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Abstract: Motivated by the growing importance of media education in schools, this article studies aspects associated with teachers' fostering of students' media and digital skills. For this, a regression analysis is conducted using a survey data sample of teachers. By taking six different areas of media-related competencies into account, the results show the factors that influence the fostering of digital skills in general and the factors that influence only specific competence areas. Two factors are significant in all models: the frequency of the media use for teaching purposes and the importance given to the competence areas. Furthermore, teaching STEM subjects and teaching in a Gymnasium are significant predictors in most models. Other predictors show significance only in single models, while how teachers evaluated the technical equipment available in their schools is not significant in any model.

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Influencing factors on teaching different facets of media and digital literacy

1 Introduction

Although the necessity to implement media education in schools is discussed for decades (e.g., The Grünwald Declaration on Media Education, 1983), the rapid pace of digitalization has reinforced this need. Scholars and policymakers recommend that schools educate students in different aspects of traditional and, especially, new media, for instance how to communicate, produce, consume and share digital content, always observing safety measures (Ferrari, 2013; Kultusministerkonferenz [KMK], 2016; Länderkonferenz Medienbildung, 2015).

In Germany, media education is established as a central task of schools (KMK, 2012). The federal states in the country ("Länder") are responsible for developing their curricula and guidelines for media education. The federal state of Thuringia launched in 2009 the latest version of its media education guideline for secondary schools – the *Kursplan Medienkunde* (Thüringer Ministerium für Bildung, Wissenschaft und Kultur, 2009). The guideline lists competencies that should be developed with students in the school years 5 to 10. In a recent evaluation study, Wolling and Berger (2018) identified six competence areas in teachers' implementation of the guideline: (1) private media use, (2) information use, (3) media influence on society, (4) practical technology use, (5) online communication, and (6) privacy protection.

So far, research conducted on teachers fostering of students' media-related skills focused on specific competence areas, namely digital information competence (Hatlevik & Hatlevik, 2018; Siddiq, Scherer, & Tondeur, 2016), protective skills (Berger & Wolling, 2019), computer and information literacy (Lorenz, Endberg, & Bos, 2019). However, media and digital literacies consist of several types of competencies. It is unlikely that teachers cover all the skill areas in their practice, especially in Germany, where media literacy is not a subject in school curricula but is integrated into traditional school subjects. Consequently, it is reasonable to expect that teachers favor certain media literacy areas over others. Therefore, it is pertinent to investigate whether there are common factors that explain the fostering of different areas of media-related competence or whether there are predictors particular to specific areas.

The present study aims to tackle this question by testing a series of predictors of teaching media and digital competence in the six different areas of the *Kursplan Medienkunde* (Thüringer Ministerium für Bildung, Wissenschaft und Kultur, 2009) proposed by Wolling and Berger (2018). Therefore, models predicting the fostering of each competence area were developed and compared employing regression analysis. The study employed data from a survey conducted with 315 teachers in 2017 in Thuringia.

2 Predicting teachers' fostering of media-related competence

Previous studies identified associations of teaching media and digital literacy with a series of factors. The frequency in which teachers adopt information and communication technologies (ICT) for instruction was found to be positively associated with the intensity in which they teach digital competence (Berger & Wolling, 2019; Hatlevik & Hatlevik, 2018; Lorenz et al., 2019; Siddiq et al., 2016).

Besides ICT use, teachers' attitudes toward the value of ICT for instruction and media education were also found to be a positive predictor (Berger & Wolling, 2019; Karaseva, Siibak, & Pruulmann-Vengerfeldt, 2015; Siddiq et al., 2016). Moreover, studies indicate that teachers' practices of promoting students' media and digital skills are related with how prepared teachers feel (Hatlevik & Hatlevik, 2018; Siddiq et al., 2016) and with the frequency of their collaboration with other teachers in ICT matters (Lorenz et al., 2019). Research also pointed out that having sufficient ICT

equipment in schools is a relevant factor for teachers' practices involving media (Knezek & Christensen, 2016; Lorenz et al., 2019; Petko, 2012).

The fostering of media-related skills may also be associated with the subjects for which teachers are responsible. Some disciplines are more in line with the contents of media and digital literacy frameworks and offer better opportunities for developing activities that promote those. Siddiq et al. (2016) pointed out that the incidence of fostering students' digital skills was higher among teachers of humanities. However, other studies indicated that teachers of sciences were better prepared, or at least felt more confident, to develop their students' media-related skills (Claro et al., 2018; Karaseva et al., 2015). Concerning differences between types of schools, Berger and Wolling (2019) found out that teachers working in a Gymnasium tended to foster students' competence in the area of online safety to a lesser extent than teachers in other school types.

Based on the previous literature review, the following factors are identified as potential predictors of teaching media and digital literacy: frequency of ICT use, attitudes, teachers' preparation in ICT, collaboration with colleagues, ICT available in schools, school subjects, and school types. In this overview, it is noticeable that the studies tested the associations of a variety of teachers' characteristics with their fostering of single competence areas of media and digital literacy. However, the question remains open whether these influencing factors can be applied to different competence areas or whether there are particularities in the fostering of specific skills. Thus, this study's main objective is to identify factors that can explain the variations in teachers' practice of fostering six different areas of students' media and digital competence, as phrased in the following research questions:

RQ1: What individual and school-related questions can explain teachers' practice of fostering students' media and digital competence in different areas?

RQ2: To what extent do factors differ in explaining the fostering of different competence areas?

3 Methods

3.1 *Data collection*

This study employs data collected through a quantitative survey conducted with secondary school teachers in 2017 in the federal state of Thuringia. From all secondary schools in Thuringia, a random sample of 88 schools was drawn, which corresponds to approximately 2,700 teachers. The schools' principals were contacted and asked to distribute the questionnaire via e-mail to their teaching staff. Additionally, paper copies of the questionnaire, together with a pre-stamped response envelope, were sent to each school in the sample. The response rate was 12 percent (315 teachers). Over half of the participants (60%) answered the questionnaire on paper.

3.2 *Sample*

This study sample consists of 315 teachers, with an average age of 51 years ($SD = 9.91$). The majority is female (72%) and over 25 years in service (54%). Forty percent work in a *Regelschule*, 35 percent in a *Gymnasium*, and 23 percent in other schools. Forty-six percent teach subjects related to Science, Technology, Engineering, or Mathematics (STEM).

3.3 *Measures*

The measures used in this study are based on the predictors of teaching media and digital literacy identified in the literature review. In this study, attitudes are represented by the importance that teachers attribute to students learning of each competence area. Besides, teachers' perception of the compatibility of the *Kursplan Medienkunde* (Thüringer Ministerium für Bildung, Wissenschaft und Kultur, 2009) with their school subjects is also included as a predictor in the model. It is considered a relevant indicator of attitudes because teachers in Thuringia are required to introduce media and digital literacy in traditional school subjects.

A substantial difference in the model tested in this study compared to the literature is the indicator of teachers' preparation in ICT. The reviewed studies measured it through self-efficacy scales (Hatlevik & Hatlevik, 2018; Siddiq et al., 2016). As the data used in the present study do not contain a measure of self-efficacy, the training teachers received in ICT is adopted as an indicator of preparation. All measures used in the analysis are described below.

Fostering students' competencies

Participants were asked how frequently they conduct activities in their classes intending to foster a predefined set of students' competencies, using a scale from 1 = never to 5 = very frequently. The items were averaged to build a composite scale of practice in the six competence areas proposed by Wolling & Berger (2018). Table 1 displays the items that compose each area, the descriptive statistics, and the scales' reliability.

Importance

Participants were asked how important they consider that students develop a set of competencies, with a scale from 1 = not important to 5 = especially important. The items were averaged to build a composite scale of importance of the six competence areas. The items that compose each area, the descriptive statistics and reliability of scales are presented in Table 1.

Compatibility with the subject taught

Teachers were asked to what extent they agreed that the content of the *Kursplan Medienkunde* (Thüringer Ministerium für Bildung, Wissenschaft und Kultur, 2009) fits the major school subjects they teach. The answer options ranged from 1 = totally disagree to 5 = totally agree ($M = 3.51$, $SD = 0.91$).

ICT use

Respondents were asked how frequently they used a set of ICTs in their classes, using a scale from 1 = never to 5 = several times a week. The items were averaged to build a composite scale of frequency of ICT use for instruction ($\alpha = 0.90$, $M = 2.81$, $SD = 0.89$).

Table 1: Areas of competence with the respective items, descriptive statistics, and scale reliability coefficients.

Competence area	Items	Practice Mean (SD) Min. 1 Max. 5	Importance Mean (SD) Min. 1 Max. 5	Cronbach's α
Private media use	1. Reflecting critically on one's own positive and negative communication experiences. 2. Prioritizing attention when multitasking with media. 3. Evaluating the danger of media addiction. 4. Distinguishing between real and virtual identities. 5. Choosing adequate media for specific purposes.	3.36 (0.74)	4.21 (0.45)	0.84
Information use	1. Judging the credibility of different information sources. 2. Searching for information effectively. 3. Providing sources of the information correctly. 4. Filtering and interpreting information from different sources. 5. Using online content in observation of copyrights.	3.59 (0.75)	4.30 (0.41)	0.83
Media influence on society	1. Evaluating the potential effect of violence in the media. 2. Understanding why different actors present facts in different ways. 3. Differentiating between advertising and journalistic content. 4. Understanding the meaning of media for the job market. 5. Understanding the influence of media on life in society.	3.21 (0.79)	4.01 (0.52)	0.86

Practical technology use	1. Presenting work results in a digital presentation. 2. Implementing practically format principles for print media. 3. Presenting data in graphics and tables. 4. Differentiating between data formats and using them with the right programs. 5. Producing digital media outputs creatively. 6. Using technical terms correctly. 7. Making calculations with a table calculations program (e.g., Excel).	2.79 (0.85)	3.63 (0.54)	0.89
Online communication	1. Using media in cooperation with others to achieve common goals. 2. Choosing the media adequately for communicating with different partners. 3. Following the adequate norms for online communication.	2.99 (0.85)	3.92 (0.52)	0.80
Privacy protection	1. Surfing safely on the internet. 2. Protecting one's data and private sphere effectively. 3. Dealing properly with cyberbullying. 4. Understanding how personal data is gathered and used further while using online media.	3.29 (0.94)	4.51 (0.45)	0.89

Training

Participants were asked whether they received in- or pre-service training regarding how to implement ICT for instruction, how to teach students to use ICT, and how to teach students to reflect critically about media use. Response options were 1 = yes or 0 = no. Items were summed to build a scale from 0 = teachers did not receive any training in any of the aspects to 3 = teachers received training in all the aspects (M = 1.04, SD = 1.16).

Collaboration

Teachers were asked whether they learned through exchange with other teachers how to implement ICT for instruction, how to teach students to use ICT, and how to teach students to reflect critically about media use. Response options were 1 = yes or 0 = no. Items were summed to build a scale from 0 = teachers did not learn anything in any of the aspects with colleagues to 3 = teachers learned something in all the aspects with colleagues (M = 1.08, SD = 1.14).

ICT available

Respondents were asked about how satisfactory they evaluated the ICT equipment available in their schools, with a scale from 1 = not available to 6 = very good. The items evaluated were the quantity of ICT available, quality of ICT available, software, access to the internet in the school rooms, speed, and quality of the connection. The items were averaged to build a composite scale of satisfaction with ICT equipment available in the school (α = 0.88, M = 2.81, SD = 0.89).

Teaching STEM subjects

A binary variable that indicates 1 = participants who teach Physics, Mathematics, Chemistry, Informatics, or Biology, and 0 = teachers who do not teach any of these subjects.

Teaching in a Gymnasium

A binary variable that indicates 1 = teachers who work in a Gymnasium, and 0 = teachers who work in other types of schools.

4 Findings

Bivariate correlations between the selected variables to be tested as predictors and the fostering of the six competence areas of the *Kursplan Medienkunde* (Thüringer Ministerium für Bildung, Wissenschaft und Kultur, 2009) are presented in Table 2. All predictor variables are significantly correlated with the fostering of at least two competence areas. Correlations among the predictor variables and variance inflation factors did not raise any concerns regarding multicollinearity. Thus, all selected factors were included as predictors in the regression analysis.

Table 2: Pearson correlation coefficients of fostering different competence areas with hypothesized predictor factors

	Private media use	Information use	Media influence on society	Practical technology use	Online communication	Privacy protection
Importance	.40***	.45***	.47***	.31***	.34***	.38***
Match subject	.37***	.44***	.33***	.41***	.36***	.30***
ICT use	.44***	.54***	.37***	.69***	.53***	.46***
Training	.19**	.29***	.13*	.24***	.23***	.16**
Collaboration	.19**	.12*	.13*	.05	.17**	.21***
ICT available	.06	.05	.11	.12*	.09	.13*
STEM	-.10	-.11	-.12*	.22***	-.06	.00
Gymnasium	-.16**	-.06	-.13*	-.11	-.14*	-.23***

Note: * $p < .05$; ** $p < .01$; *** $p < .001$*

A regression model was tested for the fostering of each competence area. Table 3 shows the predictors' standardized coefficients in the final models, which can explain 40 percent to 57 percent of the variance in teachers' fostering of the six competence areas.

The area of practical technology use has the highest explained variance (57%), possibly attributed to its strong association with ICT use. In five competence

Table 3: Regression analyses of fostering different competence areas (beta coefficients).

	Private media use	Information use	Media influence on society	Practical technology use	Online communication	Privacy protection
Importance	.38***	.36***	.45***	.18***	.27***	.35***
Match subject	---	.12*	---	.10*	---	---
ICT use	.47***	.43***	.38***	.60***	.53***	.41***
Training	---	.10*	---	---	---	---
Collaboration	.15***	---	---	---	.13**	.13**
ICT available	---	---	---	---	---	---
STEM	-.18***	-.18***	-.21***	.12**	-.14**	---
Gymnasium	---	-.13**	-.14**	-.10*	-.11*	-.19***
N	285	267	298	271	272	282
R^2	.41	.49	.40	.57	.43	.40
F	49.51***	41.75***	49.83***	70.66***	41.09***	46.02***

*Note: * $p < .05$; ** $p < .01$; *** $p < .001$; --- not significant, not included in the final model. Predictor variables were inserted hierarchically. Final models hold only significant predictors. The coefficients displayed are standardized (beta coefficients).*

areas, ICT use is the strongest predictor, with a particularly high coefficient for practical technology use. Only the area of media influence in society has importance attributed to media education in this field as the strongest predictor. In general, ICT use and importance are the strongest predictors of all areas. The other factors present weaker coefficients and do not associate with all areas. Teaching in a Gymnasium is associated negatively with five competence areas but does not predict the fostering of competencies in private media use significantly. Teaching STEM subjects predicts four areas negatively, and practical technology use positively. Privacy protection is the only competence area not associated with teaching STEM. Besides ICT use, importance, teaching in a Gymnasium, and teaching

STEM, cultivating students' skills in practical technology use is also predicted by perceiving that the competence area is a good match to the subjects for which the teacher is responsible. This is also the case of fostering competencies in information use, which shows an additional association with training. While having received training only associates with one competence area, having learned about ICT through collaboration with colleagues is positively associated with fostering students' skills in private media use, online communication, and privacy protection. How teachers evaluate the ICT structure in their schools does not predict any competence area significantly.

5 Discussion

The study aimed to explain the variance in teachers' fostering of six different media and digital competence areas. Although some predictors were significantly associated with the fostering of all or most of the six competence areas, each model varied in detail concerning the importance of the predictors. Two predictors turned out to be significant in all models: how important teachers consider that students develop competencies in a particular area and the frequency of employing ICT for teaching. Firstly, these findings endorse that teachers' attitudes are crucial in their practices involving digital media (Berger & Wolling, 2019; Ertmer, 2005; Karaseva et al., 2015; Knezek & Christensen, 2016; Siddiq et al., 2016). Thus, a positive attitude toward media education is a critical (pre-) condition for teachers to foster digital competence. Secondly, teaching with and about media are strongly associated, although not meaning the same. It seems that teachers tend to employ ICT to develop students' digital competence in general. However, the strongest association can be observed with the fostering of practical technology use, and the weakest, with the area of media influence on society. These findings are plausible since students can develop skills in operating technology tools more efficiently by using the technologies. On the other hand, competence in understanding and reflecting on the impact of media on society do not necessarily demand direct practice with ICT.

Teaching STEM subjects and teaching in a Gymnasium were significant predictors in the models of five areas. Teaching in a Gymnasium delivered negative associations. Thus, the findings from Berger and Wolling (2019) that Gymnasium

teachers tend to foster students' digital protective skills to a lesser extent than teachers in other schools can also be applied to other competence areas. Teaching STEM subjects exhibited negative associations with the fostering of four areas, thus, in line with the findings from Siddiq et al. (2016). However, with the fostering of competence in practical technology use, the association was positive. This finding indicates that specific competencies can be better accommodated in certain school subjects. For instance, STEM subjects can employ software and tools for calculation and simulations particularly well, promoting students' ICT skills.

While having received in- or pre-service training in ICT topics was associated only with the fostering of skills in information use, having learned about ICT topics through collaboration among colleagues was positively associated with the fostering of skills in private media use, online communication, and protection of privacy. Information use may be a topic very present in teacher training programs since competencies such as retrieving information, filtering, selecting, and providing information sources are requirements in many school subjects. The positive association of this competence area with the perception that the *Medienkunde* curriculum is a match to the subject taught also points in this direction. On the other hand, teachers might have better chances of getting knowledge and experience by collaborating with colleagues when it comes to topics related to the challenges and specificities of digital media.

Finally, in none of the models, the factor of how teachers evaluate the technology available in their schools had a significant effect. Such finding indicates that the mere presence of technology does not promote media education. Therefore, when policies aim to improve students' digital preparation, investments beyond technology equipment must be made.

For fostering students' media and digital skills, teachers need to be convinced of the importance of media education and make meaningful use of the ICT available. Moreover, for certain competence areas, developing teachers' capabilities through training and exchanges with colleagues is a contributing factor. Besides, it is unrealistic to expect that single teachers will integrate all competence areas in their subjects. Thus, to cover all competence areas in media literacy frameworks, the fostering of different competencies must be carefully distributed among school subjects. Finally, it seems that the fostering of digital skills has less room in Gymnasium schools. Therefore, future research should also investigate students' digital competencies in different school types and verify to what extent it is associated with differences in teachers' fostering of media education.

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