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## Media Pedagogy in German and U.S. Teacher Education

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### 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 summarised. 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.

### Keywords

Media literacy, media education, pedagogy, preservice teacher education, competency based teaching, media education curricula, university curriculum research, cross-national analysis.

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## 1. Introduction

### 1.1. 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 focussed on teachers' and preservice teachers' own media literacy skills or technological knowledge (Fry & Seely, 2011; Oh & 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, 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, & 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 countervail 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 & Paine, 2008; Tiede, Grafe, & 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.

## 1.2. 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 & Grafe, 2012; Hobbs, 2010; Tiede & al., 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 & Hamm, 2001; Imort & 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 & al., 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, 2008). 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 & al., 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 & al., 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.



## 2. Material and methods

### 2.1. The M<sup>3</sup>K model of pedagogical media competencies

A recent approach to defining pedagogical media competencies was made in the course of the German research project “M<sup>3</sup>K – Modeling and Measuring Pedagogical Media Competencies”, funded by the Federal Ministry of Education and Research. This M<sup>3</sup>K 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 competencies 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 & al., 2015).

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, & Grafe, 2010; Herzig & al., 2015; Tiede & al., 2015).

The M<sup>3</sup>K 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 1 demonstrates.

**Table 1. M<sup>3</sup>K Model of Pedagogical Media Competencies**  
Exemplary excerpt

		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			



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 & al., 2015).

## 2.2. 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 & al., 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 & Breiter, 2014). Test instruments were developed for these factors, too.

For the validation of the instruments, data was 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  $\alpha=.87$ .

## 2.3. Adoption of the German M<sup>3</sup>K questionnaire to a US-American version

In order to use the M<sup>3</sup>K 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; and



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.

## 2.4. 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.

## 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 4.

**Table 2. Overview of German and US results for media didactics, media education and technological knowledge**

	% 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% *

CI 95%, \*  $p>.05$

As table 2 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.

<b>Table 3. Overview of beliefs in media didactics and media education and of self-efficiency</b>		
	<b>Mean score (SD)</b>	
	<b>Germany</b>	<b>USA</b>
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)

Range: 1-4 with 1=very critical and 4=very convinced. \*  $p > .05$

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.

## 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.

### 4.1. 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, & Lewis, 2010), while the percentage of German students who used the computer at school was as low as 64.6% (OECD, 2015).

## 4.2. 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 & 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.

## 4.3. 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.

#### 4.4. 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 M<sup>3</sup>K 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.

#### 4.5. 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 have 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 & al., 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.

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