Social media use and mental health in deaf or hard-of-hearing adults—Results of an online survey

Karolin Schäfer* and Felix Miles

Department of Special Education and Rehabilitation, Faculty of Human Sciences, University of Cologne, Cologne, Germany

This paper presents the results of an online survey on digital participation through the use of social media of $n = 38$ German deaf or hard-of-hearing (DHH) adults. In addition, information about the respondents' mental health is collected with four different scales: the Rosenberg Self-Esteem Scale (RSES), the Fear of Missing Out Scale (FoMoS), the Patient-Reported Outcomes Measurement Information System Social Isolation Scale (PRO-MIS SI-S) and the Social Media Disorder Scale (SMDS). Correlation analyses using Pearson correlation and Spearman rank correlation tests were conducted to identify relationships between mental health and use of social media. The results indicate that the DHH adults have 4.13 social media accounts on average and use social media 3.78 h per day. This is consistent with other research findings, so that the DHH individuals in this study do not differ from other DHH adults or hearing adults in the number of their social media accounts and in their media usage time. However, there are differences in usage of social media that concern, for example, the social media platforms that are used and time of usage due to communication modality (spoken language, sign language, bimodal bilingualism, and mixed forms). DHH individuals who use sign language use social media less overall compared to DHH people who use spoken language. In terms of mental health, it was found that, as expected, addictive social media behavior and high usage time are interrelated. Addictive behavior, in turn, is often associated with low self-esteem, a sense of social isolation, and a fear of missing out. In general, many participants in the study score high in scales for self-perception of social isolation and loneliness. Nevertheless, there are also positive effects and opportunities of using social media, especially in terms of digital participation, for DHH people, which are also discussed in the article.

KEYWORDS

deaf, hard-of-hearing, social media, mental health, digital communication

Introduction

Digital communication has increasingly gained in importance as a new form of communication since the 90′s of the last century across the globe. This signifies the change of everyday communication and interaction between people through digital media (Grimm and Delfmann, 2017). The opportunity to constantly access the Internet from any place and our ability to express ourselves through language create a feeling of closeness between people regardless of where people are physically located. Moreover, this process of change toward digital media is characterized by an enormously accelerating innovation and by the particularity that the newly evolving digital communication media do not replace the existing digital forms of communication (as it was the case with previous technological

developments) but that they pop up all of a sudden and persist in parallel to the already existing forms of communication (Taddicken and Schmidt, 2017; Wampfler, 2019). This has resulted in a veritable oversupply of digital communication opportunities in the recent years.

For deaf and hard-of-hearing (DHH) people, digital media represent an important opportunity to access information and to communicate with others while having the opportunity to see the interlocutor on a screen. For DHH people who use spoken language, listening to speech, and watching mouth and lip movements at the same time or reading captions is essential to understand what is being said. For DHH people who use sign language, digital communication offers the chance to communicate in sign language on a screen—an advance that only digital media have made accessible to people from the Deaf community. In addition, the possibility of gaining information via digital media plays a very important role for DHH people (Rachdito and Hidayat, 2022). Nevertheless, recent studies suggest that there is a digital divide between DHH and hearing people, which is not due to difficulties in accessing the internet, but rather to the ability to interact while using digital media (Lago and Acedo, 2017).

Deafness does not necessarily lead to communication disorders, but people with congenital hearing loss are at risk of developing speech and language delays that might also affect communication (Nelson and Crumpton, 2015). In addition, written language acquisition can be challenging for congenital DHH people (Mayer et al., 2021). For people whose first language is sign language, written language is a foreign language that has yet to be learned in school (Clark et al., 2014). Thus, communication and comprehension of written content on the internet might represent a barrier for DHH people that prevents them from digital participation.

Furthermore, lack of experience with the internet might lead to limited knowledge about how to use digital media and how to communicate online. Rachdito and Hidayat (2022) found that DHH people have difficulties in understanding the meaning of untrue or hoax messages in social media. The authors state that emoticons have an essential meaning for DHH people in digital communication to express their feelings and to prevent misunderstandings with others.

In addition to access to digital media and use of different types of media there are other aspects that should be considered. During the COVID-19 pandemic, when e-learning played a crucial role in school education, DHH students either benefited or were left behind (Rodrigues et al., 2022), which was related to the extent to which the advantages of digital media, such as reading captions or using technology for gaining information, could be used by the students.

So, despite the many advantages and the widespread use of digital media, it is conceivable that there are access barriers for DHH people that lead them being digitally excluded. To date, there has only been little research on this topic.

Digital communication—Social media

Today, digital communication is mainly performed via social media that encompass different types of media, such as video and networking platforms, chat services, weblogs, and others (Taddicken and Schmidt, 2017). Even though these services differ in their modes of functioning, they all serve to establish and maintain social contacts.

An online survey that has been conducted on a yearly basis since 1997 examines to what extent social media are used by people living in Germany (Beisch and Koch, 2021). For this, 2,001 German-speaking people aged 14 or older were questioned about their behavior of internet use through the dual frame procedure, a random telephone sampling using a combination of landline and mobile phone numbers, in 2021. The results show that 94% of the people questioned state that they use the Internet in general. Fifty-nine percentage of those also use social media occasionally, 31% even daily. Among the people aged between 14 and 29, even 66% state that they use the Internet on a daily basis. This means that more than half of the German-speaking people from the age of 14 use social networks daily to watch video and live streams, for example, and to comment on posts (25%), to read articles (44%), or to share, post, or like information themselves and to watch the news feed (52%). Increasing age, however, is correlated with reduced daily use of social media; 39% of the people between 30 and 49 years, 17% of the people between 50 and 69 years, and only 4% of the people over 70 years use social media daily. This decrease is not *per se* only connected to people's age but also to the different experiences with socialization, the access to digital media, and the different personal interests of younger and elder people.

In 2021, WhatsApp (81%), YouTube (40%), Facebook (28%), Instagram (26%), Snapchat (10%), TikTok (9%), and Twitter (4%) were the most favored social media platforms in Germany that are used daily or at least weekly (Beisch and Koch, 2021).

Compared to older adults, adolescents and young adults differ in their preference for different types of social media. Ninety-five percentage of the young target group state that WhatsApp is their clearly preferred tool among all messenger service providers and that they use WhatsApp at least once a week. In this group, the social networks Instagram (73%) and Snapchat (44%) are considerably more relevant than Facebook (35%), closely followed by TikTok with 32%. Twitter is only rarely used by young people (9%).

The representativeness of the current data on the use of social media is controversial as the collection and analysis of data mostly take longer than the different trends and tendencies in the use of certain social media. This particularly applies to adolescents, whose behavior in social media usage changes particularly quickly (Wampfler, 2019).

Today, there are no systematic and large-scale studies on social media use of people with disabilities in general, but there are, for example, reviews on the main challenges to the realization of information and communication technology (ICT)-enabled inclusive development (Raja, 2016). Due to differences in access to digital media depending on the various needs of people with disabilities, studies on social media use of all people with disabilities would be methodologically challenging and difficult to implement. For DHH people, specific findings and needs can be derived, which are described in Section "Findings regarding social media use in DHH individuals—A research gap".

Impact of the use of digital media on mental health

There is no doubt that digitalization and the establishment of social media in everyday life as a consequence thereof have provoked a change in the German society (Buttkewitz, 2020). Some refer to it as revolution of social communication (Leiner, 2012) whereas others regard this change in the creation of interpersonal relationships as digital stress (Müller, 2020). Even though the use of social media is mainly determined by the social needs and motifs of the single users, it is still doubtful if social networks can meet those needs or if they even constitute a risk to the users' mental health (Riehm et al., 2019; Kreutzer, 2020).

This could also be particularly relevant for DHH people as it is known that the implications of a hearing loss can go far beyond the linguistic domain (Vissers and Hermans, 2018). DHH children are at risk in their social-emotional development, in executive functioning, and theory-of-mind development (Fellinger et al., 2008). The prevalence of social-emotional problems in DHH children is about twice to three times higher than in hearing children (Hintermair, 2014). Furthermore, many DHH adolescents experience some degree of isolation from their peers or family (Charlson et al., 1992), and older people with acquired hearing loss often suffer from social isolation and loneliness, which is in turn associated with increased mortality (Shukla et al., 2020).

If social media offer many benefits but also represent a potential risk to mental health, it would be of particular interest to find out how this relates to DHH people. In the following, mental health dimensions are defined and study results on the impact of social media use on the different dimensions of mental health are presented.

The WHO defines mental health as the state of wellbeing in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community (World Health Organization, 2022). According to this definition, mental wellbeing can contribute to an improvement in quality of life, performance, and social participation; it is both negatively and positively influenced by individual, genetic, and biological factors as well as family and social conditions, environmental factors, and living conditions (Hapke et al., 2012).

Negative influencing factors, such as little social support or serious events in life, might foster the development of mental disorders like anxiety disorders, depression, or psychoses which are mostly characterized by burdensome and depressive thoughts, emotions, behavior patterns and relations to others (World Health Organization, 2022). This risk, however, can be encountered by means of specific constructs, such as resilience, self-esteem, self-efficacy, optimism, life satisfaction, hope, feeling of coherence, and social integration (Hapke et al., 2012). This means, all these factors have a complex relation to each other and need to be balanced out successfully to obtain mental health. There are several assessment tools for the scientific evaluation of the different protection and risk factors (Hapke et al., 2012). In this context, potential multidimensional risk factors for mental health are also discussed in relation to the use of social media. In the following,

a series of study results are summarized—first in general, then specifically for DHH people.

Self-esteem

By now, social media offer their users innumerable opportunities of controlled self-presentation through posts, disclosure of personal interests, and publicly accessible personal information and photos according to personal preference. As this self-presentation is mostly based on an ideal concept of oneself, which should be liked by as many other people as possible, this results in both social and self-related consequences. Whereas, few studies have shown that the observation of one's own self-presentation on social media might increase one's self-esteem and thus manifest one's own self-concept through self-affirmation (Gonzales and Hancock, 2011; Toma and Hancock, 2013), scientific research in this field mainly focuses on the impact of the observation of other people's social media profiles (Vogel et al., 2014).

Hawi and Samaha (2017) observed in their study that the usage time is related to the self-esteem of social media users: People who frequently use social media (Facebook in this case), have a lower level of self-esteem and try to compensate this lack of self-esteem by a higher activity on social media. In addition, Feinstein et al. (2013), Vogel et al. (2014), and Jan et al. (2017) investigated the impact of social media on the social comparison of oneself with others and on one's self-esteem. In particular, when looking at profiles, posts, and photos of other users who are regarded as highly attractive, sportive or popular, feelings of inferiority arise which might result in depressive symptoms if this feeling comes up too often (Beranek, 2021). Furthermore, they ascertained that users who spend more time on social media than others are more likely to assume that other people are happier and have a better life than they do themselves (Chou and Edge, 2012).

Social integration vs. social isolation

Primack et al. (2017) surveyed 1,787 North American young adults aged between 19 and 32 years and found that more time spent on social media ($\geq$121 min daily) is associated with an increased feeling of social isolation, which in turn impacts negatively on the users' general mental health. As these results are completely contradictory to the actual purpose of social media which is to bring people closer to each other, the authors assume that feelings of social isolation depend on the type of experiences that people make with social media. Another study by Primack et al. (2019) demonstrated that the feeling of social isolation gets strengthened by negative experiences with social media but that this feeling cannot be encountered by positive experiences as initially assumed. Tobin et al. (2015) reported a similar impact of negative experiences and moreover found that social media users, who do not get feedback on their posts, have a decreased sense of belonging and feel socially excluded. On the other hand, there are studies that show that the use of social media can facilitate social integration and reduce the feeling of loneliness. Ellison et al. (2014) and Krämer

et al. (2017), for example, concluded in their studies that users who use social media for relationship building and who actively contribute to the establishment, maintenance, and cultivation of social contacts, expand their social capital in doing so. Due to the heterogeneity of social media contacts, this in turn reinforces the emotional and social cohesion, facilitates access to new information and knowledge, and increases the users' wellbeing (Ellison et al., 2014). Further studies found that active and intensive relationship building on social online platforms—besides the establishment of a social capital—also creates a strong community spirit and feeling of connectedness and might considerably reduce the feeling of loneliness (Steinfeld et al., 2008; Gruzd et al., 2011; Lou et al., 2012; Deters and Mehl, 2013).

Social media addiction

As many studies revealed intensive social media use as a potential cause of mental health issues, several scientific studies have been trying to find out if excessive social media use equates addiction (Chou and Edge, 2012; Vogel et al., 2014; Andreassen et al., 2017; Brailovskaia et al., 2018; Hou et al., 2019). Indeed, these studies show that excessive social media use might cause symptoms that are normally related to substance addiction (e.g., drugs or alcohol) and that might lead to health issues. As there is no definition of the term social media addiction and as there are no instruments for the diagnosis of social media addiction, Müller (2020) pointed to the criteria for the diagnosis of computer gaming addiction stipulated in Revision 11 of the international statistical classification of diseases and related health issues (ICD-11) which can also be applied to social media use. Based on that, a person is affected by social media addiction if:

- He/she has notably reduced control of the social media use (loss of control).
- The social media use is gaining excessive importance in the user's life, through which other fields of interest and everyday activities get replaced or considerably reduced.
- He/she does not change the behavior of social media use despite noticeable negative impacts in spheres (e.g., social contacts, level of performance, health).
- The psychosocial level of functioning gets constantly impaired by the symptoms mentioned above (Müller, 2020, p. 231).

According to another study by Müller et al. (2018), particularly girls aged between 10 and 17 years demonstrate problematic usage behavior, which meets the criteria mentioned above and which is indicative of an addiction to social media. Experts also assume that excessive social media use can be ascribed to previous critical experience in life, as two thirds of the people questioned answered that they were affected by an extraordinarily strain in the previous year.

Hou et al. (2019), however, observed that social media addiction does not necessarily derive from an already existing reduced mental health status but that the psychological dependence on social media *per se* has a negative impact on mental health, for instance in terms of reduced self-esteem. Experts, however, do not exclude

that reduced mental health might in general lead to social media addiction, especially if people with reduced self-esteem try to compensate this through their activities on social media (Hawi and Samaha, 2017).

Brailovskaia et al. (2018) conducted the first study in Germany on this topic: they investigated the relation between Facebook addiction and the users' personality and mental health status and concluded that Facebook addiction does not only derive from excessive Facebook use but that it particularly affects people who constantly thrive for self-affirmation and thus try to increase their self-esteem through positive feedback by others. Furthermore, they observed that Facebook addiction is also accompanied by health issues, such as depression and states of anxiety.

These findings were underpinned by a study by Andreassen et al. (2017) who found that besides people who excessively thrive for self-affirmation also young people, females, singles, university students, people with a low educational level, people with low income, and people with low self-esteem are particularly prone to the development of an addiction to social media. People with disabilities, especially disabilities or disorders that affect communication, were not considered in these studies.

Fomo—Fear of missing out

Reinecke et al. (2017) assume that besides the aspects that were just mentioned there are also motivational factors, such as social pressure and the fear of missing out, that might lead to a problematic usage of social media and thus to digital stress which might manifest in symptoms of burn-out, anxiety disorders, sleeping disorders, depression, inner restlessness, and lack of drive. In this context, the psychological concept of FoMo (Fear of Missing out) is important; it describes the fear of missing out on special events in a social community, of losing popularity, and of getting socially excluded if one does not fully dedicate to the respective community (Müller, 2020). Resulting from this, the people affected develop the need of being constantly informed about what other people do and experience.

Przybylski et al. (2013) first investigated potential risk factors that might promote the development of FoMo. They concluded that the fear of missing out is stronger if the three psychological basic needs of self-determination, self-efficacy, and social integration are not at all or only insufficiently satisfied. Reer et al. (2019) investigated the relation between FoMo and social comparison with others and ascertained that people with psychosocial issue (e.g., depression, loneliness, or states of anxiety) do not only have a high level of FoMo but also strongly tend to compare themselves with others, thus demonstrating a problematic usage of social media. Roberts and David (2020) also demonstrate that the omnipresent opportunities of connecting with other people online might result in a general increase of FoMo.

Different studies finally conclude that people who are strongly affected by FoMo, demonstrate a problematic social media usage (Przybylski et al., 2013; Abel et al., 2016; Reinecke et al., 2017; Reer et al., 2019; Roberts and David, 2020; Tandon et al., 2021). In this context, FoMo constitutes the crucial relation between mental

health and social media use (Przybylski et al., 2013; Roberts and David, 2020; Tandon et al., 2021).

Even though these scientific findings hypothesize only negative impacts of the FoMo phenomenon, Roberts and David (2020) highlight that FoMo might also have positive impacts on the users' social connectedness and mental wellbeing if FoMo makes them actively build relationships with others.

Findings regarding social media use in DHH individuals—A research gap

The establishment of social media in everyday life offers great advantages to target groups like DHH individuals because they facilitate communication and relationship building and, as a consequence, social inclusion thanks to the direct communication in writing, audio-based or sign-language posts (Blom et al., 2014; KoŽuh et al., 2015; Martzos et al., 2021). Several scientific findings assume that the primarily written communication on social media helps disguise the hearing loss in many cases which makes DHH individuals feel less stigmatized (KoŽuh and Debevc, 2020). However, the dominance of written language on social media might make passive and active interaction on social media more difficult for DHH individuals depending on their competence in written language, which might in turn further promote social isolation, loneliness and stigmatization (KoŽuh et al., 2015; Martzos et al., 2021).

Mack et al. (2020) found in a survey in DHH individuals that people whose first language is sign language often feel forced to create posts in written form even if their competence in writing is rather low. Although there is the opportunity of uploading and sending videos in sign-language, this is often hindered by bad internet connection, high battery consumption, or low data volume. It is also regarded as challenging to create sign-language videos on social media as the person signing first needs to position the smartphone in a way that the camera fully covers them and as they might even be forced to sign while holding the smartphone in the other hand, which considerably exacerbates sign-language communication on social media. According to the results of the study by Mack et al. (2020), the main reason why DHH individuals primarily communicate in written form on social platforms is the wish for social interaction and participation in digital communication.

As sign-language videos on social media (as opposed to audio-based video posts) cannot be automatically subtitled, the contents of those videos are not accessible to most people, which precludes the opportunity of multimodal and barrier-free communication for everyone.

Nevertheless, digital communication by DHH individuals via social media is primarily seen as relieving as it involves less effort and stress than face-to-face communication or (even worse) telephone conversation (Blom et al., 2014; KoŽuh and Debevc, 2020). In a way, the selection of the communication modality, however, seems to depend on the social platform that DHH individuals are active on and which modality can be used with the least effort. According to a study by KoŽuh and Debevc (2020), this provokes that DHH individuals with good written language

knowledge rather use written language on Facebook, for example, as written language is predominant there and regarded as intuitive.

A Greek study on the online behavior of DHH individuals concluded that people focusing on sign language prefer the use of Instagram because they feel at ease when searching for information, communicating with people, looking for entertainment, and building relationships as they can easily communicate via sharing short videos and photos on this platform (Martzos et al., 2021). The video platform YouTube, however, is not barrier-free accessible to all DHH individuals as it mainly uses spoken language although many videos are provided with captions.

Regarding the general usage behavior of DHH individuals in the different social networks, KoŽuh et al. (2015) and Martzos et al. (2021) conclude that DHH people tend to increasingly use digital communication in social networks. Blom et al. (2014) state this is related to the fact that DHH people use social media to reach out to relatives and friends whereas hearing people still prefer to contact people via the phone. This type of relationship building via social media has a huge impact on the feeling of belonging of DHH individuals according to KoŽuh et al. (2015) and Paglieri et al. (2022). Away from that, deaf individuals use social media to spread awareness of the Deaf community (Bart et al., 2022). Yet, there is not much evidence on how exactly digital participation is ensured and to what extent social media use impacts on mental health of DHH individuals.

Lake (2020) conducted a study in 191 North American DHH and hearing university students on the potential relations between the use of social media and feelings of isolation, cultural adaptation processes, self-esteem, FoMo, and social media addiction and potential differences between the study participants. He observed that DHH individuals used four different social media accounts on average which they used daily for around 3.78 h and thus hardly differed from the control group of hearing people. However, this study clearly demonstrated lower self-esteem, a stronger feeling of loneliness, a higher rate of the FoMo phenomenon, and a higher rate of social media addiction in the DHH study participants. The author assumed that the cultural feeling of belonging in deaf individuals who use sign language impacts on the social media use and might be decisive whether DHH individuals exclusively communicate online and interact with DHH people or also with hearing people. Generally, Lake (2020) concluded that people who feel affiliated with the Deaf community spend less time on social platforms.

Materials and methods

Research on digital participation and the psychological impacts of social media use in hearing people is already quite advanced whereas hardly any scientific evidence exists on the potential impacts in DHH individuals. Since it is known that DHH individuals are at a higher risk of being affected by reduced mental health than hearing people (Blom et al., 2014; Bogner and Hintermair, 2021), this article aims to make a contribution to this highly topical and important research field, whereas at the same time, the advantages of digital participation should in no instance be diminished.

The present study is a quantitative cross-sectional study based on a one-off data collection in Germany. The assessment tool used is a specifically designed German online questionnaire. Considering that today web surveys constitute one of the most important and most frequently used method of online surveys, a standardized questionnaire was designed based on the SoSci Survey web application (Leiner, 2019) and provided to the study participants via a link. To ensure data quality, a conscientious and error-minimizing questionnaire design is of utmost importance. Therefore, the online questionnaire was designed based on the study design by Lake (2020), building up from simple to complex topics in order to counteract a high drop-out rate.

The study aims to answer the following questions:

1. What social media usage behavior can be observed among the users surveyed, considering

   - age,
   - usage of different platforms,
   - daily usage time,
   - type of usage (active/productive vs. passive/receptive),
   - communication modality (spoken language, sign language, bimodal-bilingualism, signed speech/key word signing)?

2. How does social media usage relate to the following dimensions of mental health in the people surveyed:

   - Self-esteem,
   - Fear of missing out (FoMo),
   - Feeling of social isolation, and
   - Social media addiction?

After the collection of demographic data, such as age and hearing status, the participants were questioned regarding their interests, personal preferences, and their behavior when using social media and communicating on social media. For this, the participants were at first questioned for which of the seven social media platforms (Facebook, Instagram, TikTok, Snapchat, Twitter, YouTube, WhatsApp) they have an account. Then, the participants were asked to indicate which of the previously mentioned social media they really use. As a next step, the participants were asked about their personal preferences when using social media. Here, they were asked to indicate on a 6-point Likert scale which of the previously mentioned social media they prefer to use to publish content themselves; only the endpoints of the scale were labeled (1 = mostly preferred, 6 = not preferred at all). For the WhatsApp messenger service, information was added in brackets to make it clear to the participants that the aim of the study was to find out about their use of the public status function and not about their private chats on WhatsApp.

The next two questions aimed at assessing how often the participants use the social media and whether they use it rather passively/receptively (reading messages, browsing through newsfeeds) or actively/productively (writing private messages, publishing posts, commenting posts). For this, two 6-point Likert scales were created which the participants were supposed to use for indicating if they use the social media "less than once a day, once or twice daily, 3–4 time daily, hourly, half-hourly, or often than half-hourly", once for the active use and once for the passive

use. The next question focused even more on the usage time. For this, the participants were asked about their estimated daily use of the different social media in minutes. Here, the participants could either refer to their documented screen time on their smartphones or give a self-estimation and then enter the time into the open text field.

As a next step, four standardized scales for the assessment of self-esteem, feeling of social isolation, fear of missing out, and degree of social media addiction were applied.

For the assessment of self-esteem, the Rosenberg Self-Esteem Scale (RSES) developed by Rosenberg in 1965 and revised and improved by Collani and Herzberg in 2006 was applied (Rosenberg, 2015). The RSES comprises ten items that alternate between positive (items 1, 3, 4, 7, and 10) and negative (items 2, 5, 6, 8, and 9) statements, which allow for a holistic evaluation of one's own person and personality. In the original version of the RSES, the positive statements are analyzed on a 4-point Likert scale with 1 = strongly disagree up to 4 = strongly agree and in reversed order for the negative statements. The total score can reach between 10 and 60, the higher the score the higher the level of self-esteem. In our study, the RSES was applied as a six-point Likert scale (strongly agree, agree, somewhat agree, somewhat disagree, disagree, strongly disagree). The number of response options in the Likert scale (4, 5, 6, or 11 points) on the scale has no influence on the scale's reliability (Leung, 2011). The revised version of the RSES has a high internal consistency (Cronbachs α) of 0.84 and a high power of the items (between 0.50 and 0.71), which indicates high measurement accuracy and content validity of the translated scale.

To be able to assess the phenomenon of FoMo in this online survey, the Fear of Missing Out Scale (in the following abbreviated as FoMoS) in English language was applied. This scale developed by Przybylski et al. (2013) serves to assess and operationalize the phenomenon of FoMo and measure on a 10-item scale to what extent the participants are affected by FoMo and that other people could have more rewarding experiences than they do themselves. The 10 items are to be answered on a 5-point Likert scale (1 = "does not apply at all" up to 5 = "fully applies"). The total score can range from 10 to 50; the higher the score, the higher the degree of FoMo. The FoMoS is generally considered to have a high level of reliability and internal consistency of Cronbachs α = 0.87 up to 0.90 (Elhai et al., 2020).

The feeling of social integration and social isolation was assessed using a translated version of the originally English assessment tool Patient-Reported Outcomes Measurement Information System Social Isolation Scale (PRO-MIS SI-S) (Health Measures, 2016). This is a standardized scale in different versions that only differ from each other in the number of test items. In the present study, the Short Form v2. Social Isolation 8a version was used, because in this version, in contrast to the original version, all participants answer the same questions, which in turn allows for direct comparison of the data collected. With the PRO-MIS SI-S, the study participants were confronted with eight statements on the subjective perception of the feelings of social exclusion and loneliness which the participants were asked to evaluate on a 5-point Likert scale (1 = "never" up to 5 = "always"). A t-value higher than 50 corresponds to an excessive perception of feelings of social exclusion and loneliness and thus to a higher perception

of social isolation. The PROMIS SI-S is a scale with an excellent internal consistency (Cronbachs $\alpha = 0.92$) and high validity and measurement accuracy (Primack et al., 2017).

To assess a potential social media addiction among the study participants, the Social Media Disorder Scale (SMDS) was used (van den Eijnden et al., 2016). This scale comprises nine dichotomous-discontinuous items which the participants could simply answer with "yes" or "no". The items relate to retrospective self-estimation and survey if the participants observed a feeling or behavior of conquering thoughts, withdrawal symptoms, tolerance development, unsuccessful attempts of abstinence, or loss of interest in previous activities in themselves in the past year. If at least five items are answered with a "yes", a social media addiction is diagnosed according to the SMDS. With a high internal consistency (Cronbachs $\alpha = 0.81$) and a high validity and reliability, this scale is regarded as a suitable tool for the diagnosis of social media addiction.

The RSES for the online survey within our study was available in the revised version by von Collani and Herzberg (2006) in German whereas the FoMoS, PROMIS SI-S, and SMDS were only available in the original English version. Therefore, they were translated into German based on the principle of back-translation (Brislin, 1970). This means, the three original English scales were translated into German and reviewed by experts. The back-translation into English was then done by an English native speaker who was not familiar with the original English version of the scale. The two English versions of the three scales were than compared to each other, checked for translation quality and equivalence, and a final German version of the scale was created based on this.

To answer the research questions, Pearson correlation analyses and Spearman rank correlation tests were conducted.

Participants and recruitment

For the recruitment of the sample, DHH people involved in 12 German-speaking Facebook groups on topics about deafness and hearing were invited to participate in this online survey. The invitation was also forwarded to DHH students of the University of Cologne via Facebook. The inclusion criterion was a person's age over 18 years and the indirect inclusion criterion of written language comprehension since the questionnaire was only offered in written modality. At the beginning of the survey, the respondents were informed about the purpose and content of the survey. Subsequently, the participants gave their consent to participate in the survey by accepting the privacy statement.

Within 3 weeks, the link to the online survey was opened 257 times; 51 of these 257 people partially completed the questionnaire, 38 people fully completed the questionnaire. This means, 14.8% of the 257 link clicks resulted in a complete participation in the survey. To avoid data distortion, only fully completed online questionnaires were included in the study. In the other remaining 13 cases, where the questionnaire was only partially answered, a reason for dropout is not always apparent. In three quarters of the cases, the dropout occurred after the first few pages, in others at a later time. It is possible that the written modality of the

TABLE 1 Participant overview.

Participant information	Deaf and hard of hearing (DHH) social media users ($n = 38$)
Age: mean (standard deviation)	40.61 (14.37)
Gender: n_{women} (%$_{women}$)	28 (73.6)
Communication modality: n (%)	Spoken language: 18 (48) Bimodal bilingual: 13 (34) Signed speech/key word signing: 2 (5) Sign language: 5 (13)

questionnaire presented a barrier in some cases. However, it is not possible to conclude this with certainty. All participants who only completed part of the questionnaire, were not included in the study and in the data analysis.

The sample of the people surveyed comprises 38 DHH adults (28 female, 10 male) aged between 19 and 69 years ($M = 40.61$, SD $= 14.37$). Almost half of the 38 ($n = 18$; 48%) state that they only communicate in spoken language in their everyday lives (Table 1). Five of the 38 (13%) state that they only communicate via sign language; 13 of the 38 (34%) are bimodal-bilingual users as they use spoken language as well as sign language. The data were based on self-assessment. In addition to the predefined options of spoken language, sign language and bimodal bilingualism, there was the possibility to select the option "other forms of communication". Here, both sign supported speech and key word signing were named. Only two persons of the 38 (5%) state that they primarily communicate using sign supported speech and key word signing as a supportive medium for spoken language.

Data analysis

For the data analysis, correlation analyses were performed using the SPSS Version 28.0.1.1 statistical software. For the at least interval-scaled variables, the Pearson correlation was performed which served to analyze the power of the linear relation between two variables. For the at least ordinal-scaled variable, the Spearman's Rho ρ correlation coefficient was calculated, which also tests the power and the direction of the relations.

Results

As expected, the participants in the study were extremely diverse, which becomes particularly evident in the type of hearing care they use. The majority of the study participants (42%) is provided with hearing aids on both ears. This group mainly comprises people who communicate in spoken language and bimodal-bilingual people. Thirteen percentage of the participants have a cochlear implant on either one ear or both ears. Ten percentage use a hearing aid in one ear. Four participants (11%) state they do not use any type of hearing aid or hearing implant. Three of these four participants communicate via sign language whereas one of the four uses both sign langue and spoken language in everyday communication. Four participants stated they use a

different type of hearing aid or implant (11%). One of them has bimodal provision with an active bone conduction implant and a hearing aid. One person uses a CROS (Contralateral Routing of Signals hearing aid for unilateral hearing loss). One person has bimodal provision with a hearing aid and a cochlear implant. One person stated that she would get the first cochlear implant soon. The data on the diversity of hearing care and thus on the hearing status of the participants reflect the heterogeneity of the group of people with DHH. The onset of hearing loss (congenital, acquired) was not recorded in the questionnaire.

Social media use

The study participants were first asked whether they preferred face-to-face or digital communication. Fifty-eight percentage stated that they preferred face-to-face communication with friends and acquaintances whereas 60% preferred communication with foreign people via chat.

On average, the 38 people surveyed have 4.13 accounts on different social media platforms. All study participants in our sample have at least one account. The daily usage time is 3.78 h according to self-estimation. With an average daily use of 170 min (∼2.8 h), our study participants communicating in sign language are below average.

Eighty-seven percentage of the people questioned stated that they use WhatsApp. This is the most frequently used social media platform in our survey. Most WhatsApp users (52%) only use spoken language in their everyday life. The second most popular social media network among the study participants is Facebook. In total, 26 people (68%) stated that they really use their Facebook account. Most Facebook users (54%) also use spoken language in their everyday life. The third most frequently used social network with 25 active accounts is Instagram. Forty-four percentage of the Instagram users in our study are bimodal-bilingual users. The fourth most frequently used network with quite a gap to Instagram is the video platform YouTube. Twelve people stated that they really use their accounts on this platform. Half of the YouTube users in our study are people who only use spoken language in their everyday life. The other half comprises two users who use sign language and four users who use both spoken language and sign language in everyday communication. TikTok ($n = 7$), Snapchat ($n = 6$), Twitter ($n = 4$), and other platforms are considerably less frequently used social media tools.

Table 2 shows how often the study participants receptively use social media according to their self-assessment, e.g., for reading messages or going over the newsfeed. On the other hand, it shows how often they productively use social media to write private or public message and to publish, share or comment content. Only 38% of the people questioned state that they use social media less frequently than on a daily basis. Most people surveyed (45%; $n = 17$) use the different social media channels passively three to four times a day. Similar to this, these channels are also actively used three to four times a day by most people surveyed (32%; $n = 12$). Ten percentage of the study participants ($n = 4$) actively use social media even more often than half-hourly; 5% ($n = 2$) of the study participants state that they do so passively.

TABLE 2 Comparison of passive and active social media use.

Passive and active social media use	Passive: *n* (%)	Active: *n* (%)
	DHH ($n = 38$)	DHH ($n = 38$)
Less than daily	1 (2.6)	9 (23.7)
Once or twice a day	9 (23.7)	7 (18.4)
Three or four times a day	17 (44.7)	12 (31.6)
Hourly	5 (13.2)	5 (13.2)
About half hourly	4 (10.5)	1 (2.6)
More often than half-hourly	2 (5.3)	4 (10.5)

Thirty-five of the 38 study participants provided information on their daily social media use. The people surveyed stated that they spend 203.31 min per day on social media on average (SD = 176.31). with a range of $r = 993$, the values of usage time range between 27 and 1,020 min per day.

With a mean usage time of 269.91 min (SD = 227.18; $R = 993$), the bimodal-bilingual participants use social media the longest every day. The social media community Facebook is mostly used by people solely communicating in spoken language with a usage time of 54.35 min per day (SD = 48.47; $R = 120$). Also, the study participants using spoken language in everyday life have the highest daily usage time on Twitter with an average of 3.81 min (SD = 14.99; $R = 60$), 22.94 min on Youtube (SD = 54.26; $R = 200$) and 70.06 min (SD = 59.20; $R = 190$) on WhatsApp. 23 of the 35 study participants (66%) reach the critical value of ≥ 121 (Primack et al., 2017) minutes social media use per day.

Social media and mental health

In the following, the results of the participants in the four scales of mental health are briefly explained, taking into account that in some cases there were only very few participants per group, e.g., only two participants using signed speech or key word signing and five participants using sign language. Table 3 provides an overview of the mean and the standard deviation of the test results of the four different scales obtained, also factoring in the participants' communication modality.

The lowest scores for self esteem were achieved by the sign language users (RSES score: 35.40). The other participants scored higher for self-esteem with an average gap of up to 10 score points compared to the sign language users. While the two people who used signed speech and key word signing scored highest on self-esteem, their scores on fear of missing out were also highest (FoMoS score: 25.50).

In terms of social isolation, the average of the participations in the sample fell below the critical value of the scale. Here, the spoken language users were the most affected according to their self-assessment (PORMIS SI-S score: 55.11; critical value: >50).

Subsequently, when looking at the results of the social media disorder scale, the participants of this study did not show any results above the critical value on average. The highest scores, and thus those closest to the critical value, were observed among the

TABLE 3 Results of the scales considering the communication modality.

DHH (n = 38)	Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 2015) (German version)		Fear of Missing Out Scale (FoMoS) (Przybylski et al., 2013) (Translated into German)		Patient-Reported Outcomes Measurement Information System Social Isolation Scale (PROMIS SI-S) (Health Measures, 2016) (Translated into German)		Social Media Disorder Scale (SMDS) (van den Eijnden et al., 2016) (Translated into German)	
	M	SD	M	SD	M	SD	M	SD
Min–max	10–60	–	10–50	–	33.9–76.9	–	0–10	–
Critical value (if applicable)	–	–	–	–	**>50**	–	**≥5**	–
Sign language users (n = 5)	35.40	6.77	20.80	10.62	52.56	5.79	3.40	2.70
Spoken language users (n = 18)	43.83	8.42	22.11	6.28	55.11	7.06	1.28	1.96
Bimodal bilingual users (n = 13)	44.85	7.95	20.08	6.54	51.95	4.40	2.31	2.32
Signed speech/key word signing users (n = 2)	46.50	6.36	25.50	4.95	52.65	5.30	1.50	0.71
Mean in total	43.21	8.31	21.00	6.80	53.56	5.98	1.92	2.21

Marked in gray: lowest score for self-esteem/highest score for fear of missing out; scores above critical value; marked in bold: critical values; M, mean; SD, standard deviation.

TABLE 4 Pearson correlation analyses of different aspects of social media use and dimensions of mental health.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Age	–						
(2) Daily usage time	−0.064	–					
(3) Number of social media accounts	−0.056	0.124	–				
(4) Self-esteem	0.085	−0.216	0.384*	–			
(5) Fear of missing out	−0.083	0.316	−0.320	−0.437**	–		
(6) Social isolation	0.141	0.053	−0.273	−0.509**	0.458**	–	
(7) Social media addiction	0.177	0.350*	−0.230	−0.392*	0.377*	0.339*	–

$^{*}p < 0.05$; $^{**}p < 0.01$; $r = 0.01$ (small effect); $r = 0.03$ (medium effect); $r = 0.05$ (high effect).

sign language users (SMDS score: 3.40; critical value ≥ 5). Six of the 38 study participants (16%) had a critical value of more than 5 points on the SMDS scale.

Table 4 shows the results of the Pearson correlation analyses of social media use and the different dimensions of mental health.

The participants' age neither correlates with the behavior of usage of social media nor with their mental health (time of usage: $p = 0.703$, daily used social-media accounts: $p = 0.737$, RSES: $p = 0.612$, FoMoS: $p = 0.621$, PROMIS SI-S: $p = 0.399$, SMDS: $p = 0.288$). Moreover, the time of usage is not related to self-esteem ($p = 0.193$). However, as expected, there is a significant positive correlation of medium degree between the daily time of usage of social media and social media addiction ($p < 0.05$).

Likewise, the Pearson correlation coefficient shows a significant positive correlation of medium degree between the daily used social media accounts and the study participants' self-esteem ($p < 0.05$). In addition, there is a significant highly negative correlation between the participants' self-esteem and the feeling of social isolation ($p < 0.01$). Moreover, the Pearson correlation coefficient shows significant medium-high negative correlations between the participants' self-esteem and the degree of FoMo ($p < 0.01$) and

social media addiction ($p < 0.05$). The degree of social media addiction correlates significantly positive with the degree of FoMo ($p < 0.05$) and the personally perceived feeling of social isolation ($p < 0.05$). Furthermore, a significant positive correlation between the personal perception of social isolation and FoMo was observed ($p < 0.01$).

Table 5 shows the results of the Spearman rank correlation test.

There is a significant highly positive correlation between the frequency of daily active social media use and personally perceived social isolation ($p < 0.01$) and a significant medium-high positive correlation between active social media use and the degree of social media addiction ($p < 0.01$). However, no significant correlation was observed between the frequency of daily passive social media use and the participants' mental health.

Discussion

Digital participation is essential for DHH people and digital media offer many advantages, but they might not be fully accessible to everyone. Access for DHH people is not so much a technical

TABLE 5 Spearman rank correlation test of different aspects of social media use and dimensions of mental health.

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Social media use (active/productive)	–					
(2) Social media use (passive/receptive)	0.205	–				
(3) Self-esteem	−0.109	−0.215	–			
(4) Fear of missing out	0.246	0.150	−0.426**	–		
(5) Social isolation	0.511**	0.063	−0.452**	0.476**	–	
(6) Social media addiction	0.415**	0.151	−0.469**	0.493**	0.370*	–

$^{*}p < 0.05$; $^{**}p < 0.01$; $r = 0.01$ (small effect); $r = 0.03$ (medium effect); $r = 0.05$ (high effect).

issue but more influenced by competencies such as spoken/sign language and communication skills (Constantinou et al., 2018). In terms of communication, especially social media play an important role today. Social media offer both chances and risks as far as new opportunities of digital and social participation but also negative impacts on people's mental health are suspected (Karim et al., 2020).

The way how DHH individuals use social media for digital participation and how social media affect the different dimensions of their mental health has hardly been investigated to date. The present study contributed to this topic by looking at social media use as well as correlations between usage and mental health of DHH people.

The results show that the people in this study who use sign language for everyday communication use WhatsApp the least with a daily usage time of 31 min. Also, they only spend 1 min per day on Twitter on average. This suggests that passive and active social media use, particularly on primarily written language-based social media platforms, such as WhatsApp or Twitter, seem to be less attractive for people communicating in sign language and thus are less frequently used by this population. With an average daily usage time of 54.35 min on Facebook and 22.94 min on YouTube, people using spoken language for everyday communication spend the most time on these platforms.

However, particularly with the use of Facebook one can see that the usage time in the participants communicating in sign language only differs by 10 min from the usage time in the participants communicating in spoken language (sign language users: 44.00 min; SD = 47.09; R = 120). This might be explained by the fact that Facebook offers manifold functions and opportunities of communication and interaction that can be used regardless of the communication modality. The photo and short video platform Instagram is the mostly used social media platform among the study participants communicating in sign language with a daily usage time of 75 min.

In summary, we can state that the social media use of the DHH participants surveyed in our study does not generally differ from other people's behavior of social media use. The results of the 38 people with DHH surveyed comply with the study results of Lake (2020) in that the number of accounts (4.13 on average) and usage time of social media (3.78 h per day) of our study participants do not differ from other DHH individuals or hearing adults.

Nevertheless, DHH people communicating in sign language are below average in social media usage time of 2.8 h per day. This also confirms the results of the study by Lake (2020) who found that

people who use sign language tend to spend less time on social media than hearing people or DHH individuals who communicate in spoken language. Access barriers could be responsible for this, mainly a lack of sign language communication on the internet and difficult access to written information. Consequently, there seem to be differences in DHH people in the use of social media depending on the preferred modality of communication. People mainly communicating in sign language in everyday life rather tend to use intuitive photo and video platforms, such as Instagram, whereas people mainly communicating in spoken language rather tend to be more active on social media platforms that primarily provide content in written or spoken language.

Apart from differences in social media use, which may be affected by access barriers or low attraction, the question arises to what extent social media influences the mental health of DHH people, especially adolescents, who represent a vulnerable group here (Brown and Cornes, 2015).

In this study, there was no correlation between **(a) self-esteem** of the DHH participants surveyed and the number of social media accounts, the usage time or usage mode (active/productive vs. passive/receptive). On the contrary: the more social media accounts the DHH study participants had, the higher their level of self-esteem was.

Regarding the impact of social media use on **(b) the fear of missing out (FoMo)**, the study results indicated that according to the participants' self-estimation they were only affected by slight degrees of FoMo. No significant correlation between the time of social media use and the number of used accounts or the degree of FoMo was observed.

Regarding the phenomenon of **(c) social isolation**, it was observed that the DHH study participants exceeded the critical t-value of the PROMIS SI-S by 2.56 points on average and thus experienced more feelings of loneliness and social exclusion than the hearing participants from the norm sample. This outcome was not related to the communication modality although the spoken language users scored highest in the feeling of social isolation. The results show that the perception of social isolation and loneliness is associated with more frequent active social media use. Passive social media use, however, is not related to the perception of social isolation and loneliness.

Regarding the **(d) social media addictive behavior**, a significant correlation was observed between the active time of social media usage and social media addiction: the more the DHH study participants actively used social media, the more

frequently they were affected by social media addiction. The length of passive social media use, however, has no impact on the personal perception of addiction.

Based on the findings of this study and considering the main research question, how all of these findings affect digital participation of DHH people, there are several aspects to consider: First, digital participation can not be measured as the time spent using digital (and in this case social) media, as it becomes clear that there also might be possible risks—not only for DHH people (Brown and Cornes, 2015). Rather, digital participation could be measured by the extent to which a person sees him- or herself as self-efficacious when it comes to using digital media. This could be achieved with qualitative research approaches. Second, our study sample of DHH adults had high values in the perception of social isolation. Thus, there is a need for research into the extent to which digital participation can lead to a sense of being part of the society and whether social media can make a positive contribution here.

However, in this study only correlations were determined. This means we could not determine if social media have a negative impact on mental health of DHH people or if those who are generally exposed to different risks regarding their mental health are more likely to develop a problematic and addictive behavior of social media use. To find that out, further studies with a mixed method study design (quantitative & qualitative) and long-term studies are needed.

Limitations

The validity of the results of the present study is subject to several limitations. The sample of 38 DHH study participants is too small to be able to draw conclusions for the entire population of DHH adults. The recruitment mode also needs to be looked at critically as most of the recruiting was done via the social media platform Facebook, which bears the risk of selection bias. Moreover, everybody could decide for themselves if they wanted to participate in the study or not. Maybe people who observed a problematic social media usage behavior in themselves did not participate in the study because they felt uncomfortable with this topic.

Data collection might also be criticized. When developing the questionnaire, for example, four scales for the assessment of mental health were used but the language level was not adjusted. Some of the items were highly complex statements and formulations which were probably hard to understand or not understandable at all for people who find it difficult to process written language. To make the participation in the study easier, the survey would also have to be provided in sign language videos and written plain language in addition to the original written version; this is highly recommended for future studies. However, offering the scales in two versions (written and sign language) as well as different difficulty levels of the written modality would have required validation of the questionnaire first, so that without validation the results of this study in different language versions would have been limited.

It should also be noted that the scales used in the questionnaire are originally paper and pencil versions that have now been transferred to an online version. Although attention was paid to ensure that the scales did not differ visually from the paper and pencil versions, it is possible that completing the online version may have resulted in different response effects than completing the paper and pencil version. In an online version, for example, questions cannot simply be skipped, as access to the next page is sometimes only possible once all questions have been answered.

Another limitation refers to the assessment of the daily time of social media use in minutes because the study participants could decide for themselves whether they entered the subjectively estimated time of usage per day or the usage time that appeared on the screen of their smartphones. The self-estimation of daily social media use might result in false estimations.

This study raises further questions on the positive effects of social media on social participation and contribution of DHH people that should be further investigated. Future studies in this research field might be designed in a way that they involve greater samples and people mainly communicating in sign language by means of sign language translations.

Conclusion

The results of this study provide a basis for further studies. As DHH people, especially those who use sign language, are generally more at risk of being excluded than hearing people (Silvestri and Hartman, 2022), new strategies for digital participation are needed, and social media might offer them. Access to digital media for DHH people does not only apply to compensations offered by technology, for example captioning, sign language videos or other techniques, but also opportunities for increasing interaction, for improving language skills, for enhancing learning experiences and motivation while using digital media (Toofaninejad et al., 2017). For DHH school education, this opens completely new possibilities.

A participatory research approach would be desirable, in which digital media are developed and improved together with DHH people. Access can be very different for DHH people, so that, for example, not all DHH people benefit from sign language videos. For others, high audio quality is extremely important, or the captioning of spoken language, or visual support of information, or the use of written plain language, or many other aspects that consider the diversity of the group of DHH people.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

KS and FM conceived the study and contributed to its conception and design. KS wrote the manuscript. FM collected the

data and conducted the data analysis with the assistance of KS. Both authors read and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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