher education. Information literacy, digital literacy, some of these other literacies, computer literacy or technology, may be more prevalent as parts of Teacher Ed programs.” (expert US6)

Yet the inclusive German perspective was not unheard of by US experts, as the following quotation suggests:

“I think, in the United States, the distinction between media literacy and educational technology is maintained a bit more rigorously, but those ideas [are] certainly like an overlapping Venn diagram, where the circles have a lot of common overlap but are still distinct.” (expert US1)

A second expert even criticizes:

“In the US we see [educational technology and media literacy] as distinct separate spaces, which doesn’t make a lot of sense to me.” (expert US4)

However, there is also insecurity and anxiety related to a potential fusion of the two disciplines:

“I think my main anxiety is about the conflation of media literacy and educational technology. I worry that [...] media literacy will end up the loser in this distinction.” (expert US1)

Consequentially, US experts mostly referred to the background either of media literacy or of educational technology and German experts, while showing a certain tendency or orientation towards one subdomain, related their answers to the superordinate domain of *Medienpädagogik*. Hence, it can be concluded that there is a certain systemic or disciplinary divergence, which has impacted the experts’ views and perspective as well as their evaluations. For example, as concluded in the previous literature review, US educational technology experts had other perceptions of the spread of their subject across teacher education programs, as compared to media literacy experts, which led to differing perceptions on the same question within one group of experts.

However, it is noteworthy that both German and US experts, and for that matter, both US educational technology and media literacy specialists, pointed out experiences, perspectives and challenges which are surprisingly comparable. According to the experts, the advancement of media-related educational competencies in both countries faces conflicting fields. Centrally, on the one hand, there are systems of teacher education that are largely described as in need of improvement with their requirements, challenges and barriers. On the other hand, there are teacher educators who play a significant role and vary strongly in their engagement, interest and action-taking. With further factors contributing to this tense network of stakeholders, the situation overall appears as heterogeneous, and it becomes evident how complex an endeavor the systematic improvement of respective practices is.

11.4 Conclusions on Frame Conditions of and Stakeholder Influences on Practices of Advancing Media-related Educational Competencies

This analysis of stakeholder influences on practices in German and US teacher education, through an initial literature review and a deeper exploration of the expert interviews of stakeholders and frame conditions, allows for extended conclusions on the network of influences. Following the approach of systemizing stakeholders and conditions into levels and dimensions as suggested by related models (e.g., Egetenmeyer, Breitschwerdt, and Lechner 2019; Egetenmeyer and Grafe 2017), the overall results are summarized in Figure 7 by means of a multi-level model.

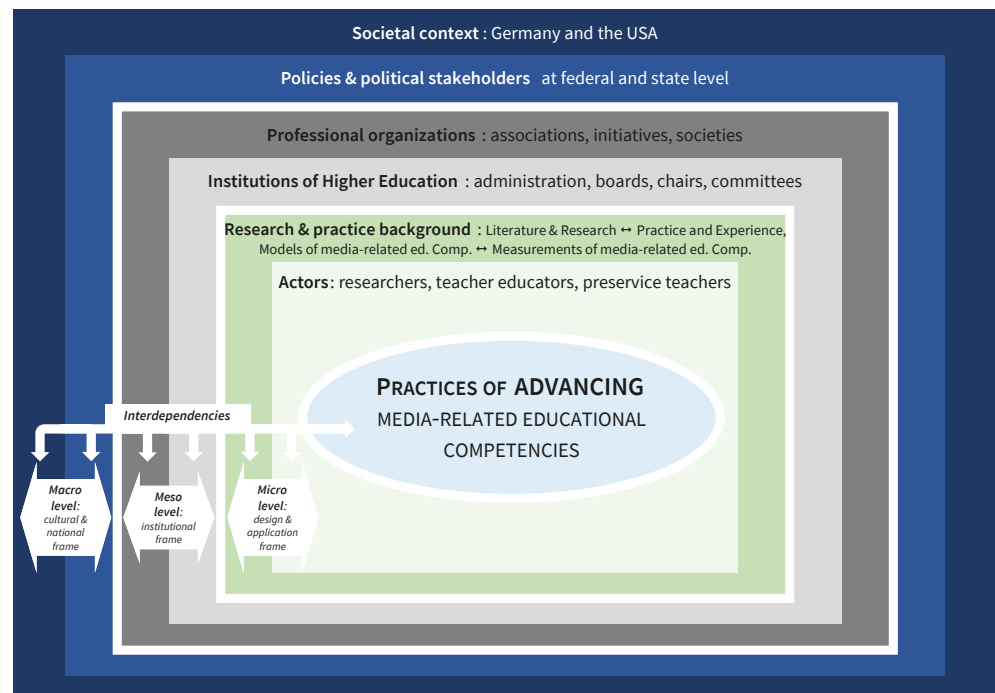


Fig. 7.: Stakeholder influences on practices of advancing media-related educational competencies (own multi-level model).

Figure 7 emphasizes how the various stakeholders and conditions mentioned in the previous chapters shape a framework for all relevant processes in the context of practice in initial teacher education. *Stakeholders* in this context are understood as persons, groups or organizations with an interest in and an impact on the practices of advancing media-related educational competencies, while *conditions* refer to non-personal influences that are still closely connected to the stakeholders and practices.

Overall, the stakeholders and conditions are organized on three levels: a macro level, a meso level, and a micro level, with interdependencies between all levels and stakeholder groups, and the practices of advancing media-related educational competencies as the central educational process researched. In accordance with the design of further related multi-level models seeking to analyze influences on educational processes, the three main levels are arranged from general to specific influence (Schrader 2011; Egetenmeyer, Breitschwerdt, and Lechner 2019; Lima, Guimarães, and Touma 2016). There are two stakeholders or influences on each level; they are arranged from a looser to a more binding or direct influence within the level.

11.4.1 Macro Level

Within this arrangement, the macro level provides the general cultural and national frame. On the outer dimension, there is the societal background of Germany and the USA as the two countries focused on in this dissertation. As the international comparative perspective applied reveals, there are national and cultural factors inherent in all dimensions and actions implicitly or explicitly shaping central processes, which is why an international comparative approach is helpful for visualizing and addressing the issue of restrictive viewpoints. In a wider sense, society is affected by all efforts in relation to media-related educational competencies, because it is a central objective of these efforts to enhance and improve initial teacher education to prepare future teachers who can then educate and teach children in appropriate and successful ways to become media-literate and responsible citizens in a digitalized society. To this extent, society and in particular schools, parents and students, but also citizens and employees from other branches, bring about certain expectations for teacher education, for the teachers graduating from it and the competencies they acquire. Hence, an awareness of the contribution and relevance of research on media-related educational competencies for society is vital for responsible and meaningful practices.

The macro level further includes political stakeholders as an inherent part of the national frame (Egetenmeyer, Breitschwerdt, and Lechner 2019). Political stakeholders are particularly indebted to their societal background: they represent and reinforce this background at the same time and are usually expected to act for the public benefit of their country or reference context. In terms of influences on practices of advancing media-related educational competencies, political stakeholders can function on different levels, as there are global, national and state influences. However, the considerations in Chapter 10 clarified that global policies provide a general and hardly binding frame. Policies on a national level both in Germany and the USA play a limited role that is mostly restricted to funding, except for the KMK in Germany with its impactful, but still advisory, resolutions. Apart from this, due to the systems of state sovereignty in educational affairs established in both countries, it is at the state level that policies most directly influence practices in initial teacher education. In both countries, regulations for the final exams of teacher education graduates are a frequently used means for state governments to ensure an obligatory inclusion of media-related topics into initial teacher education. In the US, state-wide standards for teachers are also common, while in Germany, contracts between states and universities are a further way of enforcing influence with respective contents. However, it was revealed in Chapter 10 that these influences and the resulting regulations are heterogeneous and vary between the states in both countries with regards to obligation, shape, inclusion, and results.

11.4.2 *Meso Level*

In Figure 7, the meso level describes the institutional frame for practices in initial teacher education in Germany and the USA. The outer and thus more general level refers to professional organizations, associations, societies, and initiatives, while the inner level describes the institutions of teacher education with its various interest groups.

Professional organizations often have less of a binding influence and play a rather advisory role, yet they are of major importance. As argued in Chapter 10.3, they provide standards and guidelines that have gained significance in teacher education practices in Germany and the USA. For the German context, it was pointed out that the Division Media Education of the GERA plays a dominant role in this regard, while in the USA the influence is noteworthy, especially of ISTE and SITE in the field of educational technology and of NAMLE in the field of media literacy because of their respective standards, competency models, or core principles. Just like a number of further organizations, these associations also foster dialogue and research and thus help shape the research background on the micro level. They also function as a link to the policy dimension on the macro level because they show strong mutual influences. Resolutions and guidelines from professional organizations specify the research background, which will be discussed in the context of the micro level. They are often supported and used by political stakeholders, as in the case of the ISTE standards, which were also promoted and adopted in state standards by political stakeholders in the US on national and state levels (cf. Chapter 10). At the same time, political actors sometimes also contribute to and constitute organizational and network activities, as described, e.g., in the case of the German D21 network. Hence, the interdependencies between the levels become evident.

The context of the levels of stakeholders and conditions mentioned until now has been rather broad. Decisions made in these contexts, expectations expressed, and input offered usually apply to wider reference frames, such as the whole country or states, or wider target groups. The inner part of the meso level and the micro level, on the other hand, describe the local frame for individual practices of advancing media-related educational competencies in initial teacher education.

On the inner side of the meso level, there are the institutions of higher education, specifically universities. They provide frame conditions for any practices in initial teacher education. As became evident in the expert interviews, influence can be had to varying degrees by administration, boards, chairs, and committees: importantly, the administration interferes on rare occasions only, and boards and committees have a comparable impact especially in US institutions of teacher education. Institutions further shape practices through organizational frame conditions such as leadership style, organizational structures, openness to innovative approaches, and technical equipment. These frame conditions also depend on stakeholders from the

meso and macro level in terms of regulations and obligations, e.g., for the design of study programs and exams. In the US context, there is a further influence of other institutions with a good reputation. US experts described to orientate themselves towards practices at well-known universities in some cases. Such orientations are less common in Germany, given the less hierarchical structure of German institutions of higher education.

11.4.3 Micro Level

The micro level describes the design and application frame and is thus specific to unique practices in teacher education at one place. The outer micro level consists of the research and practice background as a central condition. It includes literature and research relevant for respective practices of advancing media-related educational competencies, but also established practices and related experiences serving as an orientation and reference for the stakeholders on the inner dimension. This also comprises references in literature to, and experiences with, models and measurements of media-related educational competencies, as discussed in Parts I and II of this dissertation.

As became evident, especially in the expert interviews (cf. Chapter 11), the advancement of media-related educational competencies in Germany and the USA is oriented towards frameworks and sources with a certain focus on national references. For example, teacher educators in Germany described using the M³K framework as a reference for systemizing study offers in the field of *Medienpädagogik*, and they repeatedly pointed out the relevance of further national sources such as the works of Blömeke and Tulodziecki for their media pedagogical work. In the US, however, experts primarily built on the US research background, mentioning and sometimes critically discussing, for example, the TPACK model or the ISTE standards. To this extent, there is an evident connection between the dimensions of competency modeling and advancing competencies, which will be addressed in the concluding chapter in greater detail. In the context of the multi-level model of stakeholder influences, it is important to acknowledge that the research and experience background shapes an overall background for actors to refer to.

Actors form the most inner part of the multi-level model and comprise persons directly involved in and affected by practices of advancing media-related educational competencies. This specifically refers to researchers and teacher educators and to preservice teachers as recipients. It has been argued above that there are differences between the USA and Germany in regard to the role of preservice teachers. The influence German preservice teachers can have on their own media-related education is higher due to more autonomy in the design of individual study curricula, which brings about a certain responsibility that US preservice teachers have in fewer cases.

As the experts in the study presented in Part III emphasized, teacher educators are a key stakeholder in the advancement of media-related educational competencies with preservice teachers. Influenced by the overall context on the macro level, indebted to the regulations and other impacts from the micro and meso levels, and dependent on the frame conditions formulated by their respective institutions, teacher educators yet have a certain amount of individual flexibility to realize the advancement of media-related educational competencies with their preservice teachers in unique ways. Within the restrictions given, they can put emphasis on certain contents and neglect others and thus are of core importance for this context. The responsibility coming along with this role is even enhanced in the increasing realization of the technology infusion approach in the US suggested, e.g., by Wetzel, Buss, Foulger, and Lindsey (2014) or Foulger et al. (2019). In the case of classical distinct educational technology or media literacy courses, there is a structural responsibility for the institutions to organize, integrate and offer such courses. To a certain degree, the technology infusion approach shifts the responsibility for the media-related education of preservice teachers to the teacher educators of courses that are not inherently media-focused. This responsibility brings about a considerable challenge for teacher educators to develop the respective necessary competencies on their own (Foulger et al. 2017; cf. Chapter 4.2), but it also brings about an advantageous spread of educational technology and media literacy across topics and contents.

All in all, the analysis of stakeholders and frame conditions impacting practices of advancing media-related educational competencies in initial teacher education in the USA and Germany paints a picture of a dense network of interests and influences. The interdependencies between the levels are often mutual and subject to multi-fold individual conditions, so that the representation presented in the multi-level model is necessarily abstract and generalized. However, it becomes evident that the advancement of media-related educational competencies is a complex issue. It has been pointed out in Chapter 9, in the context of current practices, that research sources both from the USA and from Germany criticize current practices in this context from multiple angles. The overview provided in this chapter now adds to this discussion a systematization of conditions and influences and thus illustrates interdependencies and parameters that can and need to be considered and addressed in the ongoing improvement of respective practices.

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Media-related Educational Competencies of German and US Preservice Teachers. A Comparative Analysis of Competency Models, Measurements and Practices of Advancement

Conclusions: Media-related Educational Competencies of German and US Preservice Teachers

Jennifer Tiede

In the previous three main parts, the dimensions of modeling, measuring and advancing media-related educational competencies were analyzed in detail. Against this background, it has now become evident how closely interrelated the three dimensions are. The fourth research question addresses this issue: “What is the relationship between modeling, measuring and advancing media-related educational competencies in both countries?” Hence, the following final chapter will bring together and draw conclusions on the findings presented above and conclude the work with an overall summary and analysis of the relationships between modeling, measuring and advancing media-related educational competencies and with an outlook to further perspectives and research desiderata.

12. Conclusions on the Relationship of the Three Core Dimensions, and Outlook to Further Research Perspectives

12.1 *The Relationship between Models, Measurements, and Practices of Advancement of Media-related Educational Competencies*

It was the fundamental aim of this dissertation to explore media-related educational competencies by providing a multi-perspective view on this complex topic. For this purpose, three main perspectives were focused, namely modeling, measuring and advancing competencies. Based on the findings for each of these three dimensions, it is now possible to summarize main outcomes and then analyze the links and relationships between models, measurements and practices of advancement.

Considering models of media-related educational competencies, Part I of this dissertation revealed the conceptual heterogeneity of media-related educational competencies and showed facets and aspects of models which can differ. It was explained that there are valid reasons for models to vary: competency models are always influenced by a network of criteria that contribute to the individual design of each model. The differentiating criteria identified and analyzed in Part I with three models as examples from an international context, the USA, and Germany are summarized in detail in Table 17.

Analysis category	Aspects
Background	Date of publication
	Authorship
	National vs. international orientation
	Target groups
	Main objectives/functions
Model genesis	<i>A priori</i> or <i>post hoc</i>
	Inductive or deductive
	Validation
Structure	Structural competency model, competency level model, or competency development model
Level of detail	Number of sub-competencies
	Grain size
Contents	Topic and terminology
	Competency aspects, areas and fields
	Taxonomies of the cognitive domain

Tab. 17.: Distinctive model characteristics identified.

This list systemizes how models can differ from each other strongly even if sharing central aspects. For example, it has been argued that the M³K model and the DigCompEdu model are both models developed by an *a priori* approach that aim to describe media-related educational competencies needed to cope with various media-related tasks in teaching and learning scenarios. Yet there are differences between the two models – e.g., with regards to background, target group, grain size, and contents – that account for the different shapes and applicability of the two, despite their parallels. All in all, the models analyzed led to the impression that German research on media pedagogy has a solid tradition of competency research and of respective modeling approaches which are often developed either by single researchers or in project contexts. In the USA, guidelines and standards drafted in professional societies were discovered to amend competency models developed in university settings, as for example, the ISTE standards or the NAMLE Core Principles of Media Literacy Education, which are widely influential.

With regards to measurements, it was explained in Part II that competency measurements are beneficial for tracking the performance of competencies in practice and that there are three angles to consider: competence as a construct, the observation of performance evoked by tasks, and the interpretation of the data collected. The design process of tasks and items should always take into account the respective application context and function of the measurement. Differentiating factors identified in the context of item design were: objective or subjective responses, standardization of items, and their quantitative or qualitative orientation. For the interpretation

of data, again, differences with regards to the purpose of the measurement apply, as in terms of the criteria against which tests can be evaluated, i.e., social or individual reference frames or criterion-based assessments. The multifold functions of measurements described in Part II can be summarized as evaluations at the individual and systemic levels and the validation of competency models. In the context of an example of a measurement of media-related educational competencies of German and US preservice teachers, the importance of cultural adoptions was pointed out, and the necessity to align the instrument with context and function was illustrated.

Based on a literature review and on interviews with German and US experts, Part III revealed considerable heterogeneity in the field of current practices in initial teacher education. Such practices were identified to depend on stakeholders on different levels. Societal context and policies especially on national and state level define the macro level; institutions, i.e., professional organizations and institutions of higher education make up the meso level; and the overall research and practice background and actors constitute the micro level. There are interdependencies and mutual influences between all of these interest groups regarding the practices of advancing media-related educational competencies in initial teacher education in Germany and the USA.

Most of the findings in relation to stakeholders were found to apply to both countries, albeit with different foci and emphases in some cases. With regards to universities, for example, it was described that German preservice teachers themselves tend to have a greater influence on their own media-related education compared to their US peers. In terms of the actual implementation of respective contents into teacher education, the literature review revealed an increasing awareness of the necessity to integrate media in both countries. In Germany, the degree to which media-related contents are obligatorily integrated into initial teacher education was described as heterogeneous and as differing from state to state. At some places, such obligatory offerings are also amended by respective electives. All in all, the situation is characterized as deficient in a majority of related German sources. In the US, educational technology is comparably widespread across formal teacher education curricula, and media literacy has been found to increase in significance as well. There are fewer chances for electives and curricula that are mostly prescribed by the institutions of teacher education. Yet researchers in related sources are repeatedly pointing out unsatisfactory outcomes in terms of teachers' media-related educational competencies. The technology infusion approach is a rather recent US contribution to improving practices in initial teacher education. It suggests replacing educational technology courses with an integration of technology across all other subjects, an idea which is partly echoed in recent German sources as well.

Against the background of these main findings, it becomes obvious that the three main dimensions of modeling, measuring and advancing media-related educational

competencies are closely linked to each other. Figure 8 summarizes and illustrates these links in favor of a systematic exploration. It abstracts the findings made in the comparative analysis of models of media-related educational competencies – introduced by a broader overview of models from international contexts, the USA and Germany, and explicated with the examples of DigCompEdu, TPACK and M³K –; in the analysis of measurements of media-related educational competencies in both countries; and with regard to practices of advancing media-related educational competencies in German and US systems of initial teacher education. Consequentially, the links between the three main dimensions depicted in Figure 8 summarize these main findings that are applicable in both the US and the German context. They abstract general conclusions on the relationships as identified by the international comparative methodology applied. These links between the three illustrated dimensions will be explicated in the following.

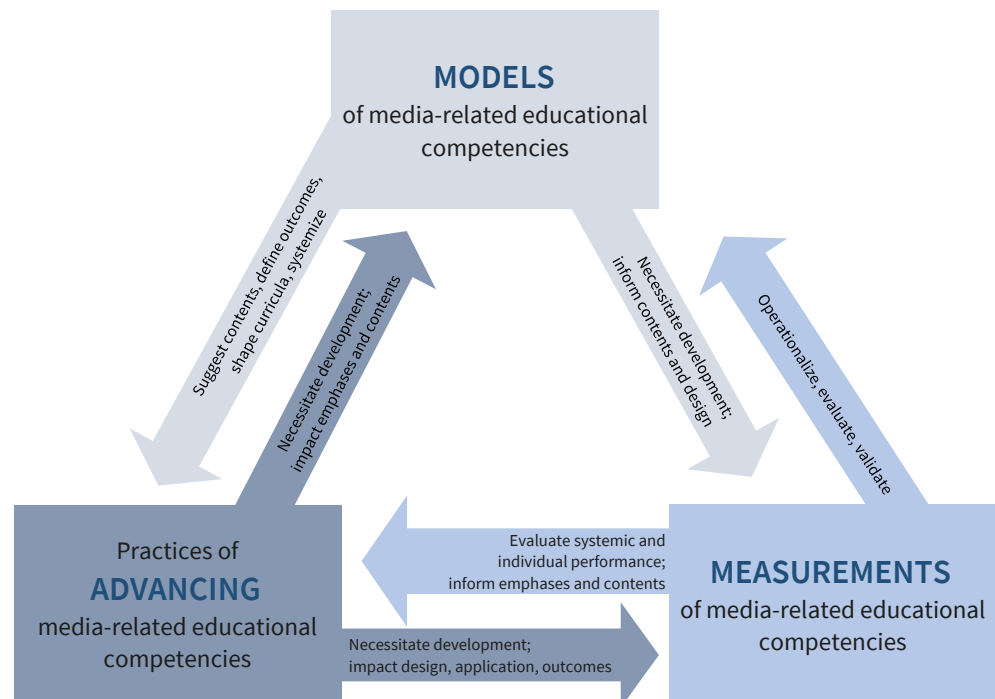


Fig. 8.: Model of relationships between three dimensions of modeling, measuring and advancing media-related educational competencies.

12.1.1 Models and Measurements of Media-Related Educational Competencies

Generally, it has become evident that modeling and measuring media-related educational competencies are two closely connected processes. Based on deductively or inductively oriented research approaches, models aim to summarize, define and

specify central competencies in a specific context. However, identifying competence in practice based on models remains problematic, as competence is a construct that is by definition non-observable. Moreover, analysis of selected models, especially from the US context, showed that models vary strongly with regards to their level of detail and specificity. TPACK was introduced as an example of a model with a low level of detail. This characteristic makes it widely useable and applicable for a variety of contexts but poses challenges in terms of defining what the competencies or, in the case of TPACK, knowledge domains comprise exactly. Hence, models necessitate the development of measurement instruments to address the challenges connected to the non-observability of competencies and to explore performance from which the presence and proficiency level of a competence can be derived. To this extent, models inform the contents and design of measurement instruments and offer systematic orientation and thematic guidance for measurement approaches.

On this basis, measurement instruments are then designed to operationalize the model contents by concretizing them to measurable performance indicators. Thus, they are a helpful means for approaching, exploring and visualizing the occurrence of the competency in question by help of performance. It was illustrated in Part II that this process of operationalizing model contents can look quite different in some cases, depending on the purpose of the measurement and on the characteristics of the competency model. The M³K model, as an example of a German model of *Medienpädagogische Kompetenz*, included standards which could then be transformed into scenarios for simulating real-life situations as a background for participants to make grounded choices. This measurement approach was designed to realize the claims made by the model to offer a contribution to the improvement of German initial teacher education; consequently, the measurement instrument was designed to be applicable for larger audiences and thus eventually suitable for the evaluation of systemic processes. To this extent, the M³K measurement instrument transfers outcomes of German competency model research to practice and therefore builds a link from the dimension of modeling to the dimension of practice. Regarding research in the US, the example of TPACK showed that there are various ways of applying a model in practice by means of an instrument. The lower level of detail in TPACK resulted in significant differences between different measurement instruments.

The relationship between models and measurements of media-related educational competencies is obviously not unidirectional. As argued in Part II, measurements can also impact competency models. Particularly with regard to the validation of models, measurement instruments play an important role by contributing to the analysis of model validity. Suitable statistical analyses of respective data collections offer valuable conclusions for the ongoing development of models, and models that have not been validated by measurements of any kind remain exploratory and of limited informative value, given their questionable validity. In this context, the case

of the non-finalized validation of the M³K instrument illustrates again the role measurements can play as a link between models and practices of competency advancement. Though the model design was built on respective literature, it was argued that missing learning opportunities in initial teacher education are assumed to have contributed to a data analysis and model validation that was not satisfactory in all aspects. Thus, the measurement helped visualize a gap between theoretical claim (i.e., model) and practice.

Comparable results can be pointed out with regard to the US context. Also in the case of TPACK, measurements were used to confirm and validate the structure and contents of the model. As argued above, such approaches led to criticism about the validity of the model (e.g., Archambault and Barnett 2010; Lux, Bangert, and Whittier 2011) and thus contributed to the ongoing scientific discourse, reception and research of the basic model.

While the examples from Germany and the USA are necessarily selective and representative of their respective national research context to a limited extent only, they yet substantiate the conclusion that the relationship between models and measurements of media-related educational competencies in both countries is to a large extent comparable. The mutual influences of the described models and measurements apply in both cases and thus support the summarization in Figure 8.

12.1.2 Measurements and Practices of Advancement of Media-Related Educational Competencies

Besides its influence on models, the dimension of measurement also informs practices of advancing media-related educational competencies. It offers insight into the effects and outcomes of practices on an individual level, especially with regards to preservice teachers, and on a systemic level, particularly in the context of measurement application in a certain cohort. In this way, measurements contribute to the evaluation of educational processes.

Consequently, as became evident in the expert interviews (cf. Part III), current practices both in Germany and the USA are increasingly geared towards standardized and assessable outcomes and measurable results. As a result, stakeholders are well-advised to derive content for initial teacher education curricula from relevant instruments and to ensure that preservice teachers receive targeted preparation for the accomplishment of important assessments as a focus of their efforts in competency advancement. This is why it appears justified to claim an influence of measurement instruments on emphases and contents in teacher education practices. The criticism expressed by some experts towards this development is substantiated by the role of measurements illustrated here: measurements necessarily have to abstract from competency models and to focus on observable and assessable performance. This

inevitably neglects further important but less quantifiable competency aspects, such as situational judgments and complex behavior.

This close connection between the dimensions of measurement and practice is also not unilateral. Obviously, as described previously, practices do not depend only on measurements but also necessitate and initiate the development of suitable measurement instruments. As practice is the target application context, their design process necessarily embraces and depends on both of the potentially conflicting fields of theory, i.e., models and practice. Measurements should be based on well-researched and valid models and should, on the one hand, reliably operationalize the competencies included. On the other hand, they need to respect the requirements and restrictions of practice and application, e.g., in terms of design and expectations. To this extent, practices of teacher education impact the design, application and outcomes of respective measurements.

Another caveat concerning the relationship between measurements and practices in advancing media-related educational competencies in the context of German and US teacher education has been brought up in the context of the study presented in Paper 1, where a comparative measurement was applied using one national German instrument. Despite the extensive and scientifically sound translation process that sought to ensure the comparability and validity of the translation, problems connected to the application of one instrument for different contexts of practice could be identified in Chapter 8. This led to the conclusion that the measurement instrument applies more appropriately to practices in its own national context. Hence, the influence of measurements on practices, and conclusions drawn from results for the evaluation of practices are always subject to further careful considerations of both contexts. It can be concluded from these results that the mutual dependence of practices and measurements is again linked to contextual factors to a significant degree.

It is noteworthy in this context that this potential of competency measurements to evaluate systemic performance was not a central objective in most of the German and US cases analyzed. Studies seeking to summarize and evaluate the status of the advancement of media-related competencies in both countries rather focused on the spread of obligatory study contents and respective regulations, as presented by Bertelsmann Stiftung et al. (2018) or Kleiner et al. (2007). Within the frame researched in this work, the only attempt to evaluate educational practices through a competency measurement was presented by the M³K project, with limitations in terms of validation and transferability applying as described. Most measurement instruments from the US context that built on TPACK rather served to evaluate individual knowledge or performance within the frame of US initial teacher education. This leads to the research desideratum of enhancing and further researching systematic approaches to the evaluation of educational processes, also with respect to competency acquisition.

12.1.3 Models and practices of advancing media-related educational competencies

Finally, the interdependencies described also suggest mutual references between the dimensions of modeling and advancing media-related educational competencies. In Part III, it was found in the expert interviews that theory-based models can have a certain influence on practices in initial teacher education if stakeholders, e.g., teacher educators, consider them a basis for selecting contents and for orientation and structure. This was described by one German expert with regards to the M³K model, which is used at his institution as a reference for the structuring of media-related study offers. Furthermore, it was pointed out that state-wide developments in initial teacher education practices were fostered based on Bremer's model. Such applications of a model to practices in initial teacher education have also been noted in the US context, where some study programs or even state standards are systematically aligned to TPACK or to the ISTE standards in particular. Hence, the influence of models on practices depends on largely comparable stakeholders both in Germany and the USA: on a smaller scale, teacher educators can decide individually to use models as a reference, and on a systemic level, state standards or exam regulations may increase significance of models or standards on a larger scale. This way, models can suggest contents for practices. They can define their outcomes and shape their curricula and contribute to a systematization of the whole media-related education if applied successfully. Consequently, models and research related to models were defined as an own dimension on the micro level in the analysis of stakeholders and conditions for practices of advancing the respective competencies (cf. Chapter 11.4).

On the other hand, practices of advancing media-related educational competencies also impact the respective competency models. Practice is the background against which models are developed. Practices of advancing media-related educational competencies are the ground on which contents and emphases for models are identified and on which their development is stimulated or necessitated. Hence, practices in initial teacher education, as a background characteristic of models, have been included in the identification of distinctive model features in Part I. It was highlighted that different practices of advancing media-related educational competencies and respective reference frames have an impact on the emphases and contents of respective models. In this context, the M³K model illustrated an example which referred quite closely to the context of German teacher education practices; consequently, the model places emphasis on theory-based competencies, which is consistent with its national reference frame. Further examples of models directly influenced by experiences in practices of teacher education include the previously described project-based German frameworks by Tulodziecki and Bremer. Likewise, the US TPACK model and the TETCs build on experiences of their authors in US initial teacher education and are thus closely linked to the dimension of practice.

All in all, these findings lead to the conclusion that the relationships between the three dimensions of modeling, measuring and practices of advancing media-related educational competencies in Germany and the USA show a significant number of parallels. Figure 8 summarizes and highlights these relationships; overall, they can be confirmed to be inherent to the separate dimensions and of key importance for their acknowledgment, interpretation, and application in both national contexts. However, it is also important to pay attention to the abstractive orientation of Figure 8; focusing on these dimensions and their interplay, it thus necessarily neglects further important influences. Part III revealed the relevance of stakeholders for teacher education practices, and comparable considerations have been suggested also in the contexts of modeling and measuring: for example, the role of professional associations has been discussed extensively, e.g., with regards to the US organizations ISTE and NAMLE who published their own standards and thus directly impact the dimension of modeling. Measurement practices are also influenced by further conditions, such as ethical and legal restrictions, going beyond the interdependency with models and practices in initial teacher education. Hence, Figure 8 represents a focused perspective narrowed down to three dimensions that are, again, all subject to their own individual stakeholder networks.

In light of this conclusion, one aspect which is clearly relevant for all three dimensions is the overall research and experience background coming into play in each process of modeling, measuring or advancing media-related educational competencies. Literature and research, on the one hand, and practice and experience, on the other, function as an important connector between the three. Models, measurements and practices can be based mainly on literature and research or mainly on practice and experience – or they can be built on both orientations, which are not mutually exclusive. They can be understood as two extremes of a continuum that every model, every measurement and every practice of advancement can be allocated to. For example, the formerly discussed TPACK model with its inductive research approach is heavily impacted by the experiences the authors collected in the course of their work as teacher educators, and it builds on their conclusions from practice. Yet, as the authors' practice was also shaped by their research expertise and the tradition of professionalization research as presented by Shulman (1986), research and literature are still important for the development of TPACK. The M³K model with its deductive approach also builds on research and its authors' experiences in German teacher education. In this way, all three dimensions are influenced to varying degrees both by literature and research and by experience and practice. Again, this impact is mutual: e.g., new models will feed into the body of relevant literature; practices of advancing media-related educational competencies will form researchers' relevant practical experience; and measurements add to both dimensions as well.

The interconnectedness and interdependency of modeling, measuring and practices of advancing media-related educational competencies overall reveal a strong connection between the three dimensions. It has become clear now that a thorough consideration of one of the three dimensions which neglects the others is likely to be deficient. These conclusions are of high relevance for further considerations and ongoing research in this field: it will be beneficial for respective works to pay attention to the networks of relationships identified to enhance understanding, coherence and validity in the context of any of the three dimensions.

12.2 Conclusions for Further Research and New Perspectives

The conclusions outlined are based on considerations from an international comparative perspective, and they stem from, and apply to, the contexts of Germany and the USA. It was argued in the introduction that the international comparative perspective was expected to widen the viewpoint and to allow for additional insights which go beyond the context of a single research background. Hence, the aspect of nationality and the impact of national peculiarities have been acknowledged, emphasized and discussed, and the analysis of the connections between the three main dimensions has been found to be applicable in the context of both countries. It will be revealing for further research works to include the perspectives of further countries to validate and enrich the conclusions drawn.

With regard to Germany and the USA, desiderata for further research can be derived on all three levels of modeling, measuring and advancing media-related educational competencies. Competency models have been described as an important theoretical basis with varying relevance for practice. This relevance is closely connected to factors like the intended purpose of model application or its background. It has been pointed out that the applicability of models and measurement instruments which strongly depend on national influences can be limited in international contexts, a caveat which justifies the recently increasing interest in internationally applicable competency models like DigCompEdu and also emphasizes the importance of international research as applied in this dissertation. Yet national competency models have also proven valuable, especially with regard to the orientation and systematization of processes on a national level, which is subject to specific and individual influences and may therefore not be represented appropriately by a general international model. Hence, the findings presented in this work lead to the conclusion that it will be worthwhile for future related research to acknowledge the mutual interdependencies between national and international competency models and to open up perspectives to contexts beyond one's own background to appreciate the benefit offered by different types of models for different purposes and functions.

Corresponding with these findings, Part II of this dissertation pointed out the importance of aligning measurements carefully with their background and purpose. In this context, deficiencies on different levels have been identified with the measurement instruments analyzed for DigCompEdu, TPACK and M³K, ranging from partly inconsistent items, as in the case of DigCompEdu, to questionable item-construct fit, as in the case of TPACK, or unsatisfying validity, as in the case of M³K. In terms of research desiderata, there is obviously a need for fostering the systematic and application-specific development of reliable and valid measurement instruments for DigCompEdu, TPACK and M³K. However, the issue of validation has been analyzed to be closely linked to the model design and instrument orientation. It is noteworthy that the M³K measurement is the only instrument identified in the study that seeks to systematically and objectively assess the level of competence among a certain preservice teacher population in order to draw conclusions on a systemic level and to ultimately contribute to the improvement of practices. On the other hand, the predominance of self-assessment instruments for DigCompEdu and TPACK stands out. Given the explicit purpose especially of DigCompEdu to offer guidance for systemic change and to contribute to the improvement of practices, it appears necessary to enrich the measurement methodology and to address the challenges of objective measurements in future developments to achieve reliable and valid conclusions and thus fulfill the claims made by the respective model.

However, the expert interviews presented in Part III revealed another need for future research. Criticism was expressed towards current practices in measuring competencies regarding the interdependency of measurement and practice. It seems that in many cases, measurable and quantifiable outcomes prevail in the perception of competency aspects that are important for advancement in initial teacher education – an observation which is critical against the background of competence being a construct which has to be operationalized for measurements. Such a perspective neglects the multifold functions competency measurements can have, and it seems desirable to further investigate the role that different types of competency measurements can and should indeed play in educational contexts both on national and international levels.

To conclude, a certain bias concerning applications of measurement instruments can be abstracted. On the one hand, it is desirable to assess and evaluate competencies systematically in favor of grounded conclusions for innovation and improvement practices, while, on the other hand, there is a certain hesitance to operationalize and quantify competencies at the level of teacher educators. Yet it can be argued that these two approaches are actually not contradictory. Instead, different expectations toward measurement processes on systemic and individual levels support the claim of carefully aligning measurement instruments with their respective

application context, and they emphasize the need for a scientific width and richness of approaches, depending on the intended context and results.

Finally, with regard to practices of advancing media-related educational competencies, Part III revealed a network of factors influencing respective processes. Centrally, there is a tension between systemic requirements and barriers, on the one hand, and work at the level of teacher educators, on the other. Efforts of varying success are being made on both sides to advance and improve respective practices. Current efforts in educational research to focus on teacher educators and to improve their competencies and enhance both their willingness and abilities to integrate respective contents into teacher education programs appear consequential against this background. Examples for such approaches are the recent Technology Infusion approach and the research on Teacher Educator Technology Competencies in the USA (Foulger et al. 2017; Foulger, Wetzel, and Buss 2019) or the European ITELab project (European Schoolnet [EUN] 2019). As described in Chapter 4.2, the TETCs research aims to explore the competencies teacher educators need in the context of advancing preservice teachers' media-related educational competencies and to offer guidance for the professional development of teacher educators. In light of the stakeholder role of teacher educators identified in Part III, it is confirmed now that such an orientation is a valuable and important contribution to the overall improvement of current practices. The European ITELab project also addresses teacher educators by researching their digital competencies, as suggested by DigCompEdu, and it offers materials for use in initial teacher education across Europe that allow for an easy and low-threshold approach to advancing respective competencies with preservice teachers (European Schoolnet [EUN] 2019). Also in this way, teacher educators are addressed and supported in their professional development. These examples illustrate how the overall field of media-related initial teacher education can benefit from a deepened focus on the role and development of teacher educators, and they suggest an ongoing and deepened analysis of the level of teacher educators, which is evolving but currently is often neglected.

It is important to note in this context that the challenges of improvement and change both on systemic and teacher educator levels are global. Despite national peculiarities and differences, it has become evident that teacher education systems both in the US and in Germany face comparable challenges with regards to the advancement of media-related educational competencies. Against the background of global mediatization and digitalization, it seems reasonable to assume that the relevance of advancing respective practices is not restricted by national borders. This finding inevitably leads to questions about the desirable strategic orientation of processes of modeling, measuring and advancing media-related educational competencies and ultimately of educational processes in general. The advantages of aligning respective processes to international models, guidelines and standards have been

discussed previously and stand out once more in the light of the global challenges connected to the digitalization of teaching and learning processes. Yet it is important to acknowledge the individual characteristics constituting a national or cultural context and not to interfuse an open and international orientation with a neglect of local and national conditions. Hence, enhancing global educational research through international comparative research approaches, and thus by combining efforts and knowledge from various media-related contexts, is a vital contribution to the advancement of research on media-related educational competencies on local levels as well. Taking into account the previous results, national and international research orientations and approaches should be balanced and used to amend and enrich the perspectives without substituting one for another.

Overall, this research objective needs to be focused on continuously in general educational contexts, but it also needs a specific focus with regards to models, measurements and practices of advancing media-related educational competencies. A respective broad and inclusive perspective will contribute to the systematic improvement of the media-related education of preservice teachers and, through this, ultimately facilitate a contemporary and successful preparation of future teachers for the multifold challenges of teaching and learning in a digitalized and mediatized world.

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