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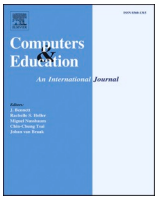

Instagram as a platform for teacher collaboration and digital social support

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ABSTRACT

Social media platforms can be sites for professional collaboration and the provision of digital social support among teachers. Instagram is one such platform that is widely used but that has received only limited attention from education researchers. To date, little is known about which teachers use Instagram for collaboration, the ways in which they collaborate, and how this collaboration contributes to their perceptions of digital social support. Using questionnaire data from 249 teachers from Germany, we identified three collaboration activities among teachers on Instagram: information seeking, information sharing, and co-creating. While teachers with higher levels of enthusiasm for teaching in particular are more likely to use Instagram to seek information, teachers with higher self-efficacy levels are more likely to share content. In addition, seeking and sharing information as well as co-creating are each positively associated with various forms of perceived digital social support. These findings point to the potential of social media use contributing to teacher professional development and indicate that it deserves more attention in both teacher education and research.

1. Introduction

Teacher collaboration is an important source of social support for teachers that reduces professional isolation and allows teachers to learn from each other (de Jong et al., 2019; Vangrieken et al., 2015). While collaboration among teachers traditionally occurred primarily within schools, nowadays many teachers use social media platforms for various self-directed collaborative activities (García-Martínez et al., 2020). In studying teachers' activities on social media, many researchers have focused on Facebook, Twitter, or YouTube. The frequently used platform Instagram, however, has remained relatively unexplored (Barrot, 2021). Previous findings shed light on the various activities teachers engage in on social media: they can seek information provided by other teachers to help them with their work (Prestridge, 2019), share teaching-related advice (Greenhow et al., 2021), and exchange ideas with other teachers (Greenhalgh & Koehler, 2017; van Bommel et al., 2020). The extent to which teachers engage in such ways on Instagram is as yet unclear. Also, little is known about the characteristics of teachers who engage in such collaborative activities and how they relate to digital social support.

The present study aims to address this gap and to contribute to the existing literature on teachers and social media in three ways. First, we focus on teacher collaboration on Instagram and, based on extant literature, develop a multi-faceted conceptualization for different forms of collaboration among teachers on social media. Second, we investigate the relationships between individual teacher

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characteristics and their Instagram collaboration activities. Third, we examine differential relationships between different forms of collaboration and teachers' perceived digital social support. The findings may contribute to a more nuanced understanding of teacher collaboration on social media platforms. They may also shed light on the characteristics of teachers who use social media, and what kinds of support teachers receive through their social media use.

1.1. Teacher collaboration

Teacher collaboration is defined in a broad sense as the "joint interaction" of teachers in "activities that are needed to perform a shared task" (Vangrieken et al., 2015, p. 23). Research has demonstrated that teacher collaboration is positively connected to teachers' well-being and job satisfaction (Reeves et al., 2017) and student achievement (Reeves et al., 2017; Ronfeldt et al., 2015; Vangrieken et al., 2015). However, whether teachers collaborate depends on various factors (Kolleck, 2019). Empirical studies have identified various characteristics that are positively related to engaging in collaborative behaviors, such as teachers' attitudes toward collaboration (e.g., Drossel et al., 2019). Moreover, research has also shown that teachers with higher self-efficacy levels are more likely to collaborate (Runhaar et al., 2010; Thoonen et al., 2011), while lower self-efficacy levels hinder collaboration (Smith, 2009). Cobb and Foeller (1992) found that teachers who show greater enthusiasm for teaching their subject collaborate more frequently with their colleagues. In a similar vein, teachers with higher work engagement levels are more likely to collaborate (Richter et al., 2011).

Research has not only focused on the antecedents and consequences of collaboration, but it has also proposed different forms of collaboration. For instance, Little (1990) distinguished between a wide range of different types of collaborative relationships among teachers: storytelling and scanning of ideas, sharing, aid and assistance, and joint work. Extending this research, Gräsel et al. (2006) identified three forms of teacher collaboration: 1) seek and share –i.e. exchange –information and material, 2) shared work, and 3) co-construction. While seeking and sharing information requires relatively little time and effort, shared work, and co-creating may require greater investment. Recent research has therefore distinguished lower-cost and higher-cost forms of teacher collaboration (Drossel et al., 2019; Muckenthaler et al., 2020). Lower-cost forms of teacher collaboration consist of activities that involve teachers reaching out to other teachers to seek information, and sharing information, ideas, and experiences as well as instructional materials (Muckenthaler et al., 2020). Higher-cost forms of collaboration, such as lesson co-planning, create greater interdependency between teachers and affect individual autonomy more strongly as participants pursue a shared goal (Drossel et al., 2019; Muckenthaler et al., 2020). Against this backdrop, a study of teachers' collaboration behavior in Germany has shown that they are more likely to engage in low-cost forms of collaboration (Richter & Pant, 2016).

1.2. Teachers on social media

Social media platforms have taken on important roles in education (Dijck & Poell, 2018). Although social media use in education has been studied in the U.S. in particular (Barrot, 2021), the phenomenon is widespread, with research also having explored education-related social media use in different countries, such as China (Xue et al., 2021), Finland (Nelimarkka et al., 2021), South Africa (Rambe & Nel, 2015), and Sweden (Hillman et al., 2021), as well as across countries (Kearney et al., 2020). Many teachers appear to be interested in and willing to use social media, although individuals' motives and behaviors vary greatly (Nelimarkka et al., 2021; Prestridge, 2019). For this reason, it is important not to treat teachers' social media activities as monolithic or uniform, as different social media uses have been associated with different predictors (Hughes et al., 2012) and outcomes (Verduyn et al., 2017), including in the case of Instagram specifically (Trifiro & Prena, 2021).

Teachers have employed social media for their own collaboration (e.g., Xing & Gao, 2018) as well as for their students' learning (see Manca et al., 2021) – our research focuses on the former. With affordances related to accessibility, flexibility, interactivity, networking, and personalization, social media platforms can potentially facilitate just-in-time professional collaboration (Greenhalgh & Koehler, 2017; Muljana et al., 2022). For example, many teachers turned to such platforms seeking resources and support during COVID-19-era emergency remote teaching (Trust et al., 2020; Greenhow et al., 2021). Teachers' self-directed social media use for professional collaboration and learning are distinct from more traditionally-organized online professional development activities, such as webinars, formal online programs, or Massive Online Open Courses. Seeing teacher professional development as "boundless and self-generating on-demand learning" (Prestridge, 2019, p. 144) requires a change in focus from design features and content delivery to self-direction and content creation, with teachers potentially combining actions as information consumers, producers, curators, and brokers. In this study we connect to research that has described three particular ways of using social media for collaboration: seeking and sharing information, and collaboration in the spirit of co-creating.

1.2.1. Information seeking

A common type of social media collaboration by teachers is seeking work-related information (Trust et al., 2016; Greenhalgh & Koehler, 2017; Jusinski, 2021; Prestridge, 2019). This includes different kinds of information, such as broad approaches (e.g., project-based learning), tricks and tips, inspiration, practitioner wisdom, and expert opinions. Because social media potentially mitigates some of the traditional temporal and geographical barriers to communication, it may facilitate teachers seeking information from a broader pool of their fellow educators, allowing them to draw upon collective intelligence (Rheingold, 2012) and to be exposed to ideas they might not otherwise encounter (Kop, 2012). Specifically, information seeking can be considered a low-cost form of collaboration when teachers look for information *from other educators*, rather than trying to find, for example, factual information from a news source. Within schools, information seeking often takes place as face-to-face exchange between teachers, for example, when one teacher asks another teacher for teaching materials or ideas. However, information seeking can also occur asynchronously within

schools, for example, when a teacher refers to material provided by another teacher that is stored in a central location (e.g., teachers' staff room). Meanwhile, information seeking online often is asynchronous to a certain extent. Social media gathers user-generated content, meaning that teachers know that if they search for information on social media, they will also find information from other teachers. Thus, it is a more diffuse type of collaborative effort - a teacher does not necessarily ask a specific teacher for information, but goes to social media because he or she assumes that one or more teachers have provided information that will help him or her solve the task at hand. However, online information seeking does not necessarily have to occur asynchronously, but can also transpire synchronously, for example, when teachers participate in live chats such as #NGSSchat (Rosenberg et al., 2020). All in all, these examples illustrate the low-cost collaborative nature of information seeking, "or scanning for ideas," as Little (1990, p. 513) describes it, as part of teacher interaction in which one person reaches out to another either synchronously or asynchronously and either online or offline.

Using social media platforms, teachers may seek information by explicitly asking questions of other social-media users (e.g., Greenhow et al., 2021) and by relatively more passive lurking in teaching-related social media spaces (see Bozkurt et al., 2020). In this context, seeking information could be influenced by the degree of enthusiasm a person shows for the content sought. Although there is no related prior teacher-related research, evidence from economics and political science suggests that, for example, product enthusiasts exhibit high levels of information seeking (Bloch, 1986) and political enthusiasm also drives information seeking on social media during elections (Hoewe & Parrott, 2019).

Information seeking via social media features its share of challenges. Social media platforms have repeatedly enabled the spread of misinformation (Allcott et al., 2019), and the quality of education-related information on social media can be problematic (Carpenter & Harvey, 2019; Sawyer et al., 2019). The commercial imperatives of social media platforms and the marketing that occurs within them must be accounted for and can affect teachers' information seeking experiences (Dijck & Poell, 2018; Krutka et al., 2019). Furthermore, the quantity of content can prove overwhelming, with self-promotional posts and spam potentially cluttering feeds (Carpenter et al., 2020; Greenhow et al., 2021; Staudt Willet, 2019), and making it difficult to assess whom to trust. Information seeking via social media can also challenge traditional conceptualizations of expertise, authority, and professionalism (Carpenter & Harvey, 2019; Nagle, 2018). So, while social media platforms appear to be common sites of information seeking by teachers, the nature of the information they encounter deserves scrutiny.

1.2.2. Information sharing

In addition to acquiring information, some teachers share information via social media platforms. For example, teachers may offer their perspectives and post examples of their teaching experiences or their students' work. Teachers can also rebroadcast or remix information originally offered by others, acting as content curators, knowledge brokers, or moderators (Hillman et al., 2021; Jusinski, 2021). Information sharing by teachers can occur in individual and ad hoc ways, but it can also be enacted by teachers or teacher collectives who coordinate their sharing and take advantage of social media affordances, such as hashtags that aggregate content on topics (Greenhalgh et al., 2020; Greenhalgh & Koehler, 2017). Prestridge (2019) notes that information seeking and sharing can be intertwined, as some educators act as info-networkers who seek "to find and take away new ideas and resources from social mediated spaces for the purpose of sharing with other colleagues" (2019, p. 153).

Just as teachers may seek information for diverse reasons, so too can they have multiple and distinct motives for sharing information. Some teachers may freely share information out of a desire to be professionals who strengthen the education field (Jusinski, 2021; Prestridge, 2019). Other teachers may share information to promote themselves (Staudt Willet, 2019), or as a part of paid promotion of third party products or services (Carpenter et al., 2022; Shelton et al., 2020). "Sharing" can therefore be to some extent self-seeking in nature, as the initial connections that might result from sharing can serve the sharer's own ends by allowing them later to, for example, ask questions, seek specific feedback, or monetize their audiences (Carpenter et al., 2022; Prestridge, 2019). An additional perspective on the predictors of teachers sharing information on social media is offered by Goodyear et al. (2014), who examined interactions on Facebook and Twitter among five physical education teachers. They found that as teachers became more self-confident, they began sharing about their own practices, which gave them an identity as educationally competent and innovative. These findings suggest that teachers with high self-efficacy in particular may share social media content. This relationship is also reflected in the broader research on social media behavior that does not focus on teachers (Chen & Hung, 2010; Kim et al., 2022; Lin, 2007).

1.2.3. Co-creating

Beyond information seeking and sharing, social media can potentially host more intensive forms of collaboration that produce teaching and learning resources or experiences. For example, teachers can use social media to crowd source the creation of teaching materials (Donlon et al., 2020; Dunlap & Lowenthal, 2018). In addition to divide-and-conquer approaches to collaboration, teachers may leverage the affordances of social media to co-create teaching and learning materials and experiences. For instance, the Global Read Aloud (GRA) is an annual international literacy project that educators organize and implement using various social media platforms (Carpenter et al., 2022). GRA educators typically find other participating teachers from beyond their schools using social media spaces, and pair their classes for synchronous and asynchronous activities based on a common text. These teachers commonly communicate via social media as they co-design GRA activities, and social media platforms often play a part in GRA teaching and learning activities (Carpenter & Justice, 2017). When engaging in such co-creation, teachers can potentially combine their "unique perspectives and strengths together to create teaching approaches that would not otherwise actualise" (Härkki et al., 2021, p. 2). Additionally, research suggests that while teacher collaboration often focuses on conversation and idea exchange, collaboration with a strong link to teaching practice can be more effective than other approaches to collaboration (Hargreaves & O'Connor, 2017; Meirink et al., 2010). However, to date, the extent to which social media platforms are used by educators for co-creating has received only

limited attention in the literature.

1.3. Digital social support through social media

Collaboration via social media is a potential source of perceived social support, which "refers to psychological or material resources that are provided to a focal individual by partners in some form of social relationship" (Jolly et al., 2021, p. 229). Building upon House's (1981) seminal work, Taylor (2011) distinguished three types of social support: emotional support, informational support, and instrumental support. Emotional support refers to the psychological support a person receives, such as empathy, caring, or trust. Informational support includes receiving information or advice that can help a person solving a problem. Finally, instrumental support consists of receiving resources, such as time, materials, or money. Social support is considered to have beneficial effects on mental and physical health (Jolly et al., 2021; Taylor, 2011; Viswesvaran et al., 1999). Social support is particularly important for teachers, as they must cope with various stressors, such as overwhelming workload, lack of social support in the workplace, and difficulties with classroom management (e.g., Chang, 2009; Montgomery & Rupp, 2005; Papastylianou et al., 2009), leading to high levels of job stress and burnout (e.g., Johnson et al., 2005; Maslach et al., 2001).

Although social support has so far been studied primarily in physical contexts, recent research suggests that individuals can also receive social support in digital spaces (Bayer et al., 2020; Colasante et al., 2020; Cole et al., 2017; High & Buehler, 2019). Consistent with in-person social support, digital social support "encompasses the comfort, assistance, and reassurance that people experience as a function of social relationships" in computer-mediated contexts (Liu et al., 2018, p. 201), and has been shown to have a positive impact on health and well-being, such as lower levels of depression (Colasante et al., 2020; Cole et al., 2017).

While there is a growing body of research examining the relationship between social media use and perceptions of digital social support, there is little research focusing on teachers in this regard. However, evidence on teachers receiving digital social support can be found in early research on teachers' online communities (Hur & Brush, 2009; Matzat, 2013). To examine digital social support in social media, Kelly and Antonio (2016) analyzed threads in Facebook groups and, drawing upon work by Clarke et al. (2014), identified six forms of support that teachers provided to one another: acting as modelers of practice, providers of feedback, supporters of reflection, conveners of relations, agents of socialization, and advocates of the practical. Kelly and Antonio (2016) thus identified concrete behaviors that could potentially contribute to digital social support. However, this study left open the extent to which these behaviors lead to a sense of receiving digital social support among educators.

Studies on teachers' Twitter use have shown that teachers can receive digital social support via social media. In survey research, Richter and Pant (2016) demonstrated that some teachers see social media platforms as an effective antidote to various kinds of harmful professional isolation. In addition, studies have shown that some teachers who use education-related Facebook groups report receiving emotional support (Bergviken Rensfeldt et al., 2018; Shelton & Archambault, 2018). The emotional support educators receive can also be related to their information seeking and sharing behaviors, as teachers may be more willing to engage with new ideas and perspectives in professional spaces that feature positive emotions and support (Gaines et al., 2019).

Apart from these promising results, research has not been able to determine the full potential of social media platforms to provide digital social support for two reasons. First, prior studies fail to distinguish between participants' various social media collaboration activities. As Liu et al. (2018) emphasized, it would be beneficial to know whether different collaboration activities are differentially associated with digital social support. Second, studies also have not distinguished between different types of social support (Meng et al., 2017). Both approaches could advance the knowledge base, as initial findings indicate that different collaboration activities by teachers on social media platforms are associated with different social support outcomes (Blight et al., 2015; Liu et al., 2018). The present study contributes to narrowing these gaps in research.

1.4. The case of Instagram

Despite being the fourth most widely used social media platform in the world (Statista, 2021), and the fourth most used in Germany (the specific context of this research; Statista, 2020), to date Instagram has received relatively limited attention from education researchers compared to other platforms (Barrot, 2021). Given Instagram's popularity, features that distinguish it from other platforms, and the limited extant research, investigations of educators' Instagram use can benefit the field. Overall Instagram use has grown vastly since 2014, from 200 million to more than 1.3 billion active users (Statista, 2021). Instagram is a social networking service owned by Meta, the parent company that also owns Facebook and WhatsApp. Instagram users can edit photo and video content with multiple filters, and posts can be accompanied by up to 2.200 text characters. The platform allows users to send private messages, include searchable hashtags, and share *stories* that are accessible to others for a limited time. Messages, posts, and stories allow users to communicate in various ways via the platform. For instance, Instagram posts often feature carefully produced and curated images (Hong et al., 2020), while stories may be relatively more vulnerable or informal.

Instagram's design, functionality, and visual nature may distinguish it from comparatively more text-focused platforms and could contribute to teachers using the platform differently from other social media (see Pittman & Reich, 2016; Shane-Simpson et al., 2018). Indeed, Carpenter et al. (2020) showed that educators who use Instagram reported more mixing of their personal and professional lives than has been observed on some other social media platforms (e.g., Twitter; Carpenter et al., 2019). Furthermore, the presence of education influencers and teacher entrepreneurs on Instagram has been noted in Carpenter et al., (2020) and Shelton et al. (2020), two of the prior studies of educator Instagram use. Among the U.S. educators ($N = 841$) in Carpenter et al., (2020) who posted content, it was most common to share advice and examples of instructional methods, curriculum, or organizational materials. Regarding the reasons for their professional Instagram activities, information-seeking motivations such as looking for content and ideas shared by

other educators were prevalent. The majority of participants described collaborating with other educators as a major reason for using Instagram. Only 35.5% reported that sharing their own content or ideas was a major motivation for Instagram use (Carpenter et al., 2020).

1.5. Aims of the present study

Social media platforms play an important role in the professional lives of many teachers. They allow access to different job-related collaboration activities independent of space and time and they can potentially contribute to teachers' professional development. Educators who engage in social media platforms vary with regard to the way they use the different types of collaboration opportunities that these platforms offer. While some teachers engage in more low-cost collaboration activities, such as seeking information, others engage in high-cost collaboration activities, such as co-creating. To date, it is unclear how this differential social media use may relate to differences in teacher characteristics, such as their self-efficacy and enthusiasm for teaching. We focus on these two teacher characteristics because they have been shown to be related to collaboration in more traditional contexts. Moreover, studies show that social media platforms can provide opportunities for digital social support as teachers can interact collaboratively with their peers. However, it is unclear to what extent different collaboration types are related to different types of digital social support. For this reason, we address the following three questions:

Research Question 1a. Can different types of collaboration by teachers be measured using a multi-faceted, theory-driven instrument? If so, to what extent do the different types of Instagram collaboration correlate?

Prior research has shown particular ways in which teachers have employed social media for collaboration. A common educator use of social media is to seek information related to their work. In addition to acquiring information, teachers share information via social media platforms. Furthermore, research has shown that teachers can also co-create using social media, for example, by jointly developing teaching and learning materials. We hypothesize that we can replicate these three forms of teacher collaboration with a newly developed, multi-faceted, theory-driven survey instrument.

Research Question 1b. To what extent do teachers report different collaboration activities on Instagram?

Research on traditional teacher collaboration has shown that teachers are more likely to use low-cost forms of collaboration. Since research on social media use also shows that low-cost forms such as seeking information are common among teachers, we expect to find higher levels of low-cost forms of collaboration.

Research Question 2. Are different forms of collaboration associated with teachers' self-efficacy and their enthusiasm for teaching?

Self-efficacy and enthusiasm have been suggested as prerequisites for teacher collaboration (Cobb & Foeller, 1992; Runhaar et al., 2010; Thoonen et al., 2011). We therefore hypothesize that higher self-efficacy as well as enthusiasm for teaching are associated with teacher collaboration activities via social media. Specifically, based on the findings of Goodyear et al. (2014), we expect self-efficacy to be related to information sharing.

Research Question 3. Are different forms of collaboration associated with the digital social support teachers receive from their colleagues on Instagram?

We choose an exploratory approach because there is not yet empirical evidence to formulate specific hypotheses. From a theoretical point of view, social interactions in the context of collaboration may form a source of social support and social media platforms are a place for teachers to receive digital social support. However, teachers differ in how they use social media platforms for collaboration. We therefore anticipate a possible positive relationship between different forms of collaboration with different forms of digital social support.

2. Methods

2.1. Study design and participants

The present study uses a cross-sectional design to examine teacher collaboration on Instagram and its relationship with teachers' self-efficacy and their enthusiasm for teaching on the one hand, and their perceptions of digital social support on the other. Data were collected using the EFS survey platform from QuestBack Unipark (Questback GmbH, https://www.unipark.com). To reach potential participants, we published a post on Instagram inviting teachers to participate in our study and including the link to the online questionnaire. To increase the post's visibility, we included school- and education-related hashtags and tagged various education micro-celebrities. We chose German hashtags that were related to education and for which at least 30,000 posts had been published (e.g., #instalehrerzimmer [translated as #teacherstaffroom], #lehreraufinstagram [translated as #teachersoninstagram]). Regarding the education micro-celebrities, we selected German educators who had at least 1000 Instagram followers. To further increase visibility, we added an Instagram story to the post which we published three times in total: on the day the post was published, one day after the post was published, and three days after the post was published. From the day the post was published, teachers had access to the questionnaire for eight days.

In total, 249 teachers agreed to participate in the study. Participants were on average 32.1 years old (SD = 9.3 years) and had been working on average for 4.1 years as a teacher (SD = 6.5 years). The majority of participants were female (97.1%) elementary school teachers (60.0%). The other teachers taught at secondary schools.

2.2. Measures

2.2.1. Collaboration in social media

We used 10 items to assess teachers' collaboration on Instagram. The instrument included multiple statements about activities teachers may engage in on Instagram based on findings from prior research (e.g., Prestridge, 2019). The instrument was partly newly developed and partly borrowed from existing instruments. As a basis for surveying Instagram collaboration, we drew on a recent study by Conze et al. (2020) that examined teachers' social interaction on Twitter. This instrument, in turn, borrowed conceptually from Gräsel et al.'s (2006) work distinguished between different forms of low and high cost teacher collaboration. We focused on three different collaboration activities: information seeking, information sharing, co-creating. The first activity, information seeking, reflects the extent to which a teacher uses Instagram to gather information that is related to the teaching profession (e.g., new teaching materials). A sample item (translated) is: "I use Instagram to look for teaching related information." The second activity, sharing information, illustrates the extent to which a teacher has chosen to upload content to Instagram that other users have free access to. A sample item is: "I share my teaching materials on Instagram." Co-creating refers to teacher collaboration on Instagram with regard to jointly working on specific problems or projects. A sample item is: "I prepare lessons together with my colleagues on Instagram." Respondents were asked to rate all items on a six-point Likert scale ranging from 1 (never) to 2 (once or twice a school year), 3 (monthly), 4 (weekly), and 5 (every day) to 6 (several times a day). The full instrument is provided in Supplementary data (Table A). The analysis of the internal structure to identify the sub-dimensions of teacher collaboration is part of the first research question. For this reason, information on the means and standard deviations as well as on the reliability of the scales are presented in the results section.

2.2.2. Teacher characteristics and digital social support

We measured teachers' self-efficacy using an established instrument for German speaking settings (Schwarzer, 1999). This scale included five items, which were rated on a four-point response scale ranging from 1 (completely disagree) to 4 (completely agree). An example item is, "I am confident that I can motivate students for new projects." To evaluate the reliability of the scale, we calculated McDonald's omega (Hayes & Coutts, 2020), based on recent methodological studies that recommend using the omega coefficient instead of the Cronbach alpha coefficient (Hayes & Coutts, 2020; Zinbarg et al., 2005). Nájera Catalán (2019) considers $\omega \geq 0.65$ as the very minimum to be reliable. The internal consistency for teachers' self-efficacy was McDonald's $\omega = 0.69$.

To capture teachers' enthusiasm for teaching, we used three items of the teacher motivation questionnaire, which was constructed for the COACTIV study (Kunter et al., 2008). The construct was measured with items such as "I really enjoy teaching". Respondents were asked to rate all items on a four-point Likert scale ranging from 1 (completely disagree) to 4 (completely agree). For the manifest scale, internal consistency was McDonald's $\omega = 0.85$.

Twelve items were used to assess digital social support. The items were based on a questionnaire used in the German COACTIV-R study and were revised for this study. The items were changed in order to reflect support that was obtained through social media. It focused on three factors: emotional support (i.e., "The other users show empathy when things aren't going so well for me at school"), informational support (i.e., "When a difficult situation has arisen in class, I find advice from the other users"), and instrumental support (i.e., "I regularly receive teaching materials from other users on Instagram"). Respondents were asked to rate all items on a four-point Likert scale ranging from 1 (completely disagree) to 4 (completely agree). The internal consistency for the manifest scales was McDonald's $\omega = 0.86$ (emotional support), 0.93 (informational support) and 0.74 (instrumental support), respectively.

2.2.3. Teacher demographic characteristics

To describe the sample, teachers' gender, age, and type of school were assessed.

2.3. Data analysis

In order to investigate Research Question 1a (whether different forms of teacher collaboration can be measured according to a multifaceted theory-driven structure), we conducted a confirmatory factor analysis (CFA) to evaluate the construct validity of the instrument. The CFA model uses a latent variable to represent each factor (collaboration) with the respective indicators. CFA allows us to model latent factors by also taking measurement errors into account. Indices of model fit were evaluated using the recommendations of Hu and Bentler (1999), who "recommend that practitioners use a cutoff value close to 0.95 for TLI [BL89, RNI, CFI or Gamma hat] in combination with a cutoff value close to 0.09 for SRMR to evaluate model fit" (p. 27). If the sample size exceeds 250, the SRMR should be paired with the RMSEA. At this point, the SRMR should be close to 0.09 and the RMSEA should be close to 0.06 or below. Since we have a sample size of 249, we decided to report CFI, SRMR, and RMSEA. Internal consistency of the instrument was evaluated by McDonald's (1999) omega. In addition, to answer Research Question 1b, we performed a descriptive analysis of the manifest scales, reporting means and standard deviations. To answer the second and third research questions, we conducted structural equation modeling (SEM). SEM allows for the modeling of multiple predictor and outcome variables simultaneously (Kline, 2011; Tarka, 2018). We first analyzed a model that investigates the relationship between both teacher self-efficacy and enthusiasm for teaching as independent variables and the different forms of collaboration as dependent variables (Research Question 2). Second, we specified a model with different forms of collaboration as independent variables and emotional support, informational support, and instrumental support as the dependent variables (Research Question 3). The alpha was set at the 5% level.

All analyses were conducted using Mplus version 8.3 (Muthén & Muthén, 2019). Parameters were estimated by maximum likelihood estimation method (ML). Missing value analysis was conducted by performing Little's (1988) missing completely at random

(MCAR) test (using IBM SPPS Statistics 26) in order to identify potential patterns in missing data that might bias the analyses. In the case of a non-significant Little's MCAR test, data were considered to be missing completely at random and therefore found to be eligible for full information maximum likelihood (FIML) estimation. FIML methods produce unbiased estimates even in the presence of missing data if the missing process was considered missing at random (Schafer & Graham, 2002). For all dependent, independent, and control variables, Little's MCAR test was not significant ($\chi^2 = 17.41$, df = 23, p = .79). For this reason, the data for all parameters were concluded to be MCAR. FIML was therefore considered safe and was applied.

3. Results

3.1. Measuring types of collaboration

The first research question addresses different forms of collaboration. Fig. 1 depicts the CFA model with the three collaboration types as correlated latent variables, each shown as a circle. Each latent variable comprises three to four indicators (manifest items), represented by the squares. All standardized factor loadings, represented by the arrows between latent variable and indicator, vary between 0.57 and 0.90 and differ significantly from zero at the 0.001 level. The results suggest that all items load significantly on the hypothesized latent factor. The estimated model meets the criteria specified and therefore indicates a good fit to the data ($\chi^2 = 67.39$, df = 32, p = .01, CFI = 0.94, RMSEA = 0.07, SRMR = 0.05). To check the robustness of the three-factor model, we compared the results with a one-factor model in which all ten items were set to load on the same factor. The results suggest that the one-factor model showed poor fit to the data, implying that items assessing forms of collaboration need to be differentiated ($\chi^2 = 306.95$, df = 35, p < .05, CFI = 0.55, RMSEA = 0.18, SRMR = 0.13).

The correlations presented in the model differ in magnitude, and only two of them are statistically significant (Fig. 1). A medium positive correlation can be found between seeking information and co-creating. A small positive correlation can be found between seeking information and sharing information. This means that people who report using Instagram more intensively to gather information also post information more frequently. The correlation between sharing information and co-creating is not statistically significant. The results thus suggest that the specified collaboration types can be differentiated from each other. Finally, a reliability analysis was performed to examine the internal consistency of the three factors ($0.70 > \omega > 0.81$). All three scales were found to be reliable when following the recommendations of Nájera Catalán (2019), implying that different forms of collaboration were measured reliably. In conclusion, the measurement of forms of collaboration demonstrated good validity and reliability.

Research Question 1b focuses on reported collaborative activities using descriptive analysis. The different means of the four scales indicate that most teachers use Instagram for information seeking ($M = 3.78$, $SD = 1.03$). In contrast, teachers participate in co-creating only to a very limited extent ($M = 1.34$, $SD = 0.61$). Somewhat more frequently, but overall also at a low level, teachers use Instagram for sharing information ($M = 2.12$, $SD = 1.01$). Thus, on average, the findings indicate a rather low level of collaboration among participants on Instagram. At the same time, however, there seems to be a great diversity within the participants.

3.2. The relationship of teacher collaboration with teachers' self-efficacy and enthusiasm for teaching

To evaluate the relationship between self-efficacy and enthusiasm for teaching and the three collaboration types (Research Question 2), we estimated a model that included self-efficacy and enthusiasm for teaching as independent variables and seeking information, sharing information, and co-creating as dependent variables. Fig. 2 shows the results of the SEM graphically. The circles represent latent variables, with the independent variables shown on the left and the dependent variables on the right. The arrows

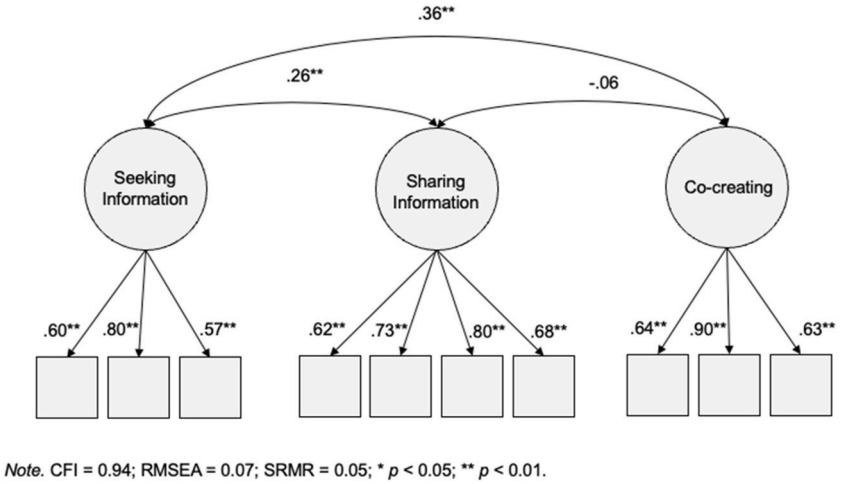


Fig. 1. Measurement model of forms of collaboration.

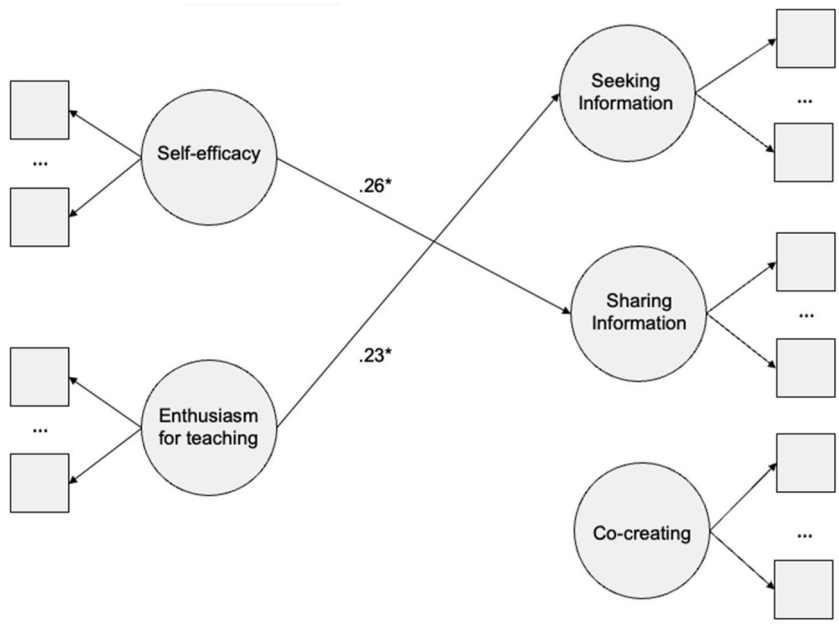
between the left and right sides represent the standardized linear regression coefficients, with only significant relationships shown. The results show that self-efficacy is positively related to sharing information. Furthermore, enthusiasm for teaching was also positively related to seeking information. On the one hand, this means that people who are more confident in their abilities are more likely to share content. On the other hand, more enthusiastic teachers spend more time on Instagram searching for information. Co-creating was neither related to self-efficacy nor to enthusiasm for teaching. Both independent variables predicted 13.0% of the variance in seeking information, 7.2% of the variance in sharing information, and 2.9% of the variance in co-creating.

3.3. Collaboration and digital social support

To answer Research Question 3, we examined the relationship between different forms of collaboration and digital social support. In this regard, we estimated a model that included all three forms of collaboration as predictors and all three types of social support as dependent variables. Fig. 3 presents the results graphically and can be interpreted in the same way as Fig. 2. The results reveal a significantly negative relationship between seeking information and informational support, but a significantly positive relationship between seeking information and instrumental support. That is, the more time teachers spend seeking information on Instagram, the less they perceive informational support. At the same time, however, they report perceiving more instrumental forms of support when they spend more time seeking information. Moreover, sharing information was positively related to both emotional support and informational support. This implies that teachers who spend more time sharing information also perceive more emotional and informational support. Finally, the results show that co-creating is positively related to instrumental support. Accordingly, teachers who spend more time co-creating on Instagram also perceive more instrumental support. The three different forms of Instagram use predicted 31.4% of the variance in emotional support, 32.1% of the variance in informational support, and 22.3% of the variance in instrumental support.

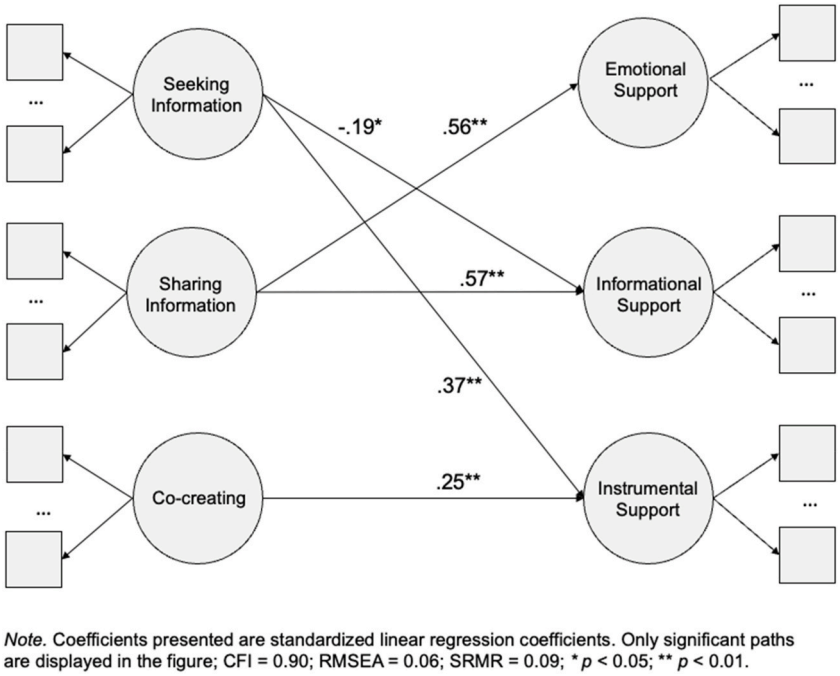
4. Discussion

This study focused on how teachers collaborate on Instagram and the extent to which the type of social media use is related to two teacher characteristics, and teachers' perceptions of digital social support. Therefore, we developed an instrument to measure teachers' collaboration on Instagram. Our study contributes to research on social media use in education by examining different types of collaboration on Instagram and describing differential relationships with different forms of digital social support. In the next three sections we discuss the results related to our three research questions.



Note. Coefficients presented are standardized linear regression coefficients. Only significant paths are displayed in the figure; CFI = 0.97; RMSEA = 0.03; SRMR = 0.05; * $p < 0.05$; ** $p < 0.01$.

Fig. 2. Direct effect model: Relationship between self-efficacy and enthusiasm for teaching and seeking information, sharing information and Co-creating.



Note. Coefficients presented are standardized linear regression coefficients. Only significant paths are displayed in the figure; CFI = 0.90; RMSEA = 0.06; SRMR = 0.09; * $p < 0.05$; ** $p < 0.01$.

Fig. 3. Direct effect model: Relationships between seeking information, sharing information and Co-creating and digital social support scales.

4.1. *Three kinds of teacher collaboration on Instagram*

The primary aim of our study was to identify forms of teacher collaboration on Instagram. The study showed that we can use a newly developed measurement instrument to capture three different collaborative activities in a valid and reliable way: seeking information, sharing information, and co-creating (Fig. 1). This finding is in line with our hypothesis as well as previous research that has shown the ways in which teachers have used social media for collaboration (e.g., Trust et al., 2016; Carpenter et al., 2020; Prestridge, 2019). Our results show in addition that seeking information is related to the two other collaboration activities. In this sense, teachers often use Instagram not only for a single collaboration activity, but combine forms of collaboration. This is in line with Carpenter et al. (2020), who demonstrated that Instagram can fulfill multiple professional purposes for teachers. We were also able to demonstrate that teachers predominantly seek information when collaborating on Instagram. As other studies have reported, social media time is frequently spent browsing one's newsfeed, which contains the information broadcast by others (Ancu, 2012; Hall, 2018). Furthermore, regarding Instagram, Carpenter et al. (2020) found that a primary reason for why teachers use Instagram is to "look at other teachers' ideas and content".

In general, our results suggest that teachers on Instagram are more likely to engage in low-cost collaboration forms, such as information seeking, than high-cost forms, such as co-creation. A possible explanation for this is provided by Muckenthaler et al. (2020), who showed that low-cost forms of collaboration restrict teachers' individual autonomy less than high-cost forms. Many teachers may opt for collaborative activities that place relatively few constraints on their own autonomy (Johnson, 2003; Vangrieken et al., 2017). Another possible explanation for our findings can be found in Vangrieken et al.'s (2015) review of teacher collaboration literature, which noted that high-cost forms of teacher collaboration require teachers to share the same goals and understand each other's contexts. This latter part may be more likely if teachers work in the same school or district. Social networking sites promise access to professional interaction independent of space and time, but educators may interact without understanding each other's context or priorities, and this could impede more intense collaborative endeavors.

4.2. *Self-efficacy and enthusiasm for teaching and collaboration on Instagram*

This research is one of the first studies that links teacher characteristics with their collaboration activities on Instagram. In line with our expectations and findings from previous studies (e.g., Goodyear et al., 2014; Kim et al., 2022), we found self-efficacy to be related to information sharing (Fig. 2). This finding aligns with research on motivational factors associated with teacher collaboration in traditional contexts that has found teachers with higher self-efficacy are more likely to engage in collaboration (Runhaar et al., 2010; Thoonen et al., 2011) and professional learning (Durksen et al., 2017). Also helpful in understanding the relationship between self-efficacy and information sharing might be research on teacher personality. In particular, some studies shed light on the relationship between self-efficacy and extraversion, indicating a positive relationship between these two variables (Richter et al., 2022; Perera et al., 2018). Extraverts, who tend to seek social attention (Paunonen, 2003), may find social media inherently appealing. In

addition, research on social media user engagement and extraversion found a link between extraversion and the regularity of posting new social media content (Bowden-Green et al., 2020). As we did not test users' personality traits in this study, we cannot claim that the same mechanisms apply here. However, research on teacher self-efficacy, teacher personality, and individuals' social media behaviors, along with our findings, provide evidence that could be tested in further research on teacher social media use.

We also found that participants' enthusiasm for teaching was positively related to information seeking (Fig. 2). This underpins economic and political science research on the relationship between enthusiasm and information seeking (Bloch, 1986; Hoewe & Parrott, 2019). Our finding also extends research on teacher enthusiasm, which has already shown that individuals with more enthusiasm for teaching show greater well-being and less emotional exhaustion (Keller et al., 2016; Kunter et al., 2011). Individuals with greater enthusiasm for teaching appear to have the desire and emotional resources necessary to invest in job-related activities such as information seeking. For example, their enthusiasm for improving in their work may be strong enough to overcome potential embarrassment at asking for information or advice. The relationship between participants' enthusiasm for teaching and their Instagram use for information seeking also echoes findings from a study on content-focused professional development in which teachers' enthusiasm for their subject was positively related to participation in professional learning activities (Richter et al., 2021).

4.3. Collaboration on Instagram and digital social support

Research has not previously uncovered the connections between different forms of digital collaboration and different facets of digital social support. Against this background, we were able to observe differential relationships for the first time (Fig. 3). In general, our study confirmed that social media platforms such as Instagram are a place where teachers can receive digital social support (e.g., Carpenter et al., 2020; Hur & Brush, 2009). However, a closer look reveals that specific results require more attention. This includes the finding that the most intensive form of collaboration (co-creation) does not have the strongest relationship with digital social support. This could be due to the fact that collaboration must meet certain characteristics to be effective (Vangrieken et al., 2015). For example, criteria have been identified in research on in-person collaboration, such as collaborators having clear roles and fair task assignments (Main & Bryer, 2005), having sufficient knowledge and skills, and employing strategies to accomplish tasks (Conley et al., 2004). The extent to which these criteria are met in the case of collaboration on Instagram is unclear. However, our findings indicate that it may be worthwhile to look closer at the quality of collaborators' social media interactions.

We found particularly strong relationships between sharing information and emotional and informational support, respectively. This result could reflect a self-fulfilling prophecy, as Oh and Syn (2015) found that social media users who wanted to share information were highly motivated to learn and expected to reciprocally receive new or updated information themselves. Oh and Syn (2015) further found that sharing information on social media allowed users to be more closely connected with other users by interacting with them more frequently. In this sense, users might share content because they are looking for support and feedback. This mechanism of sharing and in turn receiving responses works well in social media as shown by research on influencers and educational influencers (Carpenter et al., 2022).

While we found in general positive relationships between collaboration on Instagram and facets of digital social support, there was a negative relationship between information seeking and informational support. At first glance, this result seems counterintuitive, but previous research may explain this phenomenon. While social media platforms obviously offer access to information and resources, they provide few accurate or trustworthy mechanisms for determining information quality. Determining information quality seems particularly necessary given that problems and concerns have been identified with the quality of education-related content on social media (Sawyer et al., 2019; Shelton et al., 2020). Social media does not present a systematic body of knowledge or information that consistently meets scientific quality criteria and has been subjected to a traditional peer review process. This can lead to frustration among teachers despite intensive information seeking (Carpenter & Harvey, 2019) and may explain why teachers could feel unsupported information-wise. Instagram's more visual nature may also make it less suited to some kinds of informational support. Furthermore, the less prominent role that hyperlinks play on Instagram as compared to other social media such as Twitter or Facebook may confound some efforts at information seeking, as Instagram users cannot as easily provide support by pointing to relevant information found elsewhere on the Internet.

4.4. Limitations

Although our study provides new insights into teachers' collaboration on Instagram, it features some limitations. First, our study is based on a convenience sample of active Instagram users in Germany. Although this limits the generalizability of the findings, our sample seems to reflect the typical population of Instagram users as our data featured a large proportion of young and female teachers. This composition was also identified in other studies with Instagram users (Casalo et al., 2021; Kang & Wei, 2020; Mackson et al., 2019) which supports the relevance of our results. Nevertheless, we have to take into account that previous research on teacher collaboration has shown that female educators in particular are more likely to collaborate and that collaboration is higher among novices (e.g., Bridwell-Mitchell & Cooc, 2016; Mora-Ruano et al., 2018). Research on social networks has also shown that usage behavior differs between various platforms (e.g., Twitter, Instagram). Therefore, it seems necessary to replicate this study's results for other platforms and to study a more balanced group in terms of age and gender in order to assess the generalizability of our results. In addition, although we had information on participants' gender, age, work experience, and type of school, we did not collect data on participants' prior experience with social media. With this in mind, we also need to examine teachers who do not use social media platforms, or use them infrequently, to better understand what distinguishes them from frequent users. Teachers may have begun trying to use Instagram to collaborate, but then stopped using the platform entirely. Due to their absence from Instagram, such teachers

would have been unable to participate in our study, as only individuals who were active users of Instagram at the time of the survey and had logged in during the survey period were able to participate (Owen et al., 2016). Second, this study was based on a cross-sectional design that did not allow for identification of causal relationships. Longitudinal research would be needed to describe, for example, the development of digital social support. Third, our study is based on self-reports and does not capture participants' profiles or their actual social media use. Although self-reports come with limitations (Gonyea, 2005), they are widely used in social sciences, including research on social media use (e.g., Frison & Eggermont, 2016).

4.5. Implications

This study's findings have implications for further research, teacher education, and professional development. Regarding implications for research, some of these have been noted in the limitations section above. Additionally, our study provides insights into teachers' digital collaboration on Instagram in that we found that only some participants were actively involved in any form of collaboration on Instagram. Further research could seek to explore what prevents teachers from using Instagram or other social media platforms for certain kinds of professional collaboration. In this context, it would also be interesting to examine how teachers' collaboration on Instagram (or other social media platforms) changes over time or as a function of their prior experiences with social media. For example, it is known that throughout their teaching careers teachers use collaboration opportunities differently depending on their age (Richter et al., 2011) and that social media use by educators is not static (Veletsianos et al., 2018). In addition, while we described the characteristics of teachers who used Instagram for collaboration, it would be interesting to explore the extent to which Instagram-using teachers are active in traditional forms of collaboration within their school. This being said, further research could also seek to better understand how collaboration of teachers on Instagram or other social media platforms leads to change in their schools. For example, Jusinski (2021) described so-called knowledge broker teachers. These teachers acquire knowledge, skills, or teaching materials through collaborative activities such as seeking or sharing information or co-creating on social media platforms and pass these on to colleagues at their school. Observing and describing such interaction processes and identifying prerequisites for success could contribute to the research on professional development of teachers. In line with this, we also need to gain more insight into the impact of Instagram collaboration by teachers. While we found that digital collaboration was related to perceptions of digital support, it is unclear how digital collaboration relates to Instagram users' classroom behaviors and their students' learning. In this context, it also seems worthwhile to explore which collaboration modalities—online collaboration, in-person collaboration, or blended collaboration—are more useful in which circumstances, and for whom.

Regarding teacher education and professional development, we found that information seeking on Instagram, despite being the most intensively used collaboration activity, seems to be challenging. Teachers may be overwhelmed with information in some social media spaces (Staudt Willet, 2019), and some of that information can be of poor quality. To find relevant information and critically evaluate it, educators will likely need to build their digital literacy skills (Manca et al., 2021). For example, professional development courses could be offered to train teachers to use advanced search options on social media, to apply criteria for resource selection, and to avoid potential pitfalls (Greenhow et al., 2021; Krutka et al., 2019). Furthermore, by including training on social media use during teacher preparation, future educators could also be reached. However, training and guidance regarding social media use should not exclusively be platform-specific, but rather should inform teachers about the different ways they can utilize different social media platforms. As our results show, Instagram seems to attract a certain group of users, which could be due to the platform's visual nature. However, teachers who do not (want to) use Instagram may be able to engage in professional collaboration via platforms whose features are more suitable for or familiar to them. Reddit, for example, is more anonymous, and Twitter is more text focused, and these platforms could therefore be more attractive for some kinds of collaboration to other user groups.

5. Conclusion

Overall, this study expands knowledge about the ways teachers use Instagram for collaboration. In addition, we also shed light on the characteristics of teachers who use Instagram in different ways and how different uses of Instagram are related to perceptions of digital social support. Teachers, especially more enthusiastic ones, use Instagram primarily to search for information, but searching for information does not necessarily lead to teachers receiving informational support. More self-efficacious teachers, on the other hand, share information more frequently and those who participate more frequently in information sharing report high levels of digital social support. Finally, Instagram appears not to be a place for teachers to engage in co-creating. Nevertheless, Instagram seems to be a space where teachers find some sources of support. Still, further research needs to uncover the mechanisms behind it and contribute to the development of guidance and training for teachers to fully realize the potential of social media and mitigate some of its challenges.

Author credit

Eric Richter: Conceptualization, Investigation, Methodology, Formal analysis, Writing-Original Draft, Jeffrey P. Carpenter: Conceptualization, Resources, Writing-Review & Editing, André Meyer: Investigation, Data Curation, Writing-Review & Editing, Dirk Richter: Conceptualization, Investigation, Methodology, Resources, Writing-Review & Editing.

Declaration of competing interest

We have no conflicts of interest to disclose. This research did not receive any specific grant from funding agencies in the public,

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Supplementary data.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.compedu.2022.104624.

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