Digital Fluency - Inspecting the Role of Supporting Factors in the Organizational Context: A Multi-Level Approach

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"[...] but I'm not afraid of storms, for I'm learning how to sail my ship."

- Louisa May Alcott (1968) Part 2, Chapter 44: My Lord and Lady

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> *"This process of the good life is not, I am convinced, a life for the fainthearted. It involves the stretching and growing of becoming more and more of one's potentialities."*
>
> *- Carl Rogers (1961) p. 196*

SUMMARY

Digitalization is leading to significant changes in the world of work and transpires as a constant challenge in today's working life. To a certain extent, all employees are affected by digitalization and must acquire and develop digital competencies. To stay competitive, digital competencies or digital fluency could be a substantial competence. This dissertation conducts three empirical studies to expand our knowledge of employees' digital fluency, particularly the antecedents and influential factors on the acquisition of digital fluency. The three empirical studies in the dissertation move from the individual-level to the dyadic-level to the team-level perspective to provide as comprehensive an overview as possible of the acquisition of digital fluency.

Study 1, with the focus on the individual-level, provides a better understanding of the individuals' willingness of training participation, the role of personality, specific training, and the matching between these constructs. Based on 1,007 employees surveyed at a large German technology company, the study reveals that the employees' personality has an impact on their willingness of training participation. Study 2 operates on the dyadic-level and found that leadership behavior: empowering leadership and the leaders' personality have an effect on employees' acquisition of digital fluency. Building on a sample of 486 employees from a medium-sized company, Study 2 contributes to a comprehensive understanding of influential factors on employees' acquisition of digital fluency. Study 3 offers a better understanding of dyadic relationships within work groups, their influence on collective digital fluency, and the moderating effect of the leader-member exchange climate on the team-level. Results from a collected dataset of 805 employees from a large German company confirmed a moderating effect of leader-member exchange climate on collective digital fluency.

Overall, the dissertation findings highlight the importance of different antecedents and influential factors in the acquisition of digital fluency. The unique insights can help practitioners build a more suitable work environment for employees to become and stay digitally fluent and thrive in the future.

ZUSAMMENFASSUNG

Die Digitalisierung führt zu großen Veränderungen in der Arbeitswelt und stellt eine andauernde Herausforderung im heutigen Arbeitsleben dar. Viele Beschäftigte sind, zumindest bis zu einem gewissen Grad, von der Digitalisierung betroffen. Um wettbewerbsfähig bleiben zu können, müssen Beschäftigte digitale Grundkompetenzen erwerben und verbessern. Die digitale Grundkompetenz bildet somit eine bedeutende Kompetenz dar. In dieser Dissertation werden drei empirische Studien durchgeführt, um das Wissen über die digitale Grundkompetenz und deren Einflussfaktoren zu vertiefen. Um ein umfassendes Verständnis über die digitale Grundkompetenz und deren Einflussfaktoren zu bekommen, werden Erkenntnisse auf individueller Ebene, dyadischer Ebene und Teamebene gewonnen.

Studie 1 befasst sich auf der individuellen Ebene mit der Weiterbildungsbereitschaft von Beschäftigten, die Rolle der Persönlichkeit und dem Einfluss von Trainings. Auf der Grundlage von 1,007 befragten Beschäftigten eines deutschen Großkonzerns zeigt die Studie, dass die Persönlichkeit der Beschäftigten einen Einfluss auf deren Weiterbildungsbereitschaft hat. Studie 2 operiert auf der dyadischen Ebene und stellt fest, dass das Führungsverhalten und die Persönlichkeit der Führungskraft einen Einfluss auf den digitalen Grundkompetenzerwerb der Beschäftigten hat. Basierend auf Antworten von 486 Beschäftigten eines deutschen Mittelständlers trägt die Studie 2 zu einem umfassenderen Verständnis der Rolle der Führungskraft bei dem digitalen Grundkompetenzerwerb bei. Studie 3 bietet ein besseres Verständnis auf der Teamebene, indem die Untergruppenbildung in Arbeitsgruppen und der moderierende Einfluss eines Führungskraft-Beschäftigten Beziehungsklimas betrachtet wird. Die Ergebnisse von 805 Befragten eines deutschen Großkonzerns attestieren einen moderierenden Effekt des Klimas auf den Zusammenhang zwischen Subgruppenbildung und kollektiver digitaler Grundkompetenz.

Insgesamt unterstreichen die Ergebnisse die Bedeutung verschiedener Einflussfaktoren auf den digitalen Grundkompetenzerwerb. Die neuen Erkenntnisse können Praktiker:innen dabei helfen, ein Arbeitsumfeld für Beschäftigte zu schaffen, indem diese auch in der Zukunft den Anforderungen der Digitalisierung erfolgreich begegnen können.

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1 GENERAL INTRODUCTION

1.1 Relevance and Research Purpose

Digitalization has become central in almost every occupation and industry as modern work settings are immensely influenced by artificial intelligence, big data, augmented reality (Díaz Andrade et al., 2019), and Chatbots like ChatGPT (chat.openai.com/). Due to growing digital connection quality and great availability, Industry 4.0 is boosting business effectiveness and efficiency (Ibarra, 2021). Similarly, digital devices and software programs are constantly developing (Oberländer et al., 2020). As a result, organizations face a fast-changing environment where the global investment in public digital transformation technologies will almost double between 2020 and 2024, illustrated by a predicted increase from 18 billion to 75 billion connected digital devices worldwide by 2025 (Clement, 2020).

However, digitalization does not only characterize the near future; already today, researchers and managers alike observe significant changes due to digitalization. In addition to this general trend, the COVID-19 pandemic accelerated this change (Ibarra, 2021). To fight the virus, imposed lockdowns, social distancing, and smart working techniques such as remote working replace physical interactions. Online communication became the primary option for working and participating in social activities. Underlying this proposed increase in digitalization due to the general trend and the COVID-19 pandemic, digital technology usage accelerated between 2019 and 2020 by up to 100%, which brought around 3.7 billion people online (Bogdan-Martin, 2022). In Germany, where I conducted Study 1, Study 2, and Study 3 of this dissertation, 62.90 million people were using the Internet in 2019. This indicates that 75.70% of the German population used the Internet in 2019, and 79.51% (67 million) of the German population already used the Internet in 2022 (Lohmeier, 2023). Whereby a further increasing trend is to be expected. Bearing this in mind, the almost inevitable digitalization may have the following influences, among others.

On the one hand, this acceleration of digitalization holds great potential for increasing the quality of life (Ghosh, 2017). Artificial intelligence, big data, and augmented reality improve companies' efficacy in meeting their goals (Cisco, 2021). Digital innovations like ChatGPT can result in work processes that save time, increase productivity, and reduce deprivation. However, on the other hand, digital innovations can lead to social and economic threats with the insecurity of unemployment (Kryzhanovskij et al., 2021) and technostress, which is the experience of stress due to an inability to adapt to new technologies (Tarafdar et al., 2015). Due to increasing data breaches, individuals could also lack trust in digital technologies due to privacy concerns and defective cybersecurity (Ibarra, 2021). Other reported challenging outcomes for the individual are hyper-connectivity (González-López et al., 2021), job dissatisfaction (Ragu-Nathan et al., 2008), the feeling of exhaustion, loss of motivation, frustration, burnout (Tarafdar et al., 2015; Tarafdar et al., 2011), and other mental health issues (Batra et al., 2017). Given these positive changes regarding productivity increase and challenges due to individual well-being, digitalization can be both a powerful enabler and a threatening inhibitor. To leverage the benefits and meet the challenges of ongoing digitalization, individuals need digital skills to use digitalization effectively, use the advantage of the supporting factors, and be forearmed against restrictions.

Such digital skills or digital fluency is defined as the *"ability to reliably achieve desired outcomes through the use of digital technology"* (Briggs and Makice, 2012, p. 65). Such digital fluency helps the individual address the ongoing digitalization. Therefore, this ability is already highly relevant for today's workforce. The lack of digital fluency could seriously inhibit engaging in digital activities and reduce performance in work settings. This assessment is shared by employees, with nearly 60% prefiguring that digitalization will alter their work (Bogdan-Martin, 2022). Two out of five employees worldwide are affected by a mismatch between their digital and demanded skills (Bogdan-Martin, 2022). Employees are confronted with extensive changes in their everyday work with new demands and fast-changing conditions. Therefore, it is highly substantial to meet the digital requirements, build up digital fluency and acquire and apply this skill in everyday work. Accordingly, the question of *how employees can best become digitally fluent in the organizational context to meet the requirements of digitalization* is of high applied and scientific interest.

To address this question, I developed a more holistic approach outside education research, the field in which digital fluency is usually investigated. Typically, research addressing digital fluency in education research investigates the school context and pupils' learning processes regarding digital fluency (Chigona, 2018; Fields and Hartnett, 2018), which does not easily translate into a work setting. There is not yet a long history to fall back on in organizational behavior research. Nonetheless, regarding digital competencies and digital fluency literature in organizational behavior research, a high level of growth has been recorded lately and described as a "*fast-evolving landscape*" (Trenerry et al., 2021, p. 2). In a literature review, I found that the number of publications increased steadily from 2.036 in 2018 to 7.355 in 2022 (data obtained on 04.04.2023 from digital science's dimensions platform, available at app.dimensions.ai). However, the digital competencies and digital fluency literature still do not provide conclusive contextual factors on how digital fluency can be best acquired in the organizational context.

A comprehensive view of the organization confronted with digitalization is necessary to understand critical contextual factors better. Because the organization is characterized by its multidimensionality, *"a shift in mindset among individuals, teams, and organizations"* (Trenerry et al., 2021, p. 1) is needed. This follows Kozlowski and Klein's (2000) call for a multi-level approach that engenders a more integrated knowledge of the organization in the context of digitalization. To account for the multi-level structure of an organization, different levels of analysis (individual-, dyadic-, and team-level) with the additional societal-level are crucial to examine. To meet this requirement of multi-level structure analysis, I investigate the different levels separately in this dissertation. First, in a Pre-Study, I consider the highest level, the societal-level, as a valuable approach to gaining an overview of the far-reaching influences of digitalization on different areas of life. Second, regarding the individual-level, research from the social psychology perspective indicated a significant influence of demographic characteristics (Li and Ranieri, 2010), motivation (Tarafdar et al., 2015), and emotions toward digitalization (Ragu-Nathan et al., 2008) on digital fluency. Third, regarding the dyadic-level, a broad research branch, namely leadership research, found mixed results highlighting the relationship between the leader and the follower.

Most of this work addressed leadership behavior (Kaluza et al., 2020), leadership styles (Frick et al., 2021), and transformation processes (Schwarzmüller et al., 2018). Lastly, regarding the team-level, work and organizational behavior research investigated the work group influencing general work-related outcomes. Related work revealed significant group phenomena such as group divide (Saeed and Masters, 2021) and group climate (Schneider and Bowen, 1985). This dissertation follows this four level structure to understand digital fluency and its antecedents better.

By addressing this four level structure, I aim to investigate how bridging the four levels can improve our understanding of employees' digital fluency and the factors influencing the acquisition of digital fluency in the organizational context. Therefore, I put digital fluency in a holistic perspective to focus on the different levels and subsequently built a comprehensive picture of digital fluency antecedents. By doing so, I draw on existing theories such as the Person-Organization Fit (Chatman, 1989), the Empowerment Theory (Zimmerman, 1995), and the Social Identity Theory (Turner and Tajfel, 1986).

To motivate my work and investigate changes on a societal-level, I conducted a Pre-Study (see Chapter 6 for detailed author contributions) using Google Ngram data. The Pre-Study shows that digitalization is associated with mental health issues (see following Chapter 1.2) and discusses relevant factors that may cause this association. Based on the reaffirmed and far-reaching impact of digitalization, the question of how to handle digitalization and, thus, acquire digital fluency further strengthens the urgency to investigate factors impacting digital fluency. Deriving the urgency from this study, I provide a holistic understanding of employees' acquisition of digital fluency in three separate studies, following the introduced structure of individual-, dyadic-, and team-level. For each level, I built on a literature review, where I separately identify shortcomings in the research and formulate three research questions. These three questions are the basis of this dissertation, and I address each question with a stand-alone field study. In the following sections, the Pre-Study and the three primary studies are described and integrated into the overarching research question of this dissertation.

1.2 Pre-Study Google Ngram: Influence of Digitalization on the Societal-Level

We[1] conducted a Pre-Study using a linguistic big data approach to investigate whether or not digitalization impacts mental well-being. Anxiety and depression are becoming more prevalent, prompting researchers and mental health professionals to advocate for more effective mental health prevention (Ebert and Cuijpers, 2018; Ormel et al., 2019). As introduced, one potential risk factor for developing these conditions is digitalization. As digitalization-related changes occur, individuals may experience uncertainties about how digitalization will impact their work and personal lives. This may lead to feelings of worry or discomfort (Berryman et al., 2018). One example of such distress, technostress (Tarafdar et al., 2015), can manifest in various unfavorable conditions, including job dissatisfaction (Ragu-Nathan et al., 2008), feelings of exhaustion (Tarafdar et al., 2011), burnout, and loss of motivation (Ayyagari et al., 2011; Ragu-Nathan et al., 2008).

Additionally, other problems associated with digitalization, such as replacement fear (Bregenzer and Jimenez, 2021), hyper-connectivity stress (González-López et al., 2021), cognitive demand increase, and a simultaneous decrease in manual jobs (Charles et al., 2013; Jaimovich and Siu, 2012), as well as digitalization anxiety (Pfaffinger et al., 2021), may exacerbate or cause mental health issues. Identifying and addressing digitalization as a risk factor may enable more effective prevention and treatment of anxiety and depression.

The association between ongoing digitalization and mental health, particularly prior to the COVID-19 pandemic, is rarely explored. A Scopus search using the search term “Digitalization” OR “Digitalisation” AND “Mental Health” yielded 86 publications out of 890 screened publications with some connection to digitalization or mental health. However, none of the studies examined the connection between ongoing digitalization and anxiety or depression on a societal-level. Although these changes due to digitalization may significantly impact society, the methods used to investigate their influence have remained the same. Most researchers rely on longitudinal studies, self-reports, questionnaires

[1] See Chapter 6 for detailed author contributions.

(Bolger and Laurenceau, 2013), or interviews (Muris et al., 2002) to investigate this connection. Only a few studies have utilized big data to explore the relationship between digitalization and anxiety and depression. This research gap is surprising, considering that other research has highlighted that digitalization may lead to higher unemployment, particularly in populations with a lower socioeconomic status that has been shown to be more affected by mental health issues (Campion, 2013; Shepherd et al., 2013).

Our objective is to examine the potential impact of digitalization on anxiety and depression by utilizing Google Books Ngram Viewer (henceforth: Google Ngram), which contains a vast amount of data. We aim to explore the impact of digitalization on anxiety and depression by analyzing the historical literature on these topics and digitalization that has been fragmented in the past. Google Ngram comprises a vast corpus of books (over 8 million books or 6% of all published books) that has been utilized in related linguistic big data studies to investigate societal trends and changes (e.g., Twenge et al., 2019; Younes and Reips, 2018; 2019). Unlike online self-report data used in other studies, which may be limited by methodological challenges, for example, privacy concerns (Buchanan et al., 2007), Google Ngram relies on data from published books and can be considered a more impartial source.

Our goal was to investigate the potential link between the prevalence of anxiety and depression and the ongoing digitalization process. For this purpose, we collected lists of words related to anxiety, depression, and digitalization from various sources, including successive versions of the International Classification of Diseases (ICD; ICD-8 to ICD-11, Degkwitz et al., 2013; Graubner, 2013) and word lists for digitalization by Brewster and Murray-Smith (2003) and Wolf and Bartelheimer (2019). We used these word lists to conduct Google Ngram analyses to examine changes in word frequency over the past 50 years leading up to 2020. Our approach was grounded in the ICD, the leading international standard classification for mental and physiological health diagnoses. Following Younes and Reips's (2019) procedure, we focused on 26 representative anxiety and depression words and 33 representative digitalization words. With the final word lists, we ran Google Ngram analyses and collected data on the word frequency per year in percent (Figure 1).

To answer our general question: *Is there an association between the rising prevalence of anxiety/depression and an increase in the digitalization of private and professional life?*, we investigated word changes over the 50 years prior to 2020.

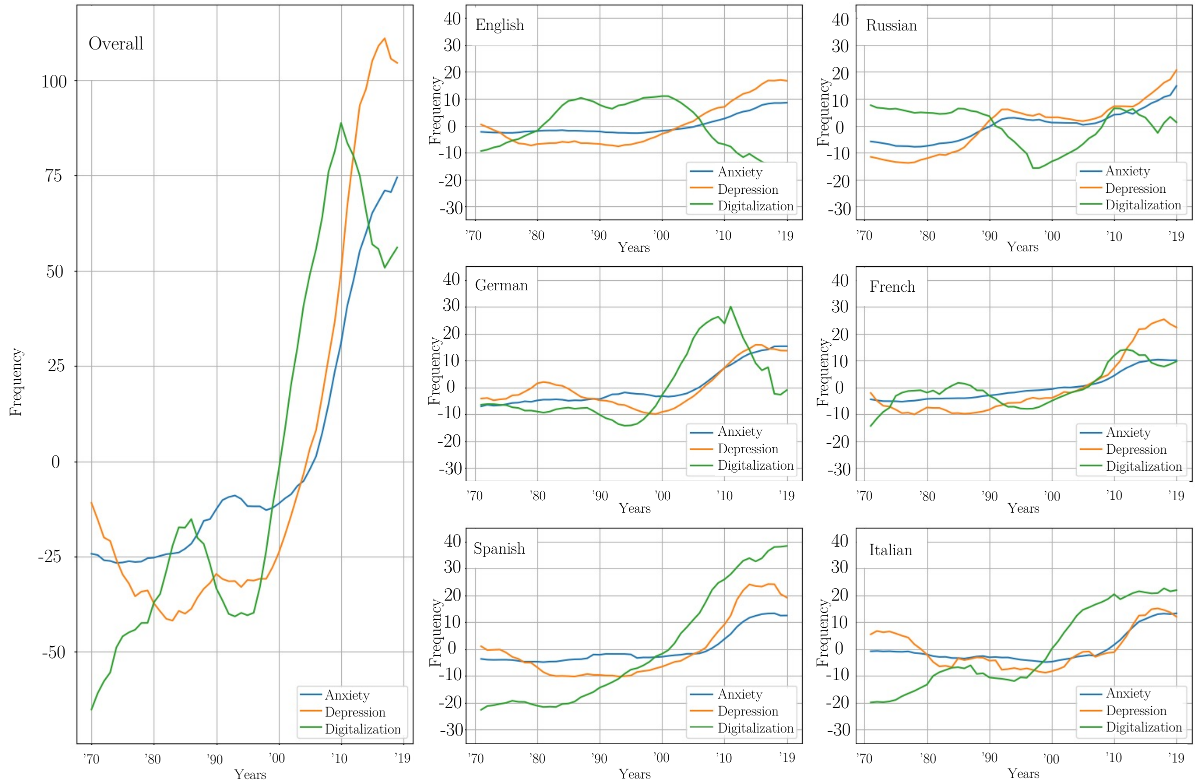

Figure 1. Google Ngram Pre-Study Results.
List-averaged Word Frequencies from 1970 until 2019 for Each Category and Language. Frequencies are z-transformed, most Common Word Controlled, and Summed Over All Words.

As shown in Figure 1, we found an increase in anxiety and depression words frequency and an increase in digitalization words frequency over all investigated languages (English, Russian, German, French, Spanish, and Italian), indicated by higher percentages over the years[2]. Hence, our findings provide further support for existing research using a relatively novel approach to investigate the rising prevalence of anxiety and depression and a possible association with increased digitalization of private and professional life. Based on the collected results from the Google Ngram study and the general finding that both anxiety and depression, as well as digitalization, are increasing, acquiring digital-related skills is a possible preventive measure. Digital-related skills, or digital fluency, could be a

[2] Detailed results can be found in the correlation matrix in Appendix A, Table 11.

helpful tool for preventing technostress (Tarafdar et al., 2015) and its damaging side effects such as exhaustion, motivation loss, and burnout (Ayyagari et al., 2011; Ragu-Nathan et al., 2008).

The presented Pre-Study is an initial point of origin to point to the great importance of digital fluency by (a) clarifying the rise of digitalization and its worldwide impact and (b) pointing to possible connections between the rise of digitalization and mental health, such as anxiety and depression. Digital fluency, a skill to gain proficiency in digitalization, could be a valuable source to build resilience. In addition to the above-discussed findings and the prediction that digitalization will continue to advance and influence other parts of private and professional life, the acquisition of digital fluency is of great importance. Thus, the Pre-Study inevitably results in the great necessity to gain a more holistic and multi-level approach regarding digital fluency and explore the possible antecedents for the acquisition of digital fluency.

Following this Pre-Study, I now describe the findings from existing literature on digital fluency and focus on the individual-, dyadic-, and team-level (see Figure 2). I identify shortcomings in digital fluency research at each level and discuss how researchers could address these different levels to provide new and valuable insights to address some limitations. Using the literature review, I formulated three research questions, one for each level. These research questions formed the foundation for this dissertation, and I address them separately in a respective study.

1.3 Literature Review

1.3.1 Digital Fluency on Three Levels

This dissertation comprises the construct of digital fluency by focusing on contextual factors of digital fluency in the organizational context. The organizational context can be structured into three levels. Studies of digital fluency have been conducted at different levels, such as the individual-level, the dyadic-level, and the team-level (e.g., individuals' outcome, leader-follower interaction, and group structure). In the following section, I provide an overview of possible antecedents of digital fluency conducted on different levels.

The intent is to highlight the differences between the three levels and their precursor of digital fluency. By focusing separately on the levels first, I aim to examine different influences and then build a holistic view of digital fluency and its antecedents in the composition of the different levels.

Research on digitalization has primarily focused on business and strategic levels, with a few implementations of individual-related factors (Trenerry et al., 2021). However, at the *individual-level*, the rapid advancement of digitalization is also fundamentally changing the nature of individuals' workplace conditions and perceptions. The associated digital fluency can be an answer to the changing demands of digitalization. Research concerning digital skills conducted at the individual-level investigates job (dis)satisfaction, coping strategies, well-being, perceptions, motivation, demographic characteristics, and work outcomes (e.g., Ching et al., 2005; Hauk et al., 2019; Trenerry et al., 2021).

As another consequence of digitalization, the interaction between individuals is also changing drastically. At the *dyadic-level*, digital fluency research (or digital competencies research) focuses mainly on interactions between two parties. In the work context, those two parties could be co-worker and leader-employee interactions. Digital work formats like online meetings and remote working advance the interaction and change the way to lead. As an influential proxy, the leader could influence employees' development of new skills (Singh and Rangnekar, 2020), such as digital fluency. Due to a shortage of well-established empirical evidence for the influence of leaders on the employees' acquisition of digital skills (Cortellazzo et al., 2019), the dyadic-level addresses a notable gap in the holistic three level view of digital fluency and its antecedents.

At the *team-level*, digitalization confronts organizations with the hidden potential for up-leveling the quality of their employees' life (Ghosh, 2017) and their work group interaction. Simultaneously, the team-level is of great scientific interest because it is one of the essential parts of the organizational structure (Kanter, 2019; Thatcher and Patel, 2011). Especially diversity in work groups will play a significant role in the digital future (Buengeler et al., 2021). Diversity can refer to a variety of attributes, such as age diversity (Blank and Groselj, 2014), gender diversity (Sherman et al., 2000), and the digital divide

(Saeed and Masters, 2021). Work groups already face several obstacles when working together that may be exaggerated due to the ongoing digitalization highlighting differences deriving from, for example, age. At the same time, work groups must be digitally fluent in engaging in online activities and participating and cooperating in digital work settings (Briggs and Makice, 2012). Taken together, digital fluency and its antecedents can be applied to different levels 2.

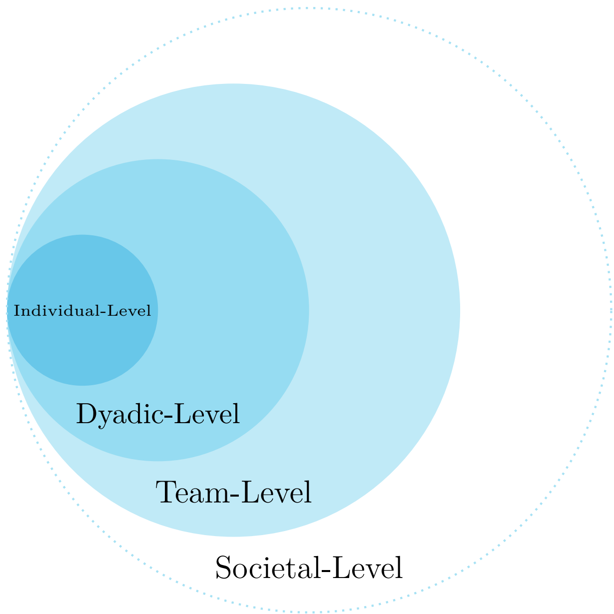

Figure 2. Overview of Four Level Structure.

1.3.2 Individual-Level Research

Despite the advancement of digitalization and the ubiquitous use of robots using artificial intelligence and big data in the work environment (Díaz Andrade et al., 2019), the individual is still the central and operating factor. Therefore, to understand digitalized processes and their application, it is essential to understand the individual, the individual's preferences, and the individual's willingness to perform in digital settings. Of the 4.9 billion Internet users worldwide in 2022, many lack digital skills preventing them from using digital devices to their full extent (Bogdan-Martin, 2022). Thus, to help overcome lacking digital skills, the underlying antecedents should be investigated. At the individual-level, several influential factors could result in the digital divide, which I will explain in the next paragraph.

Digital fluency at the individual-level is dominated by research on the digital divide (Van Deursen and Van Dijk, 2011). Initially, the digital divide referred to a disparity of access to and the use of computers. Later, more attention shifted to the social, psychological, and cultural backgrounds, causing the digital divide (Van Dijk, 2006). The digital divide is defined as "*the gap between individuals, households, businesses, and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the internet for a wide variety of activities*" (Martens and Schulze, 2001, p. 7). A detailed review of the digital divide would be beyond this Chapter's scope. Therefore, more information about the term digital divide and its origin can be found in Gunkel's (2003) work. On the individual-level, the digital divide could group individuals into ones with a high degree of digital fluency and ones with a low degree of digital fluency.

The digital divide literature pertains to different socio-demographic factors. One socio-demographic factor that is a strong indicator responsible for the digital divide is age (Elena-Bucea et al., 2021). The so-called *digital age divide*, a widely publicized form of the digital divide, describes a situation in which the use of digital technologies differs depending on the individuals' age (Blank and Groselj, 2014; Saeed and Masters, 2021). In 2022, 75% of people aged between 15 and 24 were using the Internet worldwide. In contrast, among the age group over 65, the Internet use rate was 57%. This is also displayed by less activity in online communication by individuals over 65 years (Lüders and Gjevjon, 2017). While most digital-age-divide research states that age is simply a factor of the divide, only a few studies investigate the underlying factors in detail (Abbey and Hyde, 2009).

As raised by Lindblom and Räsänen (2017), "*the digital divide at the individual level springs from many different sources*" (p. 147); thus, the continuous evolution of digital technologies has given rise to several digital divides. Various scholars agreed upon the persistence of the educational digital divide (Nishijima et al., 2017; Pick and Nishida, 2015; Van Deursen et al., 2015), which describes education as an influential factor in digital technology adoption. Also, the gender digital divide is defined as gender-related inequalities in using digital technologies (Correa, 2016; Dixon et al., 2014). Moreover, income has been identified as an essential driver of digital development (Cruz-Jesus et al., 2017). The so-called income digital divide was more significant in the upcoming digital devices where those with higher incomes could afford digital technologies (Richmond and Triplett, 2018).

Another aspect that can make a difference in adopting individuals' digital fluency is their willingness to perform or their willingness of training participation to gain a higher level of digital fluency on the job. The willingness of training participation, or the motivation to participate successfully in training (Kyndt et al., 2014), is the foundation for successful participation in training. Training on the job is a reliable method to gain mastery in work-related skills such as digital fluency. Besides the relevance of (digital) training, no research, up to now, has investigated individuals' preferences regarding training conception to boost individuals' digital fluency ultimately. Thus, the willingness of training participation could be the first step towards a deeper understanding of the individuals' willingness for digital fluency. This, in sub-sequence, paves the way to a better understanding of the conditions of acquiring digital fluency.

The literature on training participation and openness towards training participation (e.g., Fleishman and Mumford, 1989; Stewart et al., 1996) has a long history and has mainly focused on the individuals' needs. Especially the branch of training effectiveness is thoroughly researched, and related work from Alvarez and colleagues (2004) points to the necessity of a fit between the individual and the individual's needs to become skilled/digitally fluent. Thus, not surprisingly, other scholars have theoretically investigated the fit between the individual and the fit to work settings (e.g., O'Reilly et al., 1991; Westerman and Cyr, 2004) and open the branch of organization research. Most findings point to the fact that if individuals feel a sense of belonging to their work setting or employer, they are more engaged (e.g., Cable and DeRue, 2002; Dawis and Lofquist, 1984). Besides the well-researched correlation between the individual and the fit to work settings, findings regarding the fit between the individual and the individuals' training preferences are still lacking and point to a research gap. In this matter, Wexley and

Latham (2002) emphasize the importance of matching skills and tasks when designing training on the job. Though, their study still falls short as they fail to provide concrete design suggestions for training at work.

The individuals' preferences to overcome the digital divide and contribute to a better understanding of digital fluency at the individual-level is an identified research gap. As outlined in related studies, research lacks the focus on the individual regarding acquiring digital fluency. At the time of writing this dissertation, no research has been conducted on the relationship between individuals' training preferences and the training design to investigate the preliminary stage of acquiring digital fluency.

1.3.3 Dyadic-Level Research

Digitalization is shaping organizations, work environments, and social interactions. Both digitalization and the COVID-19 pandemic have accelerated the development of digital technologies in the workplace. Significantly during the first COVID-19 pandemic outbreak from December 2019 to May 2020, an increase of 60% in Internet traffic was detected. Also, during this time, videoconference traffic has increased up to 120% worldwide (Soto-Acosta, 2020). In this matter, the COVID-19 pandemic fanned the already ongoing digitalization and redefined how employees interact and collaborate by turning communication and social interaction into digital ones.

As digitalization shapes the work environment in the described manner, new challenges for leaders are unfolding while digital transformation already challenges leaders (Bolden and O'Regan, 2016), and the pandemic boosts workplace transformation even more. Because self-leadership may not be possible and doable for every employee in the workplace transformation (Frick et al., 2021), leadership could be highly beneficial for change processes and innovation (Ahmad et al., 2020). Especially in digital transformation, leaders could significantly impact and guide their employees (Baptista et al., 2020; Heavin and Power, 2018; Vial, 2021). In this context, Bolden and O'Regan (2016) state that "*there is no one approach to leadership*" (p. 439) since leadership is highly contextual. Also, Lu and colleagues (2014) concluded that effective leadership is determined by the situation in which the behavior is shown. In digitalization, leadership could be the critical factor to success (Alsheibani et al., 2019) as the leader has the proximal influence on employees and may also have the ability to affect employees' digital fluency.

Considering digitalization, the literature on leadership in digital work settings during crises is still scarce (Bartsch et al., 2020). The relationship between ongoing digitalization and leadership is still not sufficiently explored (Uhl-Bien and Arena, 2018). Also, the intersection of digitalization, work settings, and organizations is in its infancy (Cascio and Montealegre, 2016). This is surprising because, for example, Cortellazzo and colleagues' (2019) main findings showed that leaders are vital in developing a digital culture. Also, other researchers found leadership to be essential for employees' readiness for transformation processes (Frick et al., 2021) across all industries (Oreg and Berson, 2019). And yet other researchers found that leaders play a crucial role and act as role models in the face of digital obstacles (Helming et al., 2019).

Therefore, further research is urgently needed to examine how leadership mitigates employees' skill acquisition for the upcoming digital transformation (Frick et al., 2021; Oreg and Berson, 2019). Pointing to a research gap, scholars need to address the impact of leadership attributes on employees' digital skills (Frick et al., 2021). Also, Cortellazzo and colleagues (2019) have highlighted the need for more well-established empirical evidence for the influence of leaders on employees' skill acquisition.

Research on leadership has a long history and is an extensively debated topic. Leadership traits (e.g., skills, abilities, and personality) and leadership behavior (e.g., solving problems, seeking different perspectives, and supporting others) have been thoroughly researched. Besides a large body of research on leadership traits and behavior, those two approaches are characterized by a need for more integration (DeRue et al., 2011). Integration concerns many studies, as leadership studies generally build on the trait or behavior approaches, respectively. The lacking integration of the two approaches leads to a blind spot in leadership research because many studies have found similar results (e.g., Judge et al., 2002; Judge and Piccolo, 2004 vs. Eagly et al., 2003) but do not integrate them. Some leadership researchers (e.g., DeRue et al., 2011) call for an integrative understanding of the leaders' influence and disclose a research gap, which is the simultaneous consideration of the leaders' personality and behavior. Thus, identifying leaders' personality and behavior as contextual factors for acquiring digital fluency fills a notable gap.

In addition to the leader, their employees must develop digital soft skills and digital competencies to face digital challenges and seize opportunities (Soto-Acosta, 2020). These requirements call for employees to acquire digital fluency (Gallardo-Echenique et al., 2015). However, this is hindered by the fact that there has yet to be any sophisticated understanding of how to acquire digital fluency, and comprehensive knowledge about factors influencing the acquisition of digital competencies still needs to be improved (van Laar et al., 2020). Schwarzmüller and colleagues (2018) flesh out their call for research by pointing to contextual factors for digital competencies acquisition.

To understand the interaction between leaders and employees' digital fluency, more research is needed to focus on leadership influencing digital fluency to foster clarity and alignment in the scientific debate on leadership influences in digitalization. Previous studies indicate that organizations require effective leadership when digital transformation is encountered (Frick et al., 2021; Soto-Acosta, 2020). However, the literature still needs to include the relationship between leadership behavior, the leader's personality, and the employees' drive to the acquisition of digital fluency. Besides the attempt in which researchers have defined *digital leadership* (Erhan et al., 2022), describing leaders with a strong network and innovation ability, no research has, at the time of writing this dissertation, been conducted on the relationship between the leader and employees' acquisition of digital fluency. Therefore, Cortellazzo and colleagues' (2019) emphasized that "*the relationship between digital transformation and leadership requires updated lenses*" (p. 17), pointing to a research gap in the relationship between leadership and employees' digital fluency.

1.3.4 Team-Level Research

Besides the relevance of the interaction between leaders and employees, the team-level gained greater importance over the last decade. Shortly, work groups will be the dominant form of collaboration in organizations (Kanter, 2019), and the aspect of work group diversity is of high practical and scientific relevance. Diversity in work groups can relate to many different aspects, for example, demographic characteristics (Wegge and Meyer, 2020), employees' personality (Homan et al., 2008), performance orientation (Schreurs et al., 2011), and group identification (Leicht-Deobald et al., 2021), leading to "*the distribution of differences among the members of a unit with respect to a common attribute*" (Harrison and Klein, 2007, p. 1200).

An ever-increasing stream of research on work group diversity produces contrasting theoretical and empirical results because diversity is a "*multilevel and context-based construct*" (Wegge and Meyer, 2020, p. 8). Diversity in work groups can influence group relationships, performance, individual behavior (Balkundi and Kilduff, 2006), and individual skill acquisition. Nevertheless, the existing diversity literature has primarily focused on performance-related outcomes (see Bezrukova et al., 2009; Boehm et al., 2014; Van Knippenberg et al., 2004) and has neglected chiefly outcomes such as skill acquisition.

In addition, research on work group diversity has produced various contradictory results. While some scholars found that diversity positively affects work group performance (Boehm et al., 2014), innovation, and creativity, others postulate conflicts and discrimination within diverse work groups (Kunze et al., 2013; Van Knippenberg et al., 2004). Group diversity can also lead to communication difficulties and negative feelings and attitudes toward other group members (Lee and Chae, 2017). The findings of numerous meta-analyses also attest to the mixture of different outcomes and point to competing theories as one possible cause (e.g., Bell et al., 2011; Reinwald et al., 2015).

The competing theories could be loosely grouped into the information/decision-making and social categorization approaches. The information/decision-making approach describes the situation in which the individual benefits from the great variability of knowledge and abilities other individuals add to the group (Chiu, 2010). In this sense, complex problem-solving, innovation, and creativity could be supported (Li et al., 2019). On the other hand, the social categorization approach describes the process in which individuals prefer to interact and identify with similar others. Identifying with a similar group leads to the event of in-group favoritism and a group-based self-definition (Islam, 2014). Still, these competing approaches only contribute to the explanation of diverse outcomes but still need to solve the problem of the vast body of mixed diversity results.

Inconsistent results also indicate that diversity in work groups is much more complex, and simply examining heterogeneity in work groups does not adequately capture diversity. Past research on diversity focuses on single attributes and neglects the composition and arrangement of different diversity aspects. The faultline approach developed by Lau and Murnighan (1998) attempts to explain diversity within groups. Faultlines consider the composition and arrangement of various diverse aspects among an individual. Per definition, faultlines are hypothetical dividing lines splitting a group into relatively homogeneous subgroups based on the distribution of multiple attributes such as age, gender, and nationality (Lau and Murnighan, 1998). By paying attention to different attributes, the faultline approach has reconceptualized an understanding of diversity into a more integrative approach for explaining how multiple forms of diversity affect group outcomes simultaneously (Bezrukova and Jehn, 2003). This approach accounts for the complex nature of individuals within work groups. However, faultline research produces mixed findings and is of limited value. While some studies demonstrate that faultlines could hamper group performance (Bezrukova and Jehn, 2003; Bezrukova et al., 2009) and group commitment (Qi et al., 2022), other findings indicate positive effects of faultlines (e.g., increased performance and satisfaction; Gibson and Vermeulen, 2003; Lau and Murnighan, 2005). In sum, these findings do not provide a clear understanding of the effect of faultlines.

Although research on faultlines has been ongoing since Lau and Murnighan's creation in 1998, the literature is riddled with different outcomes. However, another possible cause, pointed out by meta-analyses (Bell et al., 2011; Reinwald et al., 2015), is mainly neglected moderating variables and their effect on faultlines. Thatcher and Patel (2011) concluded that their faultline model lacks the test of substantive moderators, which is also in line with Bezrukova and colleagues' (2009) call "*for other possible moderators and contextual factors*" (p. 47). Other scholars argue that mixed results in faultline literature could possibly be caused by moderators such as the group size (Schneid et al., 2016).

Generally, scholars concerned with faultline research emphasize the importance of moderating variables to advance the understanding of lacking faultline effects indicated in previous studies. Thus, up to now, the effect of faultlines on the acquisition of digital fluency has not been investigated, and research on digital fluency and the acquisition of, for example, collective digital fluency in the organizational context is greatly needed.

1.4 Research Gaps and Research Questions

Overall, previous research on digital fluency has highlighted how relevant and up-to-date findings on digital fluency are. Besides the scientific and practical relevance of digital fluency, antecedents influencing the acquisition of digital fluency are underrepresented in research. Unfortunately, one major shortcoming of past research is that a small body of research has been conducted on the influence of possible antecedents of digital fluency. Due to its relative infancy, antecedents need to be addressed on different levels of analysis. To address this and further a comprehensive understanding of digital fluency, I extended existing definitions and explored possible moderating influences of such factors on the acquisition of digital fluency. Based on my literature review (see Chapter 1.3.2 to Chapter 1.3.4), I identified and addressed three research gaps in the three studies, respectively. By identifying three gaps in three studies, I follow the level structure shown in Figure 2. The following section outlines these major research questions.

Accordingly, at the *individual-level*, the central topic is the individuals' matching to training settings and the willingness of training participation. While related work showed that a match between the design of training settings had been proven to influence the individuals' willingness to participate in training, there is a lack of thoroughly designed training settings regarding the individuals' preferences. This is surprising because training is one of the most profound methods for enhancing work performance; thus, successful participation in training is very beneficial, and subsequently, the willingness of training participation is highly crucial. However, research on factors investigating the interplay between employees' training preferences and training participation is still scarce. Lacking research might have been caused by the lack of interest in individuals' willingness and the lack of appropriate methods. To address both the research gap and the inadequate methods used to investigate this question, I used the Experimental Vignette Methodology (henceforth: EVM; Barnatt et al., 2007; Beck, 2010). This method is usually used in clinical psychology to carefully gain access to individuals' beliefs and attitudes in daily situations (Aguinis and Bradley, 2014). However, in the organizational context, I used the method to address the willingness of training participation on the individual-level. By doing so, I applied the EVM to a new context. The resulting first research question, henceforth, is:

> *Research Question 1: How do training settings influence the individuals' willingness of training participation, and what are the moderators of the linkage?*

On the *dyadic-level*, research on digital fluency is also in its infancy. Thus, it is critical to understand how employees can acquire digital fluency with the help of external influences. Influential work-related factors could be the leaders' influence. Additionally, a common problem is that research constructs are mixed despite a precise definition, which leads to blinding effects. To accurately reflect the proportional contribution of the predictor variables, the constructs of empowering leadership, leader-member exchange, and trust in leader are investigated. Also, to widen the lens for possible effects and moderating effects, the branches of digital fluency (digital competencies) literature and leadership literature are combined. Nevertheless, leadership research and its effects on the acquisition of digital fluency are mainly absent, which results in the second research question:

> *Research Question 2: How do the leadership behavior and the leaders' personality influence the employees' acquisition of digital fluency?*

The third research question operates on the *team-level*. Substantial scientific work has studied the effect of diverse work groups on organizational performance, concluding that diversity within work groups can positively and negatively affect organizational outcomes. Taken together, findings are so far inconclusive, and researchers have increasingly focused on faultline research as an essential large sub-aspect of diversity research. Despite these efforts, mixed results and contradictory theories divide the field of diversity on the team-level. Especially factors influencing diversity in groups are still an under-researched field. Given that this is a notable shortcoming and that organizations are highly influenced by increasing diversity in the digitalized workplace, I aim to address this field.

I identified that past research had yet to transfer the construct of digital fluency to the team-level, which results in collective digital fluency. Especially considering the ongoing digitalization, collective digital fluency is a highly valuable skill. Also, moderating variables such as the interaction between individuals at the workplace are worth investigating. By identifying this shortcoming and pointing to a holistic approach to digital fluency, the third research question is as follows:

> *Research Question 3: How can collective digital fluency be built in diverse work groups, and what factors shape the development?*

1.5 Dissertation Outline and Chapter Structure

Taking together these three research questions, this dissertation aims to enhance the understanding of antecedents and the acquisition of digital fluency by taking a holistic three level approach. This should be accomplished by understanding the societal-level and the employees' influencing factors at the individual-, dyadic-, and team-level. Following the three research questions, one Chapter will address each research question corresponding to one level to address the research questions proposed in the previous Chapter 1.4.

Chapter 2 addresses the first research question: *when do different training settings relate to greater willingness in training participation and, thus, subsequently, greater digital fluency?* In the first study, I build on the Person-Organization Fit (Chatman,

1989) and extend the Person-Training Fit by shifting the focus from employee-employer interaction to employee-training interaction. By doing so, I focus on the individual-level and underline that the individual's willingness of training participation is crucial to participate successfully in today's working environment. Also, I suggested that an alignment between employees' and employees' training preferences affect employees' acquisition of digital fluency. To test the theoretical model, I use the dataset of 1.007 employees I gathered from a large German technology company. As a methodological contribution, I included the Experimental Vignette Methodology (e.g., Barnatt et al., 2007; Beck, 2010) and constructed different training vignettes to improve the validity of employee surveys.

Chapter 3 addresses the second research question: *how does the leadership behavior empowering leadership and the leaders' personality influence the employees' acquisition of digital fluency?* To investigate this research question, I focus on supportive external factors such as the leadership style empowering leadership and the leader's personality and thus operate on the dyadic-level. Drawing from the Empowerment Theory (Zimmerman, 1995), viewed as a process by which employees gain mastery over their lives and show high interest in learning new skills, I argue that employees become empowered by the leaders' influence. Furthermore, I assume that the leaders' behavior, empowering leadership, positively affects employees' digital fluency. Also, I expect that the leaders' personality is crucial to employees' digital fluency. As a methodological contribution, I addressed the issue of multicollinearity of the constructs empowering leadership, leader-member exchange, and trust in leader to account for the proportional contribution of empowering leadership and confirm the robustness of my findings. I collected data from 486 employees from a medium-sized German technology company to address the research question by testing these assumptions and the construct reliability of empowering leadership. By addressing this research question, I contribute to a better understanding of external influences on employees' digital fluency, namely the leaders' behavior and personality.

Moving to the next level, Chapter 4 addresses the third research question by exploring the effect of age-technostress faultlines within work groups and its effect on collective digital fluency with the moderating effect of leader-member exchange climate.

My assumption is that faultlines within work groups could hamper collective digital fluency and that the moderating effect of leader-member exchange climate could influence the effect of faultlines within groups on collective digital fluency. As a theoretical foundation, I used the Social Identity Theory (Turner and Tajfel, 1986) and, thus, highlighted the effects on the team-level. I considered age-technostress faultlines as a fracturing condition of collective digital fluency and expected strong age-technostress faultlines to harm collective digital fluency. Moreover, I introduced the leader-member exchange climate as a moderating effect of collective digital fluency and tested my hypotheses using data from 805 employees of a large-sized German technology company.

While this dissertation comprises the four studies mentioned, I interconnect them throughout the whole dissertation. In this introduction, I motivated my work by highlighting the relevance of the dissertation's subject using research we conducted ourselves (Google Ngram study; Teepe, Glase, and Reips, 2023) and relevant research linked to the individual-, dyadic-, and team-level. I discussed theoretical and practical implications and avenues for future research for all three studies. The structure of the dissertation is graphically summarized in the following Figure 3.

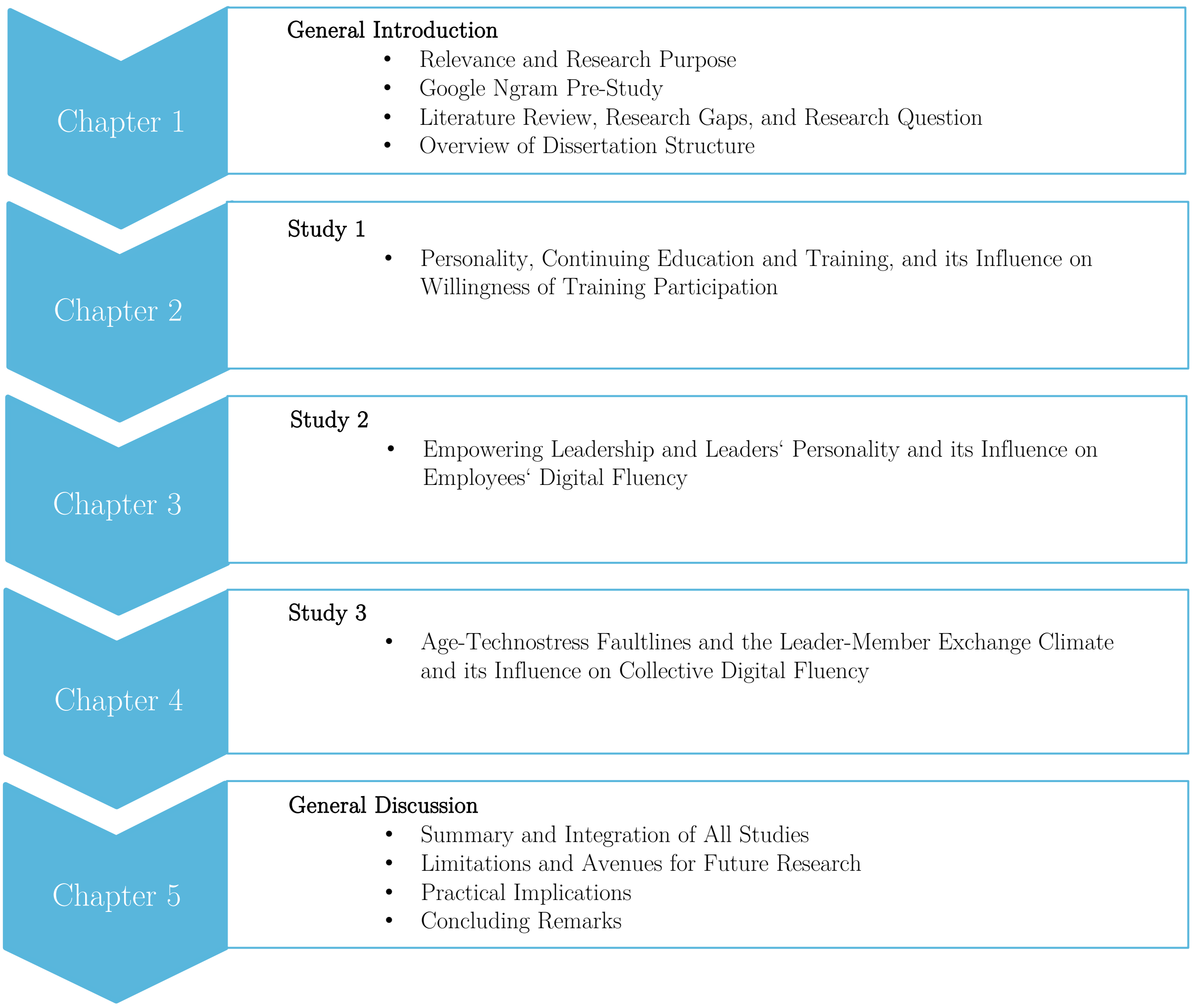

Figure 3. Overview of Dissertation Structure.

2 STUDY 1 - Is It All About Matching? Personality and Its Implications for Willingness of Training Participation: An Empirical Vignette Study

ABSTRACT

Training is one of the most profound methods for enhancing employees' work performance. To participate successfully in training, the willingness of training participation is crucial. One driver to increase the willingness of training participation could be a greater match between the employee and the training. However, research on factors investigating the concordance between the employee and the training is still scarce. I address this research gap by including the personality dimensions of extraversion and neuroticism. Therefore, I draw on the Person-Organization Fit and develop the Person-Training Fit by shifting the focus from employee-employer interaction to employee-training interaction. I argue that the validity of employee surveys should be improved by including the Experimental Vignette Methodology. I find support for the positive effect of extraversion on willingness of training participation and the negative effect of neuroticism on willingness of training participation in a sample of 1.007 employees in a German technology company.

Keywords: *Continuing Education And Training, Experimental Vignette Methodology, Personality, Willingness Of Training Participation*

2.1 Introduction

The willingness of training participation, or the motivation to participate successfully in training (Kyndt et al., 2014), is one driving factor for actual participation in training. Training is also one of the most profound methods for enhancing employees' work performance (Arthur et al., 2003). One major indicator of the success of continuing education and training (henceforth: CET) of adults is the transfer to real work situations. Therefore, it is essential for the success of CETs, that what has been learned can be applied at work. The transfer of CETs to new work situations is also a key issue in designing and assessing CETs (Herold et al., 2002; Lim, 2000). However, research provides evidence that skills learned in CETs do not always result in a valuable application in everyday work (Kraiger et al., 2020; Weinbauer-Heidel and Ibeschitz-Manderbach, 2019). All the more alarming is that only 20% to 10% of what was learned can be transferred to actual labor activities (London and Flannery, 2004). Accordingly, the effectiveness of CETs is not always a given (Kraiger et al., 2020).

The low CET transfer to work situations could, in turn, lead to a generally low willingness of training participation. Scholars found several drivers influencing the willingness of training participation. Not only external factors such as positive CET climate in a company (Rouiller and Goldstein, 1993; Tracey et al., 1995) and supervisory support (Cromwell and Kolb, 2004; Richman-Hirsch, 2001) have an impact on willingness of training participation, but also internal factors such as personality. This leads to individual differences in personality, which also have a strong influence on human experience and actions (Caspi et al., 2005). Taking the importance of human experience and action into consideration is central because the training literature also focuses on individual needs (e.g., Gulikers et al., 2019) and outcomes at the individual-level (e.g., Alvarez et al., 2004; Niittylahti et al., 2021). By addressing these individual experiences, needs, and outcomes, the potential opportunities for employees can be specifically targeted. As stated by Herold and colleagues (2002), "[. . .] *the training environment should be complex so that every individual can get something out of it*" (p. 867). Alvarez and colleagues (2004) add, moreover, "*training cannot be effective unless it meets the individual, organizational, and* *task needs*" (p. 389).

Given the outlined importance of individual needs, a closer look at the different facets of personality is necessary. Personality has been associated with job performance (Barrick et al., 2001) and is a central moderator for many work-related outcomes. The personality dimensions extraversion and neuroticism are essential as the differences in these traits have a substantial impact on their individual preference for social interaction. In turn, social interaction could be one dimension to discriminating and evaluating CETs. Extraversion has consistently been identified as a key predictor of sociability (Augustine and Hemenover, 2008), greater social satisfaction (Berry et al., 2007), and extraverted individuals are more interested in social and enterprising activities and occupations (Brown and Hirschi, 2013). The personality trait neuroticism is significantly associated with loneliness and social isolation (Christensen et al., 2002; Kotov et al., 2010). Neurotic individuals show more often antisocial behavior (Guo et al., 2018; Habashi et al., 2016) and experience greater personal distress in social interactions (Graziano et al., 2007; Habashi et al., 2016). Because of the influence of these personality traits on related topics, I focus on the two personality dimensions: extraversion and neuroticism. I assume that the effect of various CETs on the employees' willingness of training participation is moderated by the two personality dimensions: extraversion and neuroticism.

Researchers have explored the area of individual needs in the training literature (e.g., Fleishman and Mumford, 1989; Stewart et al., 1996). However, evidence for the potentially dynamic interaction between different CETs and individual differences (Herold et al., 2002), such as personality dimensions, is lacking. Related work from Alvarez and colleagues (2004) evaluating training effectiveness found that training cannot be effective if it does not consider individual needs. Due to its important influence, it is not surprising that many scientists are also theoretically investigating the fit between employees and their employers (e.g., O'Reilly et al., 1991; Westerman and Cyr, 2004). Employees are more engaged in their work or feel a sense of belonging to their employers when they anticipate similarities between themselves and the organization that employs them (e.g., Kahn, 1990). The person-organization Fit (P-O Fit; Chatman, 1989) is one approach to investigating the concordance between employees and their employers. The P-O Fit is defined as the fit between individual values and organizational values and examines how the organization affects the employee and whether the individual is or is not bound by organizational standards (Chatman, 1989). In the context of CETs and their applicability in the work context, a focus shift from the original macro-level to the micro-level regarding CETs and the employee could be instructive. This new micro-level would be described by the Person-Training Fit – henceforth: P-T Fit. Drawing from the assumption of the P-O Fit, I assume that a good P-T Fit predicts a positive job attitude (e.g., Cable and DeRue, 2002; Dawis and Lofquist, 1984). A higher fit should, if this assumption holds, result in a higher willingness of training participation. The underlying theoretical consideration of this study is that a good fit between the personality dimensions extraversion and neuroticism to CET characteristics, such as high and low social interaction, leads to a higher willingness of training participation.

Further evidence for this assumption can be found in related work, such as a study by Wexley and Latham (2002) that emphasizes the importance of considering skills and task characteristics when designing the most effective CET. Regarding the overarching research question, their work still falls short as they fail to provide concrete design suggestions for practice. Therefore, I integrate the Experimental Vignette Methodology (EVM; e.g., Atzmüller and Steiner, 2010), a method to capture people's expectations, conclusions, and heuristics in a less biased snapshot in a survey (Beck, 2010; Bradbury-Jones et al., 2014). EVMs manipulate and control independent variables (Aguinis and Bradley, 2014) in the form of short constructed descriptions (Atzmüller and Steiner, 2010) of different CETs displayed to the employees. The purpose is to assess participants' individual preferences (Shepherd et al., 2013) of social interaction by letting them rate different CETs.

In this study, I aim to integrate the literature on work and organizational behavior and personality to understand when different CETs relate to greater willingness of training participation. I attempt to make three theoretical and empirical contributions. First, I combine personality dimensions, CETs, EVM, and willingness of training participation. I state that personality influences the preference of different CETs and the willingness of training participation. In doing so, I take a new approach to explaining the diversity of the workforce and develop an understanding of the need for different CETs. Second, I transfer the P-O Fit (Chatman, 1989) into the P-T Fit by shifting the focus from employee-employer interaction to employee-training interaction to provide a suitable theoretical framework. Therefore, a core aim of this study is to develop a new theoretical framework that combines training research, psychology research, and organizational behavior research to bring together in theory what is already connected in practice. Lastly, by implementing EVMs, a survey method is used, which can control and manipulate independent variables effectively (Aguinis and Bradley, 2014; Boots et al., 2003). The developed scenarios can also serve as practical examples. While there are already many studies in other fields, such as clinical psychology, using this method, there are very few examples of application in the organizational behavior literature. Figure 4 summarizes the theory of my theoretical framework.

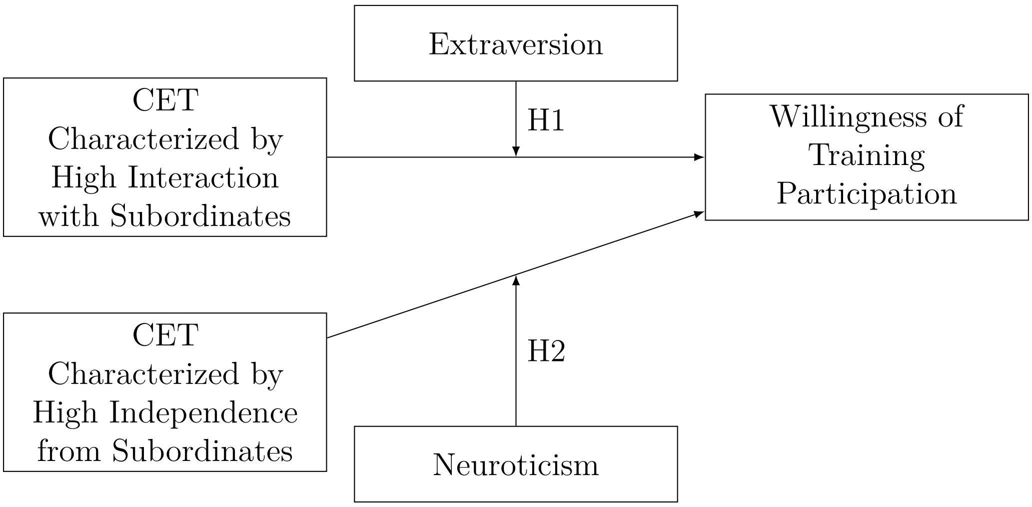

Figure 4. Research Model for Study 1.
Proposed Individual-Level Relationships between Different Forms of CETs, the Willingness of Training Participation, and the Moderating Effect of Personality Dimensions.

2.2 Theory and Hypotheses

The conceptualization of this study is based on the linking of different CETs, the moderating effect of two personality dimensions, and the effect on individuals' willingness of training participation. I focus on the individual-level by taking a closer look at each of the potential features and relations.

2.2.1 Different CETs

In this study, the CETs are differing in two CET scenarios. The first CET scenario is characterized by high independence from subordinates, and the second CET scenario is characterized by high interaction with subordinates. Thus, the two CETs differ regarding their interaction with subordinates - resulting in varying degrees of social exchange. Therefore, the first CET was induced by the following training vignette: *In this training setting, I would be able to deal with the topic alone and at my own pace. The training would take place online.* The following training vignette induced the second CET: *In this training setting, I would be able to exchange ideas in a group and share expertise with others. The training would take place online.* All training vignettes are displayed in Appendix B, Table 13.

2.2.2 Different Personality Dimensions

To explore the moderating influence of different personality dimensions, I applied the Big-Five Trait Theory Approach by Goldberg (1990). Most studies have used the Big-Five Trait Theory Approach to describe the most salient aspects of personality. Personality traits are psychological characteristics that serve as predictors for different outcomes and have, therefore, often been viewed as central to understanding a person's actions and reactions (Parks-Leduc et al., 2015). Numerous scholars have agreed that five robust factors of personality can provide a meaningful taxonomy to categorize personality attributes and the variability of human actions (Barrick et al., 1993; Goldberg, 1990). The Big-Five Trait Theory Approach differentiates between the dimensions: extraversion, neuroticism, openness to experience, consciousness, and agreeableness (Goldberg, 1990).

2.2.3 The Interaction between CETs, Extraversion, and Willingness of Training Participation Based on the P-T Fit

Since research on the relationship between extraversion and neuroticism and work performance is well established (e.g., Brown et al., 2011; Colquitt and Simmering, 1998), it is worth taking a closer look at possible drivers that influence the relationship between extraversion, neuroticism, and willingness of training participation, which in turn could lead to greater work performance. One possible influencing factor on the individuals' willingness of training participation could be supportive environments in the form of matching CETs.

So far, in organizational behavior literature, relatively little attention has been given to the investigation of the link between extraversion and social interaction in CETs. Besides, extraversion has been identified to be related to greater social satisfaction (Berry et al., 2007) because extraverted individuals seek company and social events (Hamburger and Ben-Artzi, 2000). Additionally, extraverted individuals are more outgoing and value excitement and variety in their environment (Parks-Leduc et al., 2015). Scholars have also found extraverted individuals to be more interested in social and enterprising activities and occupations (Brown and Hirschi, 2013). Given these findings and building on previous research suggesting that individual differences are crucial in establishing matching education and CETs (Kamisli and Özonur, 2019), I assume that extraverted individuals are more willing to participate in a CET, which is characterized by a high level of social interaction. This assumption will be tested with the theory already introduced. Therefore, the theoretical explanation for this study is the theory of P-T Fit, which is derived from the theory of P-O Fit. The theory of P-O Fit expresses that employees are more engaged in their work or feel a sense of belonging to their employer when they anticipate similarities between themselves and the organization that employs them (e.g., Kahn, 1990; Schneider, 1987). Moreover, researchers have shown that this involvement is enhanced when individual and organizational values and expectations match (Cooper-Thomas et al., 2004; Ostroff and Kozlowski, 1992). Consequently, a strong P-O Fit has an impact on individual behavior and general well-being in terms of organizational commitment and job performance (Lauver and Kristof-Brown, 2001; Meyer and Herscovitch, 2001).

According to the findings of Cable and DeRue (2002), greater individual-organization alignment reduces employees' turnover intention and additionally leads to more organizational citizenship behavior. Other researchers confirmed that when employees' values fit those of the employer, the employees are more likely to actively engage in valuable behavior (Gould-Williams et al., 2015). Consistent with this, the adapted theory of P-T Fit states that the greater the match between the individual and the CET, the greater the positive outcome. In this regard, if the individual is satisfied with the CET, the willingness to participate in this CET is also increasing. Therefore, I predict that extraverted individuals participating in a CET characterized by a high interaction with subordinates are more willing to participate. The assumption of a positive outcome through a good P-T Fit characterizes the underlying theoretical consideration, and I, consequently, hypothesize the following:

> *Hypothesis 1: The personality dimension extraversion positively moderates the effect of CETs characterized by high interaction with subordinates on the individuals' willingness of training participation.*

2.2.4 The Interaction between CETs, Neuroticism, and Willingness of Training Participation Based on the P-T Fit

The second personality dimension, which is the subject of this study, is neuroticism. Neuroticism is positively associated with antisocial behavior (Guo et al., 2018; Habashi et al., 2016) and personal distress (Graziano et al., 2007; Habashi et al., 2016). Neurotic individuals experience more daily problems and stressors while exhibiting stronger reactions to negative stimuli (Lahey, 2009; Robinson et al., 2007). In general, neurotic individuals tend to encounter stressful events and react with a higher level of negative effects (David and Suls, 1999). In line with this, neurotic individuals are more likely to review stressful events as threats instead of new opportunities (Suls, 2001). As a result, neurotic individuals are less likely to expose themselves to potentially stressful situations, such as interaction with others, and are often self-critical (Lahey, 2009). Additionally, several studies showed that neuroticism predicts loneliness (e.g., Hensley et al., 2012; Vanhalst et al., 2012). Saklofske and Yackulic (1989) assumed that neurotic individuals develop less meaningful relationships and consequently have interpersonal difficulties. Also, Lahey (2009) suggested that neurotic people are more likely to feel shame, discomfort, and vulnerability to stressors in social interactions, resulting in generally poor interpersonal interactions, unstable relationships with friends, and lower marital satisfaction. This, in turn, results in accompanying anxiety and loneliness (Hensley et al., 2012; Vanhalst et al., 2012).

According to these results, research in the field of individual internet use concluded that neurotic people are less likely to participate in social online communities actively (Cullen and Morse, 2011). Therefore, I assume that neurotic individuals do not enjoy interacting with others and prefer their own company. Accordingly, I expect an increase in the willingness of training participation for neurotic individuals in CETs characterized by independence from subordinates. Once again, I refer to the adapted theory of P-T Fit to explain the relationship theoretically. According to the P-T Fit theory, individuals are more involved in their activities when they detect similarities between themselves and the activity (e.g., Kahn, 1990; Schneider, 1987). Based on this consideration, I assume that a better fit between the individual and the CET also leads to a higher willingness of training participation. This is because neurotic people should feel more comfortable in CETs with less social interaction. Thus, I propose the following hypothesis:

> *Hypothesis 2: The personality dimension neuroticism positively moderates the effect of CETs characterized by high independence from subordinates on the individuals' willingness of training participation.*

2.3 Data and Methods

The main objective of this study is to empirically establish the relationship between CETs, personality dimensions, and willingness of training participation. To achieve this objective, I created an online survey that included vignettes based on the Empirical Vignette Methodology (EVM) and established questionnaires. The level of analysis for this study is the individual-level; thus, I collected survey data from one company located in Baden-Württemberg, Germany. The company is mainly active in the fields of automotive electronics, chassis systems control, car multimedia, and technical research and development. Two different locations of the company took part in the survey (location 1 $N = 34.1\%$, location 2 $N = 65.9\%$[3]). The company agreed to participate in the research and return was offered a benchmark report. Initially, all employees were invited to participate in the study by an internal e-mail distributed by authorized managers. Employees were contacted by e-mail and requested to fill out the survey. The e-mail provided a short introduction to the subject, a description of the study, and a link to a survey website hosted by an independent IT company located in Germany. All participants answered demographic questions, including, their sex, age, educational qualification, tenure, working hours per week, and whether they are leaders or not. Additionally, an algorithm programmed into the questionnaire allocated three of eight vignettes to each participant. To avoid the questionnaire becoming too long, I divided the company-specific questions into two different questionnaires, with 50% of employees randomly answering one-half of the questions and the other 50% of employees answering the other half. The selection mechanism was installed to lower the number of questions each employee had to answer, thus increasing the rate of completed questionnaires. Participants that did not complete the survey were excluded from the analysis. The final sample size was 1.007 participants. Respondents were predominantly males (77.8%), followed by females (21.5%), and diverse (.7%), with an average of 39 years of age ($SD = 10$). The most frequently represented educational qualification was diploma/master's degree (66.3%) and second doctorate (12.6%). The average tenure was 11.7 years ($SD = 9.41$). 21.7% of the participants were in a management position, and the average weekly working time was 37.4 hours ($SD = 6.11$). The variables' descriptive statistics, including means and standard deviations, are displayed in the following Table 1.

[3] Percentage of participants per location out of the total number of participants.

Table 1

Means, Standard Deviations, and Intercorrelations of Main Variables and Controls.

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1 CET: High Independence from Subordinates	3.90	.95									
2 CET: High Interaction with Subordinates	3.68	.88	.02								
3 Extraversion	10.77	2.54	-.11*	.27**							
4 Neuroticism	7.89	2.26	.14**	-.09	-.14**						
5 Willingness of Training Participation	23.31	2.27	.08	.18**	.16**	-.10**					
6 Job Satisfaction	4.01	.79	.02	.04	.18**	-.22**	-.13**				
7 Education Qualification	8.68	1.23	.10	.15**	-.00	-.07*	.09**	-.08*			
8 Age	39	10	-.01	-.02	-.14**	-.07*	-.15**	-.03	.02		
9 Leadership Position	1.78	.41	-.02	-.00	-.09**	.14**	-.07*	-.07**	-.13**	-.30**	
10 Sex	1.23	.43	-.10*	.09	.15**	.12**	.04	.05	-.19**	-.14**	.12**

Note. $N = 1.007$; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$. Values are based on two-sided significance testing; M = mean; SD = standard deviation; Education Qualification = 1 = no leaving certificate, 2 = lower secondary school leaving certificate, 3 = secondary school leaving certificate, 4 = entrance qualification for studies at universities of applied sciences, 5 = higher education entrance qualification, 6 = completed training, 7 = master craftsman/technician, 8 = bachelor's degree, 9 = diploma/master's degree, 10 = doctorate; Sex = 0 = male, 1 = female, 2 = divers.

2.3.1 Measures

2.3.2 Vignettes

I created vignettes by applying the Experimental Vignette Methodology (EVM) to determine how employees set their preferences in a constructed training setting (e.g., Barnatt et al., 2007; Beck, 2010). The aim is to understand the effects of manipulated variables on implicit judgments through the ranking of vignettes (Aguinis and Bradley, 2014). In developing the vignettes, I refer to the recommendations of previous studies. Hughes and Huby (2012) suggested designing compelling vignettes that engage participants' interests, the vignettes should be relevant to participants' lives and real-life decision-making situations (e.g., Aguinis and Bradley, 2014). According to previous studies, I highlighted the keywords of the manipulated variables to increase the visibility of keywords (Wason et al., 2002), and allowed the respondents to participate in their natural work setting (Aguinis and Bradley, 2014), shortened the vignettes to the same comparable length (Barter and Renold, 2000) and used three vignettes per employee (Aguinis and Bradley, 2014). I also created additional design elements, namely anchoring vignettes, to increase the internal validity and reliability of the survey (Steiner et al., 2016). These anchor vignettes serve as a double-consistent check. They consist of short statements, which are also used in the vignettes. Anchor vignettes were presented after the vignettes and in paired comparison and are, therefore, easier to answer via a binary selection (Barrera and Buskens, 2002). Consequently, to capture the real preferences for a CET, I combined vignettes with anchor vignettes. All vignettes and anchor vignettes are presented in Appendix B, Table 12, and Table 13. The correlations are displayed in Appendix B, Table 18. To test the validity of the latent construct variables, separate confirmatory factor analyses (CFA) were performed. Unless otherwise noted, 5-point Likert scales (1 = strongly disagree/never, 5 = strongly agree/always) were used for the following measures, and to ensure replicability, I used established questionnaire scales. Detailed wording of all items can be found in Appendix B, Table 14 (in its entirety; Table 15), and Table 17.

2.3.3 Personality

I assessed the personality of the employees by using the short measurement of personality – validity, and reliability of the GSOEP Big-Five Inventory (extraversion (Cronbach's α = .82, composite reliability (*CI*) = .83) and neuroticism (α = .68, *CI* = .69)) by Hahn, Gottschling, and Spinath (2012). The scale measures the five dimensions of personality. The dimensions are openness to experiences, conscientiousness, extraversion, agreeableness, and neuroticism based on work by Allport and Odbert (1936). The short version of the questionnaire was used to counteract fatigue caused by an excessively long questionnaire. An example item for extraversion is *"I see myself as someone who is outgoing, sociable."* An example item for neuroticism is *"I see myself as someone who worries a lot."* All item loadings for each personality dimension were significant ($\rho < .001$) and above the threshold of .5. All items for extraversion were > .7, and for neuroticism, all items were > .52. Since only three items per dimension were used, no fit indices can be reported, as more than three items are required for reliable fit indices (Hu and Bentler, 1999).

2.3.4 Willingness of Training Participation

The willingness of training participation (α = .83, *CI* = .89) was measured by using the scale developed by Van Vianen, Dalhoeven, and De Pater (2011) and Van Dam (2003). An example item for willingness of training participation is *"If it is necessary for my employer, I am willing to further my education in a subject, even if it is outside my area of expertise."* I used all five items of the original scale. Results from the CFA revealed good model fit properties (χ^2 = 13.347; *df* = 5; χ^2/df = 2.66; Comparative Fit Index (CFI) = .97; Incremental Fit Index (IFI) = .97; Tucker-Lewis-Index (TLI) = .95; Standardized Root Mean Square Residuals (SRMR) = .04).

2.3.5 Controls

I included five control variables because theoretical and empirical arguments suggest relationships with my main variables. First, I controlled for job satisfaction, as employees with higher levels of job satisfaction may also be expected to have a higher motivation to participate in work-related activities. According to Judge and Klinger (2008), *"job satisfaction is also a latent variable in that it is likely that people's overall attitude toward their job or work causes specific satisfactions to be positively correlated"* (p. 395). Besides, employees' general job satisfaction could lead to higher organizational commitment among employees (Saari and Judge, 2004), which could result in more engagement and participation in work-related activities. Second, I included the educational qualification of the employee as a control variable because scholars stated positive associations between educational level and participation in work and education. In the context that employees with higher education also participate more in further education (Bjursell et al., 2017) and show less absenteeism from work (Ng and Feldman, 2009). Therefore, higher educational qualifications may be expected to have an impact on the willingness of training participation. Third, I also controlled for the participants' age, as older employees may be less motivated to participate in work-related activities such as CETs. According to Taylor and Urwin (2001), individuals aged between 40 and 59 years are less likely to participate in training. Since it is supposed to have a lower return on investment (Ostroff and Atwater, 2003), and the general perception that older workers lack relevant skills and qualifications – manifests in negative age stereotypes (Gordon and Arvey, 2004; Kunze et al., 2013). Accordingly, negative age stereotypes may play a role, resulting in the assumption that older employees are less likely to participate in further training events (Shore et al., 2003). Fourth, I controlled for the leadership position as employees may also differ in their intention to apply CETs. Employees with a leadership position may be less motivated to attend CETs and may just look for a few takeaway points (Blume et al., 2019). On the other hand, Stiehl and colleagues (2015) identified leadership position as a strong predictor of willingness of participation in specific CETs. Due to these mixed results, the impact of a leadership position may play a role in the actual willingness of training participation and therefore needs to be controlled. Lastly, sex was included as a control variable because empirical findings indicate that women and men could differ regarding their intrinsic motivation to do something (Chen and Zhao, 2013) and their achievement motivation at work (van der Sluis et al., 2010).

2.3.6 Analytical Procedure

To test the measurement structure of my model, I applied structural equation modeling (SEM) techniques by using the statistical package AMOS 26. By conducting SEM, I compared two models with my hypothesized model. The hypotheses were tested by multiple linear regression analyses using IBM SPSS Statistics 26.

2.4 Results

2.4.1 Descriptive Statistics

Descriptive statistics are illustrated in Table 1, providing detailed information about the means, standard deviations, and intercorrelations for all relevant variables used in this study. The personality dimension extraversion is positively related to the dependent CET (r = .27, ρ < .05), characterized by high interaction with subordinates. Also, the personality dimension neuroticism is positively related to the independent CET (r = .14, ρ < .05), characterized by high independence from subordinates. As predicted, the personality dimension extraversion has a negative relation with the personality dimension neuroticism (r = -.14, ρ < .05). The willingness of training participation is negatively related to the personality dimension neuroticism (r = -.10, ρ < .05) and positively related to the personality dimension extraversion (r = .16, ρ < .05).

2.4.2 Measurement Model Comparison

Second, for evaluating the model fit, I refer to the recommendations of Bentler (2007) and Hoyle (1995) and included fit indices such as the Comparative Fit Index (CFI), Incremental Fit Index (IFI), Tucker-Lewis-Index (TLI), and Standard Root Mean Square Residual (SRMR). By comparing different models and including the fit indices, I apply common cut-off values. A cut-off value close to .95 for CFI, IFI, and TLI indicates a good fit between the hypothesized model and the observed data, with SRMR < .08 indicating a good model fit (Bentler, 2007; Hoyle, 1995). My hypothesized model is compared with two alternative models to validate my assumptions. For the hypothesized model, sufficient values for all fit indices were obtained (CFI = 1.0, IFI = 1.03, TLI = 1.04, SRMR = .04). The alternative model 1 includes two common factors and has a worse fit than the hypothesized model but still a good overall fit ($\Delta\chi^2 = 49.18, \Delta df = 2$). The second alternative model includes one common factor and has a significantly worse fit than the hypothesized model ($\Delta\chi^2 = 163.16, \Delta df = 3$). All fit indices for the measurement model comparison are displayed in the following Table 2.

Table 2
Measurement Model Comparison.

	χ^2	*df*	$\chi^2 df$	$\Delta\chi^2$	Δdf	*CFI*	*IFI*	*TLI*	*SRMR*
Hypothesized Model	24.810	41	.60			1.0	1.03	1.04	.04
Alternative Model 1	73.993	43	1.72	49.18	2	.92	.92	.90	.08
Alternative Model 2	138.348	44	3.14	163.16	3	.76	.76	.70	.13

Note. N = 1.001; χ^2 = chi-square; df = degrees of freedom; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis-Index; SRMR = Standardized Root Mean Square Residual. All measurement models are compared to the hypothesized model.

2.4.3 Hypotheses Testing

Third, the proposed hypotheses are tested and evaluated through computed regression analyses using IBM SPSS Statistics 26. Table 3 displays the results of the conducted multiple linear regression analyses. The first model tested the proposed moderating effect of extraversion on the relationship between the dependent CET with high interaction with subordinates and willingness of training participation. The results do not support hypothesis 1 as the interaction term was not significant (β = .01, ρ = .13). The second model tested the proposed moderating effect of neuroticism on the relationship between the independent CET with high independence from subordinates and willingness of training participation. Also, results showed no significant interaction term for hypothesis 2 (β = -.04, ρ = .14). Nonetheless, I could find significant effects between the personality dimensions extraversion (β = .03, ρ < .05) and neuroticism (β = -.07, ρ < .05) and willingness of training participation. I will discuss these results in the following.

Table 3
Multiple Regression Analyses.

		Willingness of Training Participation					
		Model 1			Model 2		
Predictors		*Coef.*	*Robust Std. Err.*	*95% CI*	*Coef.*	*Robust Std. Err.*	*95% CI*
	Constant	4.50	.10***	[4.29 ; 4.70]	4.87	.07***	[4.72; 5.03]
Controls							
	Job Satisfaction	.07	.02***	[.03 ; .12]	.03	.02	[-.01 ; .07]
	Education Qualification	.03	.02	[-.01 ; .07]	.02	.02	[-.01 ; .07]
	Age	-.07	.02**	[-.11 ; -.02]	-.04	.02	[-.08 ; .00]
	Leadership Position	-.06	.02	[-.11 ; -.01]	-.02	.02	[-.06 ; .02]
	Sex	-.00	.02	[-.05 ; .03]	.00	.02	[-.03 ; .04]
Main Effects							
	CET: high Interaction with Subordinates	.15	.07	[.00 ; .30]			
	CET: high Independence from Subordinates				.13	.06*	[-.00 ; .26]
	Extraversion	.03	.03**	[.00 ; .10]			
	Neuroticism				-.07	.02**	[-.12 ; -.01]
Interaction Effects							
H1	Extraversion x CET: high Interaction with Subordinates	**.01**	**.03**	**[-.31 ; .14]**			
H2	Neuroticism x CET: high Independence from Subordinates				**-.04**	**.04**	**[-.25 ; .14]**
F		6.54			2.52		
R^2		.12			.05		
ΔR^2					.17		

Note. N in Model 1 = 382; N in Model 2 = 382; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$, two-tailed.

2.5 Discussion

Training continues to be one of the most profound methods for enhancing employees' work performance. Therefore, the individuals' willingness of training participation is crucial to participate successfully in training. The importance of willingness of training participation urges the individuals' differences and needs. Whenever individual needs play a role, the personality of the individual should be considered. Furthermore, CETs cannot be effective unless the individual needs are met (Alvarez et al., 2004). The effectiveness of CETs and their transfer to real work situations is particularly crucial for employees and their employers (Herold et al., 2002). Accordingly, there is a considerable body of literature regarding personality as an important predictor of a variety of different work outcomes (e.g., Brown and Hirschi, 2013; Bullock and Reardon, 2005; Roberts et al., 2007). As frequently investigated, the personality dimension extraversion has been associated with greater training proficiency (Barrick et al., 2001) and more engagement in career planning (Rogers et al., 2008) but also with the enjoyment of large social events (Hamburger and Ben-Artzi, 2000), and more outgoing behavior (Parks-Leduc et al., 2015). Whereas the personality dimension neuroticism has been linked to reduced self-efficacy (Brown and Cinamon, 2016), less career planning (Rogers et al., 2008), and antisocial behavior (Guo et al., 2018). Consequently, the employees' personality differs regarding requirements for the work environment resulting in a diverse workforce. More recently, however, perceptions of diversity in personality dimensions have shifted toward a swelled appreciation of the source of diversity (Azucar et al., 2018). As a result, work groups in organizations have become increasingly diverse and will continue to become even more diverse. Therefore, the diverse workforce could also differ regarding their willingness of training participation.

In this study, I examined the effects of different CETs, thus referring to the call of Herold and colleagues (2002) for a deeper understanding of the potentially dynamic interaction between different CETs and personality dimensions. I used the EVM (Experimental Vignette Methodology) to construct real-life decision-making situations (e.g., Aguinis and Bradley, 2014; Hughes and Huby, 2012) and to detect implicit judgments through the ranking (Aguinis and Bradley, 2014). I conducted a study based on my theorizing and an empirical sample of 1.007 employees to answer the question: *when do different CETs relate to greater willingness of training participation in the work and organizational behavior context?* My results indicate that different CETs do not affect the individuals' willingness of training participation. Notwithstanding, my results also indicate that the personality of the employee has a significant influence on the willingness of training participation. More precisely, the results show a significantly lower willingness of training participation for neurotic employees, whereas a significantly higher willingness of training participation for extraverted employees has been identified. This is in line with previous research by several scholars who stated that personality highly affects work behavior (Barrick and Mount, 1991; Hurtz and Donovan, 2000). Brown and Hirschi (2013) concluded that personality is an important *"predictor of a variety of different work outcomes"* (p. 323). By measuring the individuals' willingness of training participation, I focused on a personal invisible attitude that could lead to a certain visible result and, therefore, could explain different work outcomes. Nevertheless, the question remains how individual willingness of training participation can be increased using different CETs.

2.5.1 Theoretical Implications

The training research explores the relationship between specific CETs and the effectiveness of CETs in organizations (Arthur et al., 2003). With this study, I contributed to this research branch by combining personality dimensions, CETs, and willingness of training participation. Specifically, I focused on the personality dimensions of extraversion and neuroticism to get insights into the relationship between CETs and willingness of training participation with the mediation of personality dimensions. In doing so, I take a new approach to explaining the diversity of the workforce and develop an understanding of the enormous influence of personality. In prior training research, several scholars acknowledged the importance and potential impact of CETs (Alvarez et al., 2004; Arthur et al., 2003; Stewart et al., 1996). Although these studies highlight the importance of CETs, the work and organizational behavior literature have paid little attention to the dynamic interaction of individual differences regarding CETs. This is crucial because work and organizational behavior literature should focus on individual needs and potential opportunities for employees. By shifting the focus on differences between individuals, I integrate a more individual-centered focus described by the micro-level and, therefore, refer to the call of Herold and colleagues (2002), who stated that there is still a lack of understanding of differences between individuals in training. Another related contribution of this research is the theoretical adaption of the P-O Fit (Chatman, 1989) into the P-T Fit. The P-T Fit is a new suitable theoretical framework that combines training research, psychology research, and organizational behavior research. The underlying theory of P-O Fit is well-established and has a relatively long history of generating considerable research (e.g., Arthur et al., 2006; Chatman, 1989; Cooper-Thomas et al., 2004; Ryan and Kristof-Brown, 2003). By constructing the P-T Fit, a methodological enhancement was made and should be considered in further studies regarding the individual and CETs. Another contribution of this study is the use of EVM. By implementing EVM, a survey method was applied to control and manipulate independent variables effectively and to understand the decision-making process of the individual (Aguinis and Bradley, 2014; Sauer, 2011). According to Barnatt and colleagues (2007), EVM is particularly useful for gaining access to individuals' beliefs and attitudes in everyday situations. These properties make EVM particularly useful in clinical psychology research (Aguinis and Bradley, 2014) but could also be valuable in surveying decision-making processes such as the individuals' preference for a CET.

In this sense, empirical vignettes are also beneficial in applied work and organizational behavior because they are more realistic and less abstract than conventional questionnaire items (Steiner et al., 2016). Nevertheless, there are very few examples of EVM applications in the training literature. What, however, leads in reverse to the fact that this is a methodological improvement and contribution of this study. With the methodological strengths of the study also comes great practical applicability. Thus, I point to a critical research gap that Joo and Lee (2017)adressed, stating that most studies are conducted with non-work populations such as students. By referring to my workforce sample which tested the CETs, which are also intended to support them, I have contributed to the research branch by making the results more valid. In this regard, the displayed CETs could subsequently be used for practical examples. However, regarding the non-significant results, I recommend creating other training vignettes. Nevertheless, the design criteria outlined should be followed, and additional anchor vignettes should be implemented more frequently.

2.5.2 Practical Implications

My findings highlight the need for a deeper understanding of individuals' personality differences and their specific requirements regarding CETs to remain competitive. This study points to the potential practical implications concerning the support of the individual's participation in CETs to increase satisfaction and willingness of training participation. An important practical implication, therefore, is to heighten the level of awareness of differences between individuals and, even more important, the considerable effect of the individuals' willingness of training participation. Regarding the diversity of the workforce, practitioners could analyze employees' personality and thus widen the lens from a one-training-fits-all approach to a more individualistic approach. By referring to the individual, employees could feel greater supported and are, therefore, more intrinsically motivated (Guillaume et al., 2014). Besides, this could also lead to a better understanding of the influence of personality dimensions on performance. Especially the personality dimension neuroticism and its' effect on training performance is poorly understood and often absent in the working context (Smillie et al., 2006).

Based on this reasoning and as a first step, practitioners could analyze the individuals' personality and then allocate matching CETs. Additionally, different sets of CETs should be accessible and could therefore be realized by implementing EVMs in employee surveys. Running EVMs as an employee survey can help companies gauge someone's hidden preferences regarding CET activities. Applying EVMs in the working context is not only an easy and practical excess to the individuals' preferences regarding CET activities but also a valid method to assess dependent variables, including intentions, attitudes, and behavior (Aguinis and Bradley, 2014). Even better, employees could answer realistic

EVMs and benefit from tailor-made CETs. The development of tailor-made CETs can be supported and implemented by the company's human resource management. Such an implementation of tailor-made CETs could also lower absenteeism (Alvarez et al., 2004), increase self-efficacy (Tracey et al., 2001), and willingness of training participation. Therefore, I call for greater sensitization regarding the individuals' personality and their CET needs. Following Wexley and Latham (2002), I emphasize the need for providing concrete design suggestions for CETs to help every employee to participate successfully in work.

2.5.3 Limitation and Direction for Future Research

The study combines theoretical and practical ways to understand individual needs better; moreover, my study also has some limitations that open possibilities for further research. First, I designed training vignettes that differ in terms of their social interaction with others, but both describe an online scenario. In particular, the social exchange on the internet may create a distance that is also appreciated by neurotic individuals and therefore blurs the lines between social interaction and social independence in my manipulated variables. For future research, I recommend considering the special situation of online interaction in more detail. Additionally, the double consistency check derived from the anchor vignettes shows that both vignettes significantly correlate with anchor vignette III (digital vs. analog; Appendix B, Table 18). Whereas the first training vignette (CET: high independence from subordinates) positively correlates (r = .33, ρ < .05) with anchor vignette III, the second training vignette (CET: high interaction with subordinates) negatively correlates (r = -.25, ρ < .05) with anchor vignette III. Together, this result shows that implementing anchor vignettes is a useful additional design element to identify the internal validity of the measurement. Therefore, I agree with Steiner and colleagues (2016), who called for applying anchor vignettes when conducting EVM. To the best of my knowledge, the implementation of anchor vignettes is still limited and should be included mandatory when using EVMs.

Second, even though I focused on personality as deep-level diversity, related literature suggests that other deep-level attributes (Harrison et al., 2002) could also affect the willingness of training participation. Those other deep-level attributes could be individual values and attitudes, which are elusive to detect and could have neglected influences (Barsade et al., 2000). Hence, as Guillaume and colleagues (2012) stated, surface-level attributes and deep-level attributes are both influential and should be controlled. Additionally, controlling situational constraints such as time pressure and monetary reasons (Ertz et al., 2016) or individual constraints such as the locus of control (Gaspar, 2013) could be beneficial for explaining factors that influence the willingness of training participation.

Third, my sample is based on white-collar workers employed in one organization in Germany. Thus, future research should try to replicate my results in other contexts. Other contexts might involve blue-collar workers within other companies, industries, and countries. This is relevant as blue-collar workers with different educational backgrounds might prefer other CETs and might have another general level of willingness of training participation. The sample also consisted mainly of highly qualified employees (diploma/master's degree = 66.3%, doctorate = 12.6%), which is not representative of the German workforce as 15.9% holding a diploma/ master's degree or a doctorate in 2019 in Germany (Gude, 2018).

Lastly, a frequent criticism regarding the use of EVM is the ongoing debate concerning the relationship between individuals' beliefs and actions and the associated question of how EVMs can capture reality (Bradbury-Jones et al., 2014). Some scholars are concerned about the differences between people's thoughts and feelings in a given situation and how they behave (Barter and Renold, 2000; Paddam et al., 2010). Hypothetical vignettes are, thus, limited in their ability to mime real-life scenarios. However, the more realistic a given EVM is, the more likely the answer will reflect the individual's belief (Bradbury-Jones et al., 2014).

2.6 Conclusion

Following repeated calls for more comprehensive research on individual needs, the present study extends the theory in organizational behavior research by focusing on the effect of different CETs on the individuals' willingness of training participation moderated by two personality dimensions. Drawing on the P-T Fit, I develop predictions about the effect of personality and matching CETs on the individuals' willingness of training participation. Although there are manifold drivers influencing willingness of training participation, my findings reveal that personality has a significant influence on the willingness of training participation. While the personality dimension of neuroticism has a negative influence on the individuals' willingness of training participation, the personality dimension of extraversion has a positive influence on the willingness of training participation.

The present study helps to move the perspective from the macro-level with the focus on the organization and the employee to the micro-level with the focus on CETs and the employee. I encourage scholars to conduct more dynamic and merging research in organizational behavior research, personality research, and diversity research. I also encourage practitioners to use EVM and anchor vignettes in HRM practice when investigating employees' work preferences. EVM offers practitioners the opportunity to engage employees' interests and individual preferences in a less biased snapshot.

2.7 Study Results in the Context of Digital Fluency

The conducted Study 1 *Is It All About Matching? Personality and Its Implications for Willingness of Training Participation: An Empirical Vignette Study* takes the first step towards a deeper understanding of the individuals' willingness of training participation and subsequently paves the way to a better understanding of the conditions of the acquisition of digital fluency. Digital fluency is the *"ability to reliably achieve desired outcomes"* (Briggs and Makice, 2012, p. 62) using digital technology. This ability is highly valuable due to the rapid development of digital technologies in most labor contexts (Oberländer et al., 2020). Organizations face extensive technology integration in daily work, and global investment in digital technologies is expected to increase immensely with the tendency to exponential growth. To stay competitive as a company with equipped employees, it is, therefore, necessary to investigate how employees can be trained in their digital fluency.

In the first study, I could show that the employees' personality has a significant influence on the employees' willingness of training participation. The construct of willingness of training participation is the motivation to take part in training (Kyndt et al., 2014). Taking part in training or work-related settings is the foundation for successful participation in labor (Alvarez et al., 2004). Also, willingness of training participation can be the first step toward the acquisition of digital fluency. Again, acquiring digital fluency is necessary to meet the needs of increasingly technological labor (Briggs and Makice, 2012). In Study 1, I could show that the personality dimension extraversion has a positive influence on the willingness of training participation and neuroticism has a negative influence on the willingness of training participation. Thus, my findings highlight that the individuals' personality differences should be taken into account when training settings are designed for the acquisition of new skills such as digital fluency. In the context of ongoing digitalization, the acquisition of digital fluency should be individual-centered, with a profound understanding of differences in employees' personality. Besides this finding, I also point to an important practical implication. With the implementation of EVMs in the working context also comes great practical applicability. I recommend using EVMs to investigate the best settings for the acquisition of digital fluency. I claim that an open mindset related to digital technologies and digital fluency is a critical skill for every employee. Therefore, more in-depth research into digital fluency and its possible antecedents is needed. I will address shortcomings by focusing on the dyadic- and team-level. By doing so, I will follow the structure of the three level structure (Figure 2, p. 10) and continue with the dyadic-level in Study 2.

3 STUDY 2 - The Role of Empowering Leadership and the Leaders' Personality and Its Influence on the Acquisition of Digital Fluency among White-Collar Workers

ABSTRACT

Digitalization is a constant major challenge in nowadays working life. In this context, acquiring digital fluency, the ability to achieve desired outcomes using digital technology reliably, is crucial for employees to stay competitive. Therefore, it is even more critical to understand how employees can be helped to acquire digital fluency. Supportive external factors could be the leadership style: empowering leadership, and the leader's personality. A current unexplored branch of digital competencies research is pointed out by referring to those work-related influencing factors, such as the leaders' influence. To address this research gap, I built on the Empowerment Theory (Zimmerman, 1995), which is viewed as a process by which employees are helped to gain mastery over their lives and show high interest in learning new skills such as digital fluency. Empowering leadership and the leaders' personality could influence the employees' level of empowerment and, subsequently, their digital fluency. I find support for positive main effects of empowering leadership and leaders' conscientiousness on employees' digital fluency. Also, I find support for a negative main effect of leaders' neuroticism on employees' digital fluency in a sample of 486 employees from a medium-sized German technology company. Implications for future research and professional practice on digital fluency and the influence of leaders are also discussed.

Keywords: *Digital Fluency, Empowering Leadership, Empowerment Theory, Leader-Member Exchange, Leaders' Conscientiousness, Leaders' Neuroticism*

3.1 Introduction

Digitalization has become central in most occupations and industries as modern work settings are immensely influenced by artificial intelligence, big data, and augmented reality (Díaz Andrade et al., 2019). Digital devices and software programs used in professional life are constantly developing (Oberländer et al., 2020). By 2025, an increase from 18 billion to 75 billion connected digital devices is predicted worldwide (Clement, 2020). These changes call for the acquisition of employees' digital competencies (Gallardo-Echenique et al., 2015). One term for digital competencies is digital fluency, or the *"ability to reliably achieve desired outcomes through the use of digital technology"* (Briggs and Makice, 2012, p. 62). Digital fluency is regarded as one of the essential vital competencies for active participation in professional life (Cascio and Montealegre, 2016; Zimmermann and Kunze, 2019). The relevance of digital fluency raises the question of *how organizations can promote employees' digital fluency.* However, comprehensive knowledge about crucial factors influencing the acquisition of digital competencies is still scarce (van Laar et al., 2020). Also, Schwarzmüller and colleagues (2018) called for a deeper understanding of contextual factors of digital competencies.

To understand the influence of contextual factors and as a theoretical base, I draw on the Empowerment Theory (Zimmerman, 1995). The theory is rooted in the assumption that empowerment, the granting of the authority to perform new skills, includes both the process of becoming empowered and the outcome of being empowered (Swift and Levin, 1987). The empowering process describes the situation where employees are given opportunities to influence and control their decisions and and master their actions (Rappaport, 1987; Zimmerman, 1995). The empowering process can include opportunities to develop and practice new skills (Singh and Rangnekar, 2020), such as digital fluency. On the other hand, the outcome of being empowered is a consequence of the empowerment process, which can manifest in the employees' actions and reactions. This, in turn, can be mapped by the employees' desire to acquire new skills. In professional life, the leaders' behavior is a proximal influence on employees' actions and reactions and may have the ability to affect employees' digital fluency generally. A leadership style that may address these requirements is empowering leadership. Empowering leadership is characterized by distributing power and motivation among followers (Amundsen and Martinsen, 2014b). Researchers found empowering leadership to be positively correlated with employees' self-efficacy (Ahearne et al., 2005) and self-motivation (Hulpia et al., 2012), which in sub-sequence, could lead to skill acquisition, such as the acquisition of digital fluency. Empowering leadership can satisfy employees by involving delegation of authority, employees' development, and encouragement by expressing confidence in employees' work (Kim and Beehr, 2020). Conversely, empowering leadership should increase employees' digital fluency by nurturing engagement and an intrinsic interest in work (Stone et al., 2009). The promoted intrinsic interest in work could be linked to more significant curiosity about skill acquisition and a superior willingness to become digitally fluent. In line with this, scholars have confirmed a positive link between employees' intrinsic interest in work and greater digital skill development (Kaše et al., 2019). Thus, to contribute to the existing digital competencies literature, I aim to add the construct of empowering leadership as an influential factor in employees' acquisition of digital fluency.

Additionally, the leaders' personality is another influence on employees' actions and reactions and may also have the ability to generally affect employees' acquisition of digital fluency (e.g., Bono and Judge, 2003). Therefore, I consider empowering leadership and the leaders' personality as sources of contextual factors influencing the employees' acquisition of digital fluency. Investigating empowering leadership and the leader's personality, the leader's behavior and traits are considered highly influential on employees' acquisition of digital fluency. By doing so, I answer Derue and colleagues' (2011) call to concurrently take the leaders' behavior and traits into account to explain more variance in leadership effectiveness. Thus, leadership effectiveness can be a fruitful source for employees' acquisition of digital fluency. Accordingly, in empowering leadership, the leaders' personality highly influences employees' skill acquisition. In a similar vein, the leader's personality, defined as *"individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions"* (McCrae and Costa, 2003, p. 25), also impacts employees' skill development (Brown and Hirschi, 2013; Judge et al., 2002) and employees' technology-use in professional life (Diller et al., 2020).

The Big Five personality dimensions can be subdivided into the dimensions: openness to experience, conscientiousness, neuroticism, agreeableness, and extraversion (Goldberg, 1990). Especially the two personality dimensions: conscientiousness and neuroticism, are central to acquiring new skills, are stable for working-age adults, and are unrelated to life-changing experiences (Cobb-Clark and Schurer, 2012). Following the Empowerment Theory by Zimmerman (1995), the author states that employees' willingness for skill acquisition will be promoted when they feel empowered by experiencing control and support and participating in decision-making and problem-solving (e.g., Zimmerman, 2000). A leader scoring high on conscientiousness will support and encourage employees' motivation and digital skill acquisition (Diller et al., 2020), whereas a leader scoring high on neuroticism will show low self-efficacy (Dalal, 2005), leading to less supportive behavior. To the best of my knowledge, the effect of leaders' personality on the acquisition of employees' digital fluency is not researched in depth. Indeed, Cortellazzo and colleagues (2019) pointed out that there is a shortage of well-established empirical evidence for the influence of leaders on the acquisition of digital skills. Thus, identifying empowering leadership and the leaders' personality as contextual factors for acquiring digital fluency fills a notable gap. Furthermore, to the best of my knowledge, considering leaders' personality as a moderating effect on the effect of empowering leadership on employees' digital fluency has not yet been researched. This moderating effect also fills a research gap and will be addressed in depth throughout this study.

I propose that empowering leadership will facilitate the acquisition of employees' digital fluency. The leaders' personality dimensions: conscientiousness and neuroticism, will affect employees' digital fluency, whereas leaders' conscientiousness will positively affect employees' digital fluency, and leaders' neuroticism will have a negative effect. Based on the Empowering Theory by Zimmerman (1995), empowering leadership and the personality dimension: conscientiousness will satisfy humans' belief in one's ability to exert control, and the personality dimension: neuroticism will hinder humans' belief in one's ability to exert control, leading to reduced digital fluency. An open and exploratory work situation is created by forming an empowering environment that promotes a reasonable basis for acquiring digital fluency. Also, Ryan and Deci (2020) suggest that future studies should investigate how employees can be supported to increase their digital skills, such as e-learning and remote learning. By looking not only at the leaders' behavior but also at the leaders' traits, it will be examined to what extent both factors reinforce each other to lead to the improved acquisition of digital fluency.

This line of inquiry adds to the limited research (e.g., Deci and Ryan, 2000) that has explicitly investigated employees' digital fluency in conjunction with empowering leadership and the leaders' personality. Hence, it contributes to digital competencies research (e.g., Cortellazzo et al., 2019) that seeks to shed light on relevant factors influencing the acquisition of digital competencies in professional life. In summary, I attempt to make three significant contributions to digital competencies research. First, as a theoretical contribution, I add to the digital competencies research by investigating potential, influential factors prompting to gain mastery in digital fluency. Prior research focused on the influence of meta-knowledge (e.g., Wei et al., 2020), age (e.g., Hauk, 2018), or workplace resilience and adaptability (e.g., Trenerry et al., 2021) on employees' acquisition of digital fluency. Nevertheless, factors influencing the employees' acquisition of digital competencies are still in their infancy (van Laar et al., 2020) and need to be investigated in depth (Schwarzmüller et al., 2018). By focusing on the impact of leaders on their employees', I provide a deeper understanding of possible predictors in the work context for digital fluency. This, in turn, offers a starting point for connecting digital competencies research with the branch of leadership research leading me to my second contribution. Second, I integrate both leaders' behavior (empowering leadership) and leaders' traits (leaders' personality). To contribute to an integrative understanding of leadership effectiveness, I answer a call by some leadership researchers (e.g., DeRue et al., 2011) to consider the leaders' personality and behavior simultaneously. Because the bulk of leadership research has been carried out on the leaders' behavior or the leaders' traits, my study breaks new ground by connecting the proximal and distal influences with digital fluency. Finally, I use different statistical analyses to differentiate the constructs of empowering leadership, leader-member exchange, and trust in leader. In doing so, I refer to a research gap identified by Sharma and Kirkman (2015). Thus, I contribute to a more *"robust understanding of the widely practiced but relatively under-researched empowering leadership construct"* (Sharma and Kirkman, 2015, p. 219). According to this, there is still substantial overlap between related constructs, and research is needed. Overall, this study offers a much-needed first step in understanding how organizations can leverage the resource at hand: leadership, to reach its full potential and provide an environment for their employees' acquisition of digital fluency. Figure 5 below illustrates the assumed relationships and the resulting hypotheses of this study.

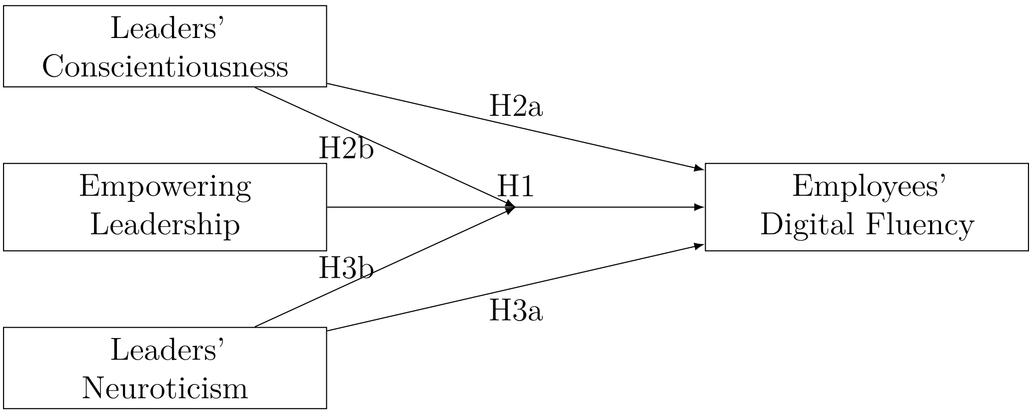

Figure 5. Research Model for Study 2.

Proposed Dyadic-Level Relationships between Empowering Leadership, the Leaders' Personality, and Employees' Digital Fluency.

3.2 Theory and Hypotheses

To establish the illustrated theoretical model, I refer to the Empowerment Theory (Zimmerman, 1995). The Empowerment Theory by Zimmerman (1995) provides a theoretical frame for understanding the higher-order multidimensional construct of psychological empowerment. Empowerment refers to a *"process through which people and groups gain greater control over their lives* [. . .]*"* (Maton, 2008, p. 5). The model encompasses three interrelated dimensions, namely interpersonal psychological empowerment, interactional psychological empowerment, and behavioral psychological empowerment (Peterson, 2014; Zimmerman, 2000). The interpersonal component of psychological empowerment describes the process of *learned hopefulness* and *perceived control* regarding one's actions (Christens et al., 2013). The interactional component of psychological empowerment involves the process of *critical awareness, skill development*, and *resource mobilization* (Zimmerman, 1995). The interactional component describes how people think about something. The last component is behavioral psychological empowerment, which involves *individuals' actions* that are expected to affect outcomes directly (Zimmerman, 2000). By doing so, individuals gain control over their lives and actions (Perkins and Zimmerman, 1995) and can be empowered by external settings or persons (Rappaport, 1987). Empowering leadership as an external setting can increase employees' digital fluency by providing power and authority. The empowerment approach emphasizes the ability of individuals to face and solve complex situations and engage in problem-solving (Peterson, 2014). The self-reliant decision leads to more satisfaction and success because the individual pursues goals in her/his way and masters her/his behavior (Deci and Ryan, 2000; Gagné et al., 2000).

Besides, the leaders' behavior is viewed as one possible catalyst for employees' behavior (Lee et al., 2018) and enables skill acquisition. Gagné and colleagues (2005) stated a positive relationship between a leader's autonomy support and the followers' work outcomes. A leader's autonomy support leads to greater needs satisfaction of their followers, which boosts job satisfaction and psychological adjustments (Gagné and Deci, 2005). The downward influence of the leader on employees as a direction of power relationship could be induced by the leadership style empowering leadership and the leader's personality. The present Study 2 conceptualizes three influential factors, namely the leadership style: empowering leadership, and the two personality dimensions conscientiousness and neuroticism on employees' digital fluency.

3.2.1 The Influence of Empowering Leadership on the Employees' Digital Fluency

Digital fluency consists of the capacity and the willingness to perform in digital work and modern organizations. Briggs and Makice (2012) refer to *"digital fluency as an ability to reliably achieve desired outcomes through the use of digital technology. This* *ability is helped or hindered by the situational forces and the digital fluency of others"* (p. 65). The concept of digital fluency consists of two first-order constructs, namely digital knowledge and digital self-efficacy (Zimmermann, 2020). Digital knowledge not only *"involves knowing how to engage with technology, but also being able to produce things of significance with technology"* (Wang et al., 2012, p. 2). Digital self-efficacy is linked to Bandura's self-efficacy concept, which describes the belief that one can successfully carry out behavior necessary to generate specific outcomes (Bandura, 1977). In 2015, Bandura added that *"people's beliefs in their capability influence the goals they set for themselves and their commitment to them in the face of difficulties"* (p. 1026). Putting Bandura's self-efficacy concept in the context of digital self-efficacy means that people with an exceptionally high level of digital self-efficacy are more likely to use digital technologies and thus become more successful. As reported by Chen and colleagues (2011), empowering leadership is proposed to influence the individual's motivation and willingness to engage actively in work-related settings (Chen et al., 2007; Chen et al., 2011). Empowering leaders have been especially proposed to influence the individuals' motivation (Chen et al., 2011) and the individuals' motivation to engage in learning activities (Chen et al., 2007; Chen et al., 2011) by making employees feel psychologically empowered and efficient in self-leadership (Amundsen and Martinsen, 2014b).

According to the Empowerment Theory, empowering leadership can encourage employees to become more digitally fluent in three different ways. First, empowering leaders allow employees to be receptive to their work environment and provide autonomy from bureaucratic constraints that slow responsiveness (Ahearne et al., 2005). Additionally, empowering leaders delegate responsibilities – leading to a situation where employees feel *autonomy control* and responsibility for their skill acquisition and development. This, ultimately, leads to an innate self-interest in greater digital fluency. Second, empowering leaders encourage employees to believe in their self-efficacy and capabilities. By emphasizing the employees' *skill development*, empowering leaders enable employees to take responsibility for their actions, such as becoming more digitally fluent in labor. Lastly, one dimension of empowering leadership is fostering participation to accomplish collective goals and connection to subordinates. The feeling of having the opportunity to *show actions* that are expected to affect a specific outcome makes employees more willing to contribute to the company's goals and, for example, show extra-role behavior such as further educating themselves in relevant topics such as digitalization. By fostering employees' interpersonal, interactional, and behavioral psychological empowerment, the foundation is laid for acquiring digital fluency.

Briggs and Makice (2012) refer in their definition to *"situational forces"* (p. 65) as a fruitful source for becoming digitally fluent. Situational forces could be empowering leaders who distribute relevant information and provide development support (Amundsen and Martinsen, 2014b), leading to greater followers' digital knowledge. By taking on the coaching role, empowering leaders allow followers to gather relevant information and subsequently become digital knowing. In addition, empowering leaders could also support followers' digital self-efficacy by sharing power, motivational support, and development support (Amundsen and Martinsen, 2014b). Chen and colleagues (2011) stated that empowering leaders empower their followers, resulting in a feeling of competence and, subsequently, self-efficacy. Digital self-efficacy could, in turn, be supported through psychological empowerment and self-leadership (Amundsen and Martinsen, 2014b) in digital work and modern organizations. The empowering leadership style could be beneficial in acquiring skills such as digital fluency. Lee and colleagues (2018) indicate that the complex nature of the effectiveness of empowering leadership warrants further investigation, such as moderating effects. The scholars revealed that empowering leadership has significant effects on self-rated, other-rated, and objective performance but with a high degree of variance, indicating the presence of moderating variables (Lee et al., 2018). Thus, sufficient reasons exist to expect a positive relationship between empowering leadership and individuals' engagement in work-related activities (Cai et al., 2018). Empowered (Bauwens et al., 2021) and engaged (Cortellazzo et al., 2019) employees are less exhausted by the requirements of digitalization because empowering leaders can positively influence the employees' readiness for artificial intelligence (Alsheibani et al., 2019). Taken together, empowering leadership can increase employees' interpersonal, interactional, and behavioral psychological empowerment that can enhance employees' digital fluency. Empowering leadership has been especially proposed to influence individuals' motivation (Chen et al., 2011) and individuals' motivation to engage in learning activities (Chen et al., 2007; Chen et al., 2011) by making employees feel psychologically empowered and efficient in self-leadership (Amundsen and Martinsen, 2014a). Thus, psychologically empowered employees should also show higher digital fluency. In terms of encouraging employees' digital fluency, the empowering leadership style could be beneficial due to its supportive and motivational character. Therefore, I hypothesize:

Hypothesis 1: Empowering leadership has a positive relation with employees' digital fluency.

3.2.2 The Influence of Leaders' Conscientiousness on the Employees' Digital Fluency

Again, referring to the Empowerment Theory (Zimmerman, 1995), their interpersonal, interactional, and behavioral psychological empowerment should be satisfied to support employees' skill acquisition to become digitally fluent. By doing so, not only the leadership style of a leader could influence employees' performance but also the leader's personality. The continuing impact of leaders in the work context raises the question of the influence of leaders' personality. There is a considerable body of literature regarding the effects of personality (e.g., Brown and Hirschi, 2013; Judge et al., 2002). Personality traits are psychological characteristics that serve as predictors of various outcomes and are often considered central to understanding a person's actions and reactions (Parks-Leduc et al., 2015). Scholars agreed that five robust factors of personality can provide a meaningful taxonomy to categorize personality attributes and the variability of human actions (e.g., Barrick et al., 1993; Goldberg, 1990), consisting of openness to experience, conscientiousness, neuroticism, agreeableness, and extraversion (Costa and McCrae, 1992).

Indeed, there is evidence of the effect of two particular personality traits on digital skill acquisition: conscientiousness and neuroticism. Therefore, I focus on the leaders' personality dimensions, conscientiousness and neuroticism. Sahyaja and Rap (2018) stated that conscientiousness is a valid factor influencing leaders' behavior, leading to firm performance in the digital area. Conscientiousness is a personality trait defined by characteristics such as competence, dutifulness, high work ethics, and self-discipline (McCrae and Costa, 2003). Conscientiousness has been associated with general cognitive and motivational resources (Victor et al., 2001) as a valid predictor of performance (Barrick and Ryan, 2004), and as an essential determinant of goal-setting behavior (Barrick et al., 1993). Conscientiousness is also positively related to performance on the individual- and team-level (Barrick et al., 2001). Conscientiousness has been linked to performance orientation (Judge and Ilies, 2002) and enhanced self-efficacy (Brown and Cinamon, 2016). According to Brown and Hirschi (2013), the individuals' level of conscientiousness is positively related to engagement in career, exploration and planning activities and career decisions. The personality dimension conscientiousness has been identified as the most stable tendency for explaining work performance (Barrick and Mount, 1991; Stewart et al., 1996) and, accordingly, could serve as a fruitful source for skill acquisition.

Numerous scholars have found clear linkages between leaders' personality and their employees' endeavors to gain new skills. For instance, leaders scoring high on conscientiousness tend to be more thorough, responsible, organized, and planful (Barrick and Mount, 1991). In a meta-analysis that included 73 studies, Judge and colleagues (2002) found conscientiousness ($r = .16$) to be positively related to leadership effectiveness. Conscientiousness has been detected as a valid predictor across performance (Barrick et al., 2001) and goal-setting behavior (Barrick et al., 1993). Because highly conscientious leaders show more initiative to do what needs to be done to accomplish work, their influence may be more supportive and employee-oriented. Babalola and colleagues (2019) found conscientious leaders to be more morally reflective and supportive of employees' initiative growth, which can also be applied to employees' acquisition of digital fluency.

Again, in line with the Empowerment Theory (Zimmerman, 1995), conscientious leaders provide employees with more *motivation control* by acknowledging the employees' perspectives, encouraging self-initiation, and offering opportunities for employees. Conscientious leaders also support employees' engagement in work activities in acquiring new skills (Bakker et al., 2010), such as digital fluency. Additionally, conscientious leaders support employees' *perceived competence* by making them feel that they can master their activities. Also, conscientious leaders strengthen employees' self-efficacy beliefs (Brown et al., 2011) by supporting their feeling of competence. Leaders scoring high on conscientiousness support employees' *actions that are expected to directly affect outcomes* by making them feel connected with and supported by others (Slemp et al., 2018). By supporting the three interrelated dimensions of psychological empowerment, leaders can create working conditions where employees feel free to pursue and gain digital fluency. It, therefore, can be deduced that leaders' conscientiousness possibly influences employees' digital fluency positively, bringing me to hypothesize:

Hypothesis 2a: Leaders' conscientiousness has a positive relation with employees' digital fluency.

Additionally, I assume a moderating relation of leaders' conscientiousness on the relation of empowering leadership on employees' digital fluency. If the leader is highly conscientious, expressed through high competence, dutifulness, high work ethics, and great self-discipline (e.g., McCrae and Costa, 2003), the relation of empowering leadership on employees' digital fluency becomes even stronger. The positive relation of conscientious leaders should increase the positive relation of empowering leadership on employees' digital fluency because the leaders' actions and reactions are manifested in their personality.

Following the Empowerment Theory (Zimmerman, 1995), leaders who empower their employees are more likely to support their employees' *perceived competence* by allowing employees to be receptive to their work environment (Ahearne et al., 2005). Those leaders are also more likely to delegate responsibilities to their employees. Additionally, highly conscientious leaders presumably provide employees with sufficient *critical awareness* by acknowledging the employees' perspectives and opportunities to become digitally fluent. Conscientious leaders who practice empowering leadership behavior ultimately support employees' *action that is expected to affect outcomes directly.* Empowering leaders can also support employees' feeling of being competent by reinforcing them to take responsibility for their further education in digital topics. In addition, conscientious leaders strengthen employees' feelings of competence (Brown et al., 2011). Again, conscientious leaders who show empowering behavior tend to exhibit employees' feeling of *competence*, which can ultimately result in self-efficacy in being digitally fluent. Leaders who show empowering behavior also foster employees' participation in company activities and their relations with subordinates. The employees' feeling of being *capable of their resources* is even more present when the leader is highly conscientious.

In contrast, if, on the other hand, the leader exhibits empowering behavior but is not very conscientious, the moderating effect of the leaders' conscientiousness on the relationship between empowering leadership and digital fluency will diminish. Thus, taken together, if a leader shows empowering behavior and is conscientious results in a behavior that is supportive of employees' perceived competence, critical awareness, and individual actions. Altogether, this leads to the following hypothesis:

> *Hypothesis 2b: Leaders' conscientiousness moderates the relationship between empowering leadership and employees' digital fluency such that the relation of empowering leadership on employees' digital fluency is stronger if the leaders' conscientiousness is high.*

3.2.3 The Influence of Leaders' Neuroticism on the Employees' Digital Fluency

As the ongoing digitalization confronts us with major labor changes, digital devices, and software programs are constantly developing (Oberländer et al., 2020). The constant need for adaption can result in technostress, *the experience of stress due to an inability to adapt to new technologies* (Tarafdar et al., 2015). Also, employees can experience feelings of exhaustion, loss of motivation, frustration, and burnout (Ayyagari et al., 2011; Ragu-Nathan et al., 2008). Since the digitalization of the workplace can also create stressful situations, there is a need to examine how leaders who are not naturally good at dealing with stressful situations react. The personality dimension neuroticism receives considerable attention as it is an important predictor of how people cope with stressful situations (Cox-Fuenzalida et al., 2004). Per definition, neuroticism identifies the degree to which an individual *"perceives the world as threatening, problematic, and distressing"* (Clark and Watson, 1999, p. 403). Scholars have found that neuroticism refers to emotional instability and less satisfaction with life (Brown and Hirschi, 2013). In other studies, scholars have demonstrated that neurotic individuals show more often antisocial behavior (Guo et al., 2018; Habashi et al., 2016) and personal distress in interaction with others (Graziano et al., 2007; Habashi et al., 2016). Also, individuals scoring high on neuroticism often show low self-efficacy and low work satisfaction (Dalal, 2005), which could lead to a counterproductive role model in the context of a leadership role.

In general, Judge and colleagues (2002) found the Big Five personality dimensions to be correlated (ρ = .39, p. 802) with leader effectiveness, which prompted them to conclude that the *"Big Five typology is a fruitful basis for examining the dispositional predictors of leadership"* (p. 733). In their meta-analysis, the authors found a negative correlation between neurotic leaders and their effectiveness in labor (ρ = -.22, p. 802) and self-efficacy beliefs (Judge and Ilies, 2002). Leaders scoring high on neuroticism tend to have lower self-efficacy in accomplishing their leadership duty because they generally tend to see the world as threatening, problematic, and distressing (e.g., Clark and Watson, 1999).

Next, and again, based on the Empowerment Theory (Zimmerman, 1995), employees' well-being and work-related motivation rest on the extent to which external factors such as the leaders' behavior support the three interrelated dimensions: interpersonal, interactional, and behavioral psychological empowerment. This theory provides an explanation that actions, activities, and structures may be empowering and that the outcome of such processes results in a level of being empowered. Neurotic leaders are more likely not to provide supportive actions, activities, and structures and are less likely to share power and allow their employees to *mobilize resources* (Perkins and Zimmerman, 1995; Zimmerman, 1995). Also, by practicing less social interaction and giving less motivational-and developmental support (Guo et al., 2018; Habashi et al., 2016), employees' confidence in their *skill development* is weakened. Again, established findings show that neurotic leaders invest less in social interaction resulting in little pronounced support for employees' individual action that is expected to affect outcomes directly. In consequence, employees should show less digital fluency. The two sub-dimensions of digital fluency, digital knowledge and digital self-efficacy, can be hindered by neurotic leaders in the way that neurotic leaders are less capable of supporting employees' psychological empowerment. In a meta-analysis by Judge and Ilies (2002), the correlation between neuroticism and self-efficacy was ρ = -.29 (p. 801). Applied to the context of digital self-efficacy, neurotic leaders can weaken employees' acquisition of digital fluency, bringing me to hypothesize that:

Hypothesis 3a: Leaders' neuroticism has a negative relation with employees' digital fluency.

Additionally, I assume a moderating relation of leaders' neuroticism on the relation of empowering leadership to employees' digital fluency. If the leader is highly neurotic, which can be expressed through antisocial behavior (Guo et al., 2018), low self-efficacy and low work satisfaction (Dalal, 2005), the effect of empowering leadership becomes weaker. In line with this, leaders who show less satisfaction with life (Brown and Hirschi, 2013) can be less expected to show supportive behavior to their employees.

Following the Empowerment Theory (Zimmerman, 1995), employees whose leaders show empowering behavior feel more in *control* while pursuing their working goals. A leader who is neurotic and practices empowering leadership shows inconsistent behavior. This inconsistency could result in a hampered effect of empowering leadership on employees' digital fluency. Also, neurotic leaders are less likely to invest in social interaction (Guo et al., 2018; Habashi et al., 2016), leading to less social exchange and support for employees' *skill development*. Thus, even when showing empowering leadership behavior, neurotic leaders should have less impact on employees' acquisition of digital fluency. For the aspect of *resource mobilization*, neurotic leaders show more often fewer social skills and interpersonal relations (Feitosa, 2013) and subsequently less ability to support employees' need for *motivation control*. The positive aspects of empowering leadership should be canceled out by the negative aspect of the leaders' neurotic behavior. Neurotic leaders are less likely to support the employees' three interrelated dimensions, namely intrapersonal, interactional, and behavioral psychological empowerment, and their empowering behavior is less intrinsic and natural in relation to conscientious leaders. Altogether, this leads to the following hypothesis:

> *Hypothesis 3b: Leaders' neuroticism moderates the relationship between empowering leadership and employees' digital fluency such that the relation of empowering leadership on employees' digital fluency is weaker if the leaders' neuroticism is high.*

3.3 Data and Methods

The main objective of this study is to empirically establish the relationship between empowering leadership, the leaders' personality dimensions: conscientiousness and neuroticism, and employees' digital fluency. I created an online survey that included established questionnaires to archive this objective. I surveyed white-collar workers because white-collar work is also at high risk of being profoundly affected by digitalization (Düll et al., 2016). The level of analysis for this study is the dyadic-level; thus, I collected survey data from one company located in Baden-Württemberg, Germany. The company is mainly active in the industries of automotive engineering, drive technology, medical technology, transport technology, and ventilation technology. Three different locations of the company took part in the survey (location 1 $N = 334$ (68.88%[4]); location 2 $N = 83$ (17.01%); location 3 $N = 69$ (14.11%)). The company agreed to participate in the study and return was offered a benchmark report. Initially, all white-collar workers were invited to participate in the study by an internal e-mail distributed by authorized managers. Employees were contacted by e-mail and requested to fill out the survey. The e-mail

[4] Percentage of participants per location out of the total number of participants.

provided a short introduction to the subject, a description of the study, and a link to a survey website that was hosted by an independent IT company located in Germany. All participants answered demographic questions, including their education qualification, age, sex, tenure, their working hours per week, their proportionally remote work in percentage, and whether they are leaders or not.

Additionally, an algorithm programmed into the questionnaire allocated the company-specific questions into two different questionnaires, with 50% of employees randomly answering one-half of the questions and the other 50% of employees answering the other half. The selection mechanism was installed to lower the number of questions that each employee had to answer and thus increase the rate of fully completed questionnaires. Participants who did not complete the survey were excluded from the analysis. The final sample size was 486 participants. Respondents were mostly males (77.4%), followed by females (22.4%), and diverse (.2%) with an average of 41 years of age (SD = 12.36). The most frequently represented educational qualification was diploma/master's degree (31.55%), master-craftsman/technician (25.15%), and bachelor's degree (15.26%). The average tenure was 12 years (SD = 9.08). 21.11% of the participants were in a leadership position. The average weekly working time was 35.7 hours (SD = 4.91), and the average remote work proportion was 10.24% of the week (SD = 20.81).

3.3.1 Measures

To test the validity of the latent construct variables, separate confirmatory factor analyses (CFA) were performed. Unless otherwise noted, 5-point Likert scales (1 = strongly disagree/never, 5 = strongly agree/always) were used for the following measures, and to ensure replicability, I used established questionnaire scales. All items were coded such that higher scores indicate higher levels of the construct. Detailed wording of all items can be found in Appendix B, Table 16, Appendix C, Table 19, Table 20, and Table 21.

3.3.2 Digital Fluency

(Cronbach's $\alpha = .91$, composite reliability (CI) = .90). I measured digital fluency using the 6-item scale by Kunze and Zimmermann (2020). Digital knowledge ($\alpha = .89$, $CI = .90$) and digital self-efficacy ($\alpha = .87$, $CI = .87$) are the sub-dimensions of the digital fluency scale. An example item for digital knowledge is *"I know how to use digital technologies without too much effort."* For digital self-efficacy, an example item is *"I feel confident that I can use digital technologies to improve my job performance."* All item loadings for both sub-dimensions were significant ($\rho < .001$), above the threshold of .5, and for all items, Cronbach's α was greater than .89. Following the recommendations by Hoyle and Panter (1995), I evaluated the model fit of digital fluency by using fit indices, including χ^2, Comparative Fit Index (CFI), Tucker-Lewis-Index (TLI), and the Standardized Root Mean Squared Residual (SRMR). CFI and TLI with values close to .95 indicate superior fit, and the SRMRs' acceptable cut-off value is set at $< .08$ (Hu and Bentler, 1999). I included all six items of the original scale, which resulted in superior model fit properties ($\chi^2 = 142.45$; CFI = .94; TLI = .88; SRMR = .07).

3.3.3 Empowering Leadership

($\alpha = .92$, $CI = .92$). I used the 10-item empowering leadership scale designed by Aherane and colleagues (2005) to measure empowering leadership. One exemplary item is *"My manager believes that I can handle demanding tasks."* I used all ten items because their reliability was sufficient and Cronbach's α was greater than .91. Results from the CFA showed good fit properties ($\chi^2 = 540.04$; CFI = .84; TLI = .97; SRMR = .08).

3.3.4 Personality of the Leader

Conscientiousness ($\alpha = .77$, $CI = .78$) and neuroticism ($\alpha = .85$, $CI = .85$). To measure the personality of the leader, I used the NEO-FFI-30 scale by Körner and colleagues (2008), only including the answers from respondents holding a leadership position. An example item for conscientiousness is *"[I see myself as someone who] keeps things neat and tidy."*, and for neuroticism "[...] *worries a lot."* The 12-item scale also consists of inverted items to control for tendencies to answer and to reduce monotony (Harrison and McLaughlin, 1993). Results from the CFA revealed good model fit properties for leaders' conscientiousness (χ^2 = 16.49; CFI = .95; TLI = .91; SRMR = .06) and leaders' neuroticism (χ^2 = 16.15; CFI = .97; TLI = .95; SRMR = .05).

3.3.5 Controls

I included five control variables because theoretical and empirical arguments suggest their relationships with the focal variables. First, I included the educational qualification[5] of the employee as a control variable because scholars stated positive associations between educational level and skill acquisition. Employees with higher education also participate more in work-related activities (Bjursell et al., 2017) and show less absenteeism from work (Ng and Feldman, 2009). Therefore, higher educational qualifications may impact skill acquisition and, subsequently, digital fluency. Second, I also controlled for the participants' age measured in years as the time elapsed since birth. Older employees may be less motivated to participate in work-related activities, resulting in the general perception that older workers lack relevant skills and qualifications, manifesting in negative age stereotypes (Gordon and Arvey, 2004; Kunze et al., 2013). Additionally, scholars found support for the digital divide theory (Li and Ranieri, 2010; Salajan et al., 2010), which states a negative relationship between age and digital fluency. Third, sex was included as a control variable because empirical findings indicate that women and men could differ regarding intrinsic motivation to do something (Chen and Zhao, 2013) and their achievement motivation (van der Sluis et al., 2010). Fourth, I controlled for time spent working remotely in hours per week, as interaction and communication between the leader and employees are more distant under the challenging conditions of agile work structures. Fifth, Sharma and Kirkman (2015) highlighted differences between empowering leadership and other key leadership constructs, such as leader-member exchange (henceforth: LMX). LMX refers to a dyadic relationship shared by the leader with each of his/her employees (Sharma and Kirkman, 2015) and is associated with greater employee performance (Wayne et al., 2002),

[5] Coding used for the following control variables are explained in detail in the notes section of Table 4, p. 70).

such as higher digital fluency. Hassan and colleagues (2013) found correlations between LMX and leadership support, which could be summed in the empowering leadership sub-dimension: enhancing the meaningfulness of work. Leader-member exchange (α = .88, *CI* = .89) was measured using the LMX-7 scale developed by Graen and Uhl-Bien (1995). An example item for LMX is *"How well does your leader understand your job problems and needs?"* The response categories range from 1 = rarely/none to 5 = very often/very high. I used all seven items of the original short scale (Appendix C, Table 21) since Cronbach's α was greater than .85 for each item. Results from the CFA revealed superior model fit properties (χ^2 = 58.30; CFI = .97; TLI = .95; SRMR = .03). Lastly, in a similar vein, *trust in leader* could also have an impact on the effect of empowering leadership (Bobbio et al., 2012) in the sense that trusting someone leads to more open communication and subsequently to more empowering behavior (Mutonyi et al., 2020). The constructs empowering leadership, LMX, and trust in leader are statistically delimited in a further validity check.

3.3.6 Analytical Procedure

To test my five hypotheses, I apply multiple linear regression analysis using STATA 17.0. To test the proposed direct and moderation effects of my hypotheses, I examine empowering leadership and the leaders' personality dimensions, conscientiousness and neuroticism. All variables in the analyses are z-standardized prior to the regression analysis (Frazier et al., 2004). I used structural equation modeling (SEM) to test my direct and indirect effects. Additionally, I examine how the scales of empowering leadership, LMX, and trust in leader differ statistically. To inspect the general robustness of my results, I examine endogeneity by following the procedure suggested by Shaver (2005).

3.4 Results

3.4.1 Descriptive Statistics

Descriptive statistics illustrated in Table 4 provide detailed information about the means, standard deviations, and intercorrelations for all relevant variables used in the second study. Among these variables, I detected several correlations. Empowering leadership is positively related to employees' digital fluency (r = .23, ρ < .01) and leaders' conscientiousness (r = .36, ρ < .01). Also, empowering leadership is negatively related to leaders' neuroticism (r = -.33, ρ < .01). Employees' digital fluency is positively related to leaders' conscientiousness (r = .27, ρ < .01), LMX (r = .13, ρ < .01) and negatively related to leaders' neuroticism (r = -.25, ρ < .05). As predicted, leaders' conscientiousness has a negative relation with leaders' neuroticism (r = -.52, ρ < .01). Furthermore, leader-member exchange is positively related to empowering leadership (r = .82, ρ < .01) which is reviewed in the supplementary analyses and discussion sections.

Table 4

Means, Standard Deviations, and Intercorrelations of Main Variables and Controls.

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1 Empowering Leadership	4.24	.82								
2 Employees' Digital Fluency	4.14	.65	.23**							
3 Leaders' Conscientiousness	4.39	.45	.36**	.27**						
4 Leaders' Neuroticism	1.71	.60	-.33**	-.25*	-.52**					
5 Education Qualification	7.06	1.97	.12**	.24**	.01	-.18				
6 Age	41.7	12.36	-.04	-.31**	.17	-.15	-.10*			
7 Sex	.23	.42	-.02	-.07	-.26**	.27*	-.21**	-.11*		
8 Remote Work	10.25	20.82	.07	.06	.08	.03	.09*	-.02	.02	
9 Leader-Member Exchange	3.74	.71	.82**	.13**	.24*	-.20*	.08	-.01	-.01	.03

Note. $N = 486$; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$. Values are based on two-sided significance testing; M = mean; SD = standard deviation; Education Qualification = 1 = no leaving certificate, 2 = lower secondary school leaving certificate, 3 = secondary school leaving certificate, 4 = entrance qualification for studies at universities of applied sciences, 5 = higher education entrance qualification, 6 = completed training, 7 = master craftsman/technician, 8 = bachelor's degree, 9 = diploma/master's degree, 10 = doctorate; Sex = 0 = male, 1 = female, 2 = divers.

3.4.2 Construct Validity

Prior to my hypotheses testing, I run several validity checks for the constructs empowering leadership, LMX, and trust in leader. First, I tested the convergent validity – a measurement indicating whether tests have the same or similar constructs. The Average Variance Extracted (AVE) is a criterion for assessing convergent validity. The values for empowering leadership (AVE = .76), LMX (AVE = 1.33), and trust in leader (AVE = 1.20) are all above the threshold of .5, indicating a good convergent validity.

Discriminant validity is the degree to which measures of different traits are unrelated. By analyzing the traits empowering leadership, LMX, and trust in leader, I could confirm that the square root of AVE ($\sqrt{(AVE/DV)}$) for empowering leadership (.87) and LMX (1.15) is greater than the correlation between the constructs – indicating discriminant validity. In the same vein, theoretical reasons raise the question of whether the construct of trust in leader overlaps with empowering leadership (Huang et al., 2010). Leaders' empowering behavior can cause trust in leader (Dirks and Ferrin, 2002), and reciprocally, trust in leader can cause encouraging empowering leadership behavior. Again, I control for the discriminatory validity of the constructs empowering leadership and trust in leader (1.09). The results indicate that the constructs empowering leadership, LMX, and trust in leader are sufficiently discriminant.

3.4.3 Hypotheses Testing

Table 5 shows the results of the direct and moderated effects to test my hypotheses. According to hypothesis 1, empowering leadership is positively related to the employees' digital fluency. As shown in Table 5 (Model 2), empowering leadership was significantly associated with employees' digital fluency (β = .33, ρ = .07). This finding supported hypothesis 1. According to hypothesis 2a, the leaders' conscientiousness is positively related to employees' digital fluency. Table 6 (Model 3) shows that the leaders' conscientiousness has a significant effect on the employees' digital fluency (β = .27, ρ = .10). Thus, hypothesis 2a can be confirmed. The results indicate that leaders' neuroticism has a negative and significant (β = -.21, ρ = .09) effect on the employees' digital fluency (Model

4). Therefore, hypothesis 3a, stating that the leaders' neuroticism has a negative effect on employees' digital fluency, can also be confirmed.

Besides, I investigated the moderating effect of the leaders' personality dimensions, conscientiousness, and neuroticism on the effect of empowering leadership on the employees' digital fluency. As shown in Table 6 (Model 3 and Model 4), I could confirm a direct effect of leaders' personality dimensions which is significantly related to employees' digital fluency. According to hypothesis 2b, the leaders' conscientiousness positively moderates the relationship between empowering leadership and employees' digital fluency. Table 6 (Model 3) shows that the interaction term between empowering leadership and leaders' conscientiousness is not significantly related to employees' digital fluency (β = .09, n.s.), and hypothesis 2b can be rejected. Also, the leaders' neuroticism is negatively associated with employees' digital fluency (β = -.21, ρ = .09), but the moderation with the effect of empowering leadership on the employees' digital fluency moderated by leaders' neuroticism also shows no significant results (β = -.09, n.s.) leading to the rejection of hypothesis 3b. Statistical results of the analysis are displayed in the below-shown Table 5 and Table 6.

Table 5

Multiple Regression Analyses.

		Employees' Digital Fluency					
		Model 1			Model 2		
Predictors		*Coef.*	*Robust Std. Err.*	*95% CI*	*Coef.*	*Robust Std. Err.*	*95% CI*
	Constant	-.00	.04	[-.08 ; .07]	-.01	.07	[-.08 ; .07]
Controls							
	Age	-.30	.04***	[-.38 ; -.21]	-.29	.04***	[-.37 ; -.21]
	Education Qualification	.19	.04***	[.11 ; .28]	.18	.04***	[.10 ; .26]
	Sex	-.06	.04	[-.05 ; .10]	-.06	.04	[-.14 ; .02]
	Remote Work	.03	.04	[-.05 ; .10]	.01	.04	[-.06 ; .09]
	Leader-Member Exchange	.11	.04**	[.03 ; .19]	-.15	.07*	[-.29 ; -.02]
Main Effects							
H1	Empowering Leadership				**.33**	**.07*****	[.19 ; .46]
H2a	Leaders' Conscientiousness						
H3a	Leaders' Neuroticism						
Interaction Effects							
H2b	Empowering Leadership x Leaders' Conscientiousness						
H3b	Empowering Leadership x Leaders' Neuroticism						
F		19.63			20.95		
R^2		.03			.21		
ΔR^2					.24		

Note. Model 1 - 2 N = 469; Model 3 - 4 N = 97; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$, two-tailed.

Table 6
Multiple Regression Analyses (continued).

		Employees' Digital Fluency					
		Model 3			Model 4		
Predictors		*Coef.*	*Robust Std. Err.*	*95% CI*	*Coef.*	*Robust Std. Err.*	*95% CI*
	Constant	.01	.09	[-.17 ; .20]	.02	.10	[-.17 ; .21]
Controls							
	Age	-.10	.09	[-.29 ; .08]	-.08	.10	[-.28 ; .11]
	Education Qualification	.16	.09	[-.01 ; .33]	.12	.09	[-.05 ; .30]
	Sex	-.10	.10	[-.31 ; .10]	-.09	.10	[-.29 ; .11]
	Remote Work	.13	.08	[-.04 ; .29]	.17	.08*	[.00 ; .33]
	Leader-Member Exchange	-.12	.15	[-.41 ; .17]	-.14	.15	[-.44 ; .15]
Main Effects							
H1	Empowering Leadership	.19	.14	[-.09 ; .46]	.23	.14	[-.05 ; .51]
H2a	Leaders' Conscientiousness	**.27**	**.10****	[.07 ; .47]			
H3a	Leaders' Neuroticism				**-.21**	**.09***	[-.40 ; -.03]
Interaction Effects							
H2b	Empowering Leadership x Leaders' Conscientiousness	.09	.05	[-.01 ; .19]			
H3b	Empowering Leadership x Leaders' Neuroticism				-.09	.05	[-.19 ; .14]
F		2.69			2.51		
R^2		.20			.19		
ΔR^2		.44			.69		

Note. Model 1 - 2 N = 469; Model 3 - 4 N = 97; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$, two-tailed.

3.4.4 Supplementary Analyses

To increase the robustness of the findings, I performed different supplementary analyses. First, I used Relative Weights Analysis (RWA) to compare the relative explanatory power. To do so, I calculated the total variance predicted in a regression model into weights that accurately reflect the proportional contribution of the predictor variables, addressing the issue of multicollinearity of empowering leadership, LMX, and trust in leader (Johnson, 2000). Following the procedure of Tonidandel and LeBreton (2011), I could find that empowering leadership explained the greatest amount of variance in employees' digital fluency (55.93%), compared to LMX (15.22%) and trust in leader (28.85%; see Appendix C, Table 22).

Second, again I controlled for multicollinearity by identifying the Variance Inflation Factor. The *VIF* measures how much the variance of the estimated regression coefficients is inflated compared to when the explanatory variables are not linearly related. A *VIF* of 1 indicates no correlation, a *VIF* between 1 and 5 indicates a moderate correlation and a *VIF* above 5 shows a high correlation. 'Empowering leadership and LMX' and 'empowering leadership and trust in leader' are close to 1, indicating no or small correlation between empowering leadership and LMX and trust in leader.

Third, to inspect the general robustness of my results and statistically support the causality, I controlled for endogeneity biases (Antonakis et al., 2010). Endogeneity biases arise from unmeasured omitted variables that could be related to the error term of both the independent and dependent variables. As Shaver (2005) concluded, *"if the variables M and Y are collected by the same method* [...], *then it is possible that the measurement errors of M and Y are correlated"* (p. 335). To examine endogeneity, I specified three additional models and followed the procedure suggested by Shaver (2005). The first alternative model allows an error correlation between empowering leadership and the employees' digital fluency, and I use LMX as instrument, as it shows a high correlation with empowering leadership ($r = .82$, $\rho < .01$). In this alternative model, the error correlation was non-significant, and the relationship between empowering leadership and the employees' digital fluency remained positive and significant ($\beta = .17$, $\rho < .05$). The second alternative model allows an error correlation between the leaders' conscientiousness and employees' digital fluency while using LMX as instrument as it shows again high correlations with the leaders' conscientiousness (r = .24, ρ < .5). The error correlation was non-significant and the relationship between leaders' conscientiousness and the employees' digital fluency remained positive and significant (β = .63, ρ < .09). The third alternative model allows an error correlation between the leaders' neuroticism and employees' digital fluency while using sex as instrument as it shows a high correlation with the leaders' neuroticism (r = .27, ρ < .5). The error correlation was non-significant and the relationship between leaders' neuroticism and employees' digital fluency remained negative and significant (β = -.01, ρ < .05). The results of the analysis suggest that my findings are robust, even when controlling for a potential endogeneity bias. Overall, the results of the supplementary analyses indicate robust findings, and I can consequently confirm my hypotheses 1, 2a, 3a, and reject my hypotheses 2b and 3b.

3.5 Discussion

The rapid digital transformation of the past years has increased our awareness of the importance of employees' digital fluency. Therefore, it is urgent to understand how organizations can actively promote employees' digital fluency to remain competitive. With this concern, this study focuses on two contextual factors that can strongly influence the employees' acquisition of digital fluency, namely the leadership style: empowering leadership and the leaders' two personality dimensions, conscientiousness, and neuroticism.

Empowering leadership is generally considered to be a suitable leadership approach, but its' effectiveness is questioned due to mixed results (Amundsen and Martinsen, 2014a; Cheong et al., 2019). Those mixed results could be routed in mediation and moderation effects of empowering leadership (Lee et al., 2018). Hence, I take a step toward an integrative investigation on moderation effects, namely leaders' traits and leaders' behavior, by combining the leadership style: empowering leadership and the leaders' personality. My findings revealed that the leadership style: empowering leadership positively affects employees' digital fluency. By building on the Empowerment Theory by Zimmerman

(1995), my results are in line with previous research, stating that empowering leadership can cause job crafting and enhance employees' skill acquisition (Kim and Beehr, 2021), such as by showing skills like digital fluency. Empowering leaders can ultimately fulfill employees' state of empowerment. When the state of empowerment is achieved, employees are highly driven, resulting in the acquisition of digital fluency (Deci and Ryan, 2000; Stone et al., 2009). In contrast to the effects of empowering leadership, I could find less strong but also significant effects of the leader's personality dimensions: conscientiousness and neuroticism on employees' digital fluency. According to this, conscientious leaders can positively effect employees' digital fluency, and neurotic leaders can negatively effect employees' digital fluency. Again, following the line of reasoning, conscientious leaders are highly likely to support employees' state of empowerment, whereas neurotic leaders are not.

On the contrary, I could not support a significant moderating effect of the leaders' personality dimensions: conscientiousness and neuroticism, on the effect of empowering leadership on employees' digital fluency. This is also in line with previous research, finding that leaders' behavior has greater validity than leaders' traits on leadership effectiveness (DeRue et al., 2011). One explanation could be the distinction between my studied constructs' distal and proximal effects. The perceived distance between leaders and their employees has been investigated by a variety of researchers (e.g., Antonakis and Atwater, 2017; Hooper, 2017). Whereas the leaders' traits are a more proximal source for employees, empowering leadership creates the circumstance where leaders encourage, support, and help through their direct interaction with employees (Chuang et al., 2016). Thus, the leaders' behavior is more proximal and observable than the leaders' personality, which is more distal. The leaders' behavior should be more influential on the employees' motivation to perform and employees' digital fluency (e.g., Van Iddekinge et al., 2009).

3.5.1 Theoretical Implications

The empirical results of my study contribute to digital competencies research in four major ways. First, as already mentioned, the key role of the leaders' distal and proximal influences on employees' digital fluency also has theoretical implications. Thus, the leaders' influence is a crucial component giving one possible answer to *how organizations can promote employees' digital fluency.* Because theoretical frameworks with a clear understanding of distal and proximal effects and their specific impact are still limited (Hooper, 2017), the division into leaders' behavior and leaders' traits incorporate important external factors.

Second, the study contributes to the conjunction of two research branches, namely leadership research and digital competencies research, and points to the relevance of combining these. This adds to the growing evidence for the effectiveness of empowering leadership on employees' skill acquisition (e.g., Bauwens et al., 2021; Cheong et al., 2019; Kim and Beehr, 2021). My analysis further reveals that empowering leadership has a significant effect on employees' digital fluency; thus, the leaders' behavior could greatly affect the employees' skill acquisition. This pattern of findings resonates with the study by Van Iddekinge, Ferris, and Heffner (2009), who found leaders' behavior to have a strong, direct influence on employees' performance. On the other hand, I was able to uncover that the leaders' personality also plays a role but to a less significant extent. Again, scholars found the leaders' personality to be less relevant to the employees' acquisition of new skills (Van Iddekinge et al., 2009). Also, Derue and colleagues (2011) concluded that the leaders' behavior tends to explain more variance in leadership effectiveness than the leaders' personality. This finding leads to the theoretical implication that empowering leadership can be a reliable dependent variable for employees' skill acquisition.

As a third theoretical implication of this study, I explored the empirical distinctiveness of empowering leadership in comparison to LMX and trust in leader to determine whether empowering leadership accounts for the unique variance in digital fluency. By doing so, I answered a call by Cheong and colleagues (2016), who stated that future work should deepen the understanding of empowering leadership by focusing on, for example, *"LMX, level of trust, power distance"* (p. 613). The question of whether the independent variable empowering leadership is different from the LMX construct and trust in leader was explored. As stated by Lee and colleagues (2018), the differentiation between empowering leadership, LMX, and trust in leader has rarely been tested empirically and, therefore, was included in this analysis. According to a meta-analytic examination by Lee and colleagues (2018), there are theoretical reasons to believe that LMX has explanatory power to empowering leadership. In that sense, LMX and empowering leadership both share relation-oriented behavior (DeRue et al., 2011), and LMX is considered to psychologically empower (Martin et al., 2016). Nevertheless, LMX focuses on the direct relationship between the leader and the follower, which could be built on empowerment but is not urgently necessary (Lee et al., 2018). Thus, it assesses the value that empowering leadership adds to the branch of leadership research. According to Cheong and colleagues (2019), the *"construct pruning or securing the conceptual space of a specific leadership construct of interest* [empowering leadership] *is imperative"* (p. 36). Given the conceptual similarity of empowering leadership, LMX, and trust in leader the incremental variances are questionable (Lee et al., 2018). Comparing the relative explanatory power using Relative Wights Analysis (*RWA*), I calculated the total variance predicted in a regression model into weights that accurately reflect the proportional contribution of the predictor variables, addressing the issue of multicollinearity (Johnson, 2000). Sharma and Kirkman (2015) draw attention to the conceptual similarities between empowering leadership and LMX, saying that *"empowering leadership shares both similarities and important differences with other leadership constructs, including* [...] *LMX"* (p. 197). I furthermore answer a call by Lee and colleagues (2018), who stated that the discrimination of the constructs is greatly needed. To avoid the proliferation of different leadership constructs (also see DeRue et al., 2011), I tested for incremental validity (see Table 22) and could confirm the incremental contribution of empowering leadership (55.93%) in comparison to LMX (15.22%) and trust in leader (28.85%) is the highest. Nevertheless, it should be noted that the constructs empowering leadership, LMX, and trust in leader have some overlap in terms of content. Empowering leadership has a link to LMX as they both include respect and interaction between leader and employees (DeRue et al., 2011), but LMX can also be detected in other leadership styles and thus is not unique to empowering leadership (Sharma and Kirkman, 2015). Trust in leader also relies on the social exchange, which is central in LMX (Lee et al., 2018), and empowering leadership is postulated to affect trust in leader as well (Kim and Beehr, 2021).

Fourth, in the timely need for a valid measurement of leadership effectiveness, employees' digital fluency can be such a measurement. In today's world, where digitalization demands ever-improving digital fluency, the level of digital fluency can be implemented as a relevant outcome of leaders' capabilities. Also, Cheong and colleagues (2019) reviewed prior empowering leadership literature, reassessed the effectiveness of empowering leadership, and concluded that there is *"a need for a more systematic approach for investigating the effectiveness of empowering leadership"* (p. 35). Even though prior studies have investigated outcomes such as employees' performance (Vecchio et al., 2010), self-efficacy (Kim and Beehr, 2017), work effort (Amundsen and Martinsen, 2015), and work-role performance (Hassan et al., 2013), a performance measurement regarding digital skills such as digital fluency, is missing to the best of my knowledge. Especially, experts have concluded that digital fluency is as important as literacy (known as the general ability to read and write) and numeracy (known as the general ability to understand and work with numbers) because it is in high demand in daily professional life (Ludlow, 2018). Therefore, I want to point out how important it is to consider digital fluency to measure the effectiveness of today's leaders.

3.5.2 Practical Implications

The findings of this study uncover important implications for the company's human resource management and top management staffing. The effect of empowering leadership on the employees' digital fluency is significant, leading me to conclude that leaders who psychologically empower employees' self-leadership (Amundsen and Martinsen, 2014a) support employees' acquisition of digital fluency. Additionally, the effect of empowering leadership on employees' digital fluency is even stronger than the effect of leaders' personality dimensions: conscientiousness, and neuroticism on employees' digital fluency. This provides support for the practical importance of empowering leadership and leads to the following hands-on implications.

First, companies should reflect critically on their leader promotion and as they onboard their leaders. During recruiting processes, selection tools that identify and select leaders who will likely show empowering behavior could be implemented. Validated methods such as psychological questionnaires (e.g., empowering leadership scale by Ahearne and colleagues, 2005) or Assessment Centers for leaders should be applied. In the existing recruitment processes, which optimally run over several days, the behavioral repertoire, in particular, enhancing the meaningfulness of work, fostering employees' participation, expressing confidence in employees, and providing autonomy from bureaucratic constraints, should be examined. By cultivating empowering behavior, such as developmental support, which includes role modeling and guidance (Amundsen and Martinsen, 2014a), employees who are showing that behavior should be rewarded with a position of more leadership responsibility. Kim and Beehr (2021) advocate a reward system that encourages empowering behavior by promoting empowering leaders.

Second, companies might consider focusing on the important role of leadership by providing additional leadership programs for employees within a leadership position. According to Ahearne and colleagues (2005), the dimensions of empowering leadership include: enhancing the meaningfulness of the employees' work, fostering participation in work, expressing confidence in employees, and providing autonomy from bureaucratic constraints. To put these dimensions into practice, scholars have suggested a variety of leadership practices, such as 360-degree feedback or mentoring programs that can shape the leaders' behavior and provide valuable feedback to them (e.g., Day, 2000). Also, already existing executive education programs and leadership centers should be incorporated, resulting in interventions focusing on the development of empowering behavior. Several scholars (e.g., Chuang et al., 2016; DeRue et al., 2009) recommended formal leadership programs that encourage leaders to see themselves as leaders and promote to act by providing support to their employees. For this purpose, leaders should be provided with guidance, best practices, verbal feedback, words of encouragement, and other forms of social persuasion. Windeler, Maruping, and Venkatesh (2017) revealed participation decision making, coaching, and showing concern as specific behaviors through which leaders enable their employees to perform. Thus, leaders would benefit concretely from adding empowering leadership behavior to their repertoire of leadership skills.

3.5.3 Limitation and Direction for Future Research

This study should be considered with some notable shortcomings generating avenues for future research. First, Lee and colleagues (2018) pointed out that the constructs: empowering leadership, LMX, and trust in leader have rarely been differentiated in leadership research and LMX could have explanatory power in empowering leadership. To strengthen my independent variable: empowering leadership, I controlled for LMX and trust in leader. However, I found that empowering leadership and LMX are correlating significantly ($r = .82$, $\rho < .01$), which leads me to question the construct reliability of empowering leadership and the separability of the two constructs. Rather, one needs to take a closer look at the construct of empowering leadership and underline that LMX can be a dimension of empowering leadership by fostering employees' participation and having meaningful conversations with one another. Additionally, Huang and colleagues (2010) pointed out that trust in leader and empowering leadership could also be overlapping constructs. Again, it is important to note that empowering leadership, like LMX, could be highly related to the trust in leader construct. By creating meaningful interaction between leader and employees, more trust is developed. It is crucial to consider that empowering leadership builds on existing constructs such as LMX and trust in leader for future research. For this reason, I suggest that further studies explicitly ask about LMX and trust in leader to see to what extent these dimensions have a major impact on empowering leadership and thus agree with Kim and Beehr (2021), who also recommend investigating the relationship between empowering leadership and LMX.

Second, although my study has the advantage of high internal validity since it was anchored in the context of one company from one source, also may have caused potential common method variance. This may have limited the observed variability and the generalizability of my conclusions. However, I ran endogeneity analyses to gain confidence in my proposed model following Antonakis and colleagues (2014). In addition, the data was collected from one company with three locations based in Baden-Württemberg, Germany, which may influence my findings' generalizability to other organizations and cultural contexts (96.09% German mother tongue). To solidify the generalizability of my findings, replicated research should be exerted in different contexts and with a longer time span. The external validity may be increased by using data from other organizations, other national settings, and a longitudinal design. Especially the longitudinal design allows the examination of moderation processes that might unfold over time.

Third, another limitation of this study also concerns the composition of the sample. I surveyed white-collar workers, which resulted in an education qualification distribution of mainly diploma/master's degree (31.55%), master craftsman/technician (25.15%), and bachelor's degree (15.26%). This sample primarily works with digital technologies, and thus the acquisition and level of digital fluency should be interpreted cautiously. Again, to solidify the results, the study should be replicated with a more diverse workforce encompassing both blue- and white-collar workers.

Lastly, another limitation of this study is the insufficient control of boundary conditions, such as the current work situation. Humphrey, Nahrgang, and Morgeson (2007) suggested taking the specific work situation into account because it can cause traits. This is in line with a study by Van Knippenberg (2012), who noted that situational influences could have an impact on the leaders' general behavior and should therefore be controlled carefully. Besides these limitations, this study offers additional avenues for future research. For future research, I suggest scholars run endogeneity analyses to support the causality statistically. Zhang and Shaw (2012) stated that *"in some cases, additional analysis is warranted* [...]" (p. 10). Another way to extend this study would be the replication of the study with a more diverse workforce concerning education qualification, nationality, employer, and a greater time span. To ensure the increased variance explained by empowering leadership, further studies could include closely related leadership concepts such as transformational and charismatic leadership (Cheong et al., 2016) to unveil the unique variance attributed to empowering leadership. Further research could improve upon the present study by examining how leadership behavior mitigates resistance to an upcoming Artificial Intelligence change (Frick et al., 2021) and employees' ability to acquire digital fluency. Because digitalization is central in most occupations and industries (Díaz Andrade et al., 2019) employees' acquisition of digital fluency is highly required.

3.6 Conclusion

Digitalization is a constant major challenge in nowadays working life. In this context, the acquisition of digital fluency is crucial for employees to stay competitive. It is, therefore, even more important to understand how organizations can promote employees' digital fluency and contribute to digital competencies research. One supporting external factor could be the influence of leaders. The empowering leader who distributes power, autonomy, and motivation among their employees enables the acquisition of employees' digital fluency. Also, the leaders' personality influences employees' digital fluency in a way that conscientious leaders influence employees' digital fluency positively, and neurotic leaders influence employees' digital fluency negatively. Therefore, organizations should actively foster leadership training. Doing so is necessary to promote the understanding of the role of leaders and the leadership style empowering leadership theoretically and practically. With the second study, I contribute to a better understanding of contextual factors in employees' acquisition of digital fluency.

3.7 Study Results in the Context of Digital Fluency

With the findings that the leaders' behavior and personality significantly influence the employees' acquisition of digital fluency, another contextual factor is uncovered. These results help academia and practitioners develop a comprehensive understanding of digital fluency and its acquisition. To gain an even more holistic understanding of digital fluency, the third level, namely the team-level, is the last level I focus on. In addition to the leader, work group characteristics can also influence the individual and the acquisition of digital fluency. In the following study, I will investigate the work group and the leader as possible contextual factors. I refer to the last level, the team-level, and focus on possible influencing factors on digital fluency.

4 STUDY 3 - The Role of Age-Technostress Faultlines within White-Collar Work Groups and the Leader-Member Exchange Climate's Influence on the Acquisition of Collective Digital Fluency

ABSTRACT

The present study extends knowledge of collective digital fluency of work groups and the effect of age-technostress faultlines with the moderating effect of leader-member exchange climate. Grounded in Turner and Tajfel's Social Identity Theory (1986) and Lau and Murnighan's Faultline Concept (1998), both theories of social categorization, this study argues that age-technostress faultlines could occur in work groups and negatively influence collective digital fluency. This study provides further evidence for the hypothesis that leader-member exchange climate moderates the relationship between age-technostress faultlines and collective digital fluency. The result from a sample of 805 employees with 119 work groups from a large-sized German technology company indicates a positive moderating effect of leader-member exchange climate on the relationship between age-technostress faultlines and collective digital fluency. These results contribute to the discussion regarding digital fluency and the influence of leaders and provide recommendations for professional practice and future research.

Keywords: *Age-Technostress Groups, Collective Digital Fluency, Diversity, Faultline Concept, Leader-Member Exchange Climate, Social Identity Theory, Technostress, Work Group*

4.1 Introduction

Two societal trends are gaining immensely in importance: the age diversity in the workforce and the rapid development of digital technologies across most job settings (e.g., Liu et al., 2021; Toossi, 2012). As a result of those two trends, organizations face a fast-changing workforce compared with the urgent need to stay competitive. While in 2000, in Germany, the age group 30 - 49 years was the largest employee group (23.7 million); it is projected that by 2050, the age group 15 - 29 years will encompass 6.1 million employees, the group of 30 - 49-year-old employees 14.7 million and the group of 50 - 64-year-old employees 11 million, leading to an equal distribution of age groups and, thus inevitably to age diversity in work groups (Fuchs et al., 2011).

Despite the changes regarding age distribution, another societal transformation emerged in the last two decades, namely the digital transformation of business and private life. Between 2020 and 2024, global investment in public digital transformation technologies will double (Lohmeier, 2023). This development highlights that so-called digital-related skills are already highly relevant for today's workforce. Briggs and Makice (2012) define these digital-related skills, called digital fluency, as the *"ability to reliably achieve desired outcomes through the use of digital technology"* (p. 62). Scholars argue that digital fluency is a crucial skill for every employee, regardless of the age (Hampel and Kunze, 2023). While an employee's digital fluency depends on the individual, the group in which he or she can obtain, demonstrate, or improve those skills is highly relevant. Therefore, a closer look into the group structure is needed. I refer to this as a shared climate of digital fluency within a group. I aim to address Kozlowski and Klein's (2000) call for a level approach that engenders a more integrated knowledge of the organization. Given the described rapid digitalization in an increasingly age-diverse workforce, this more integrated approach regarding digital fluency in organizations is needed.

A first approach towards an integrated understanding may be investigating work groups where employees interact and share their knowledge because it is the foundation for a group climate and where a common interpretation can manifest (Ostroff and Kozlowski, 1992). For a better understanding of such group climate, I refer to the definition of

Schneider and Bowen (1985), stating that a shared group climate reflects employees' shared perception of the extent to which the employer rewards policies, procedures, and practices. A shared climate enables individuals to coordinate their activities and share their knowledge toward producing stable and prosperous behavior patterns (Nooteboom, 2000; Weber and Camerer, 2003). Digital fluency is an example of such a successful pattern of behavior. Collective digital fluency can help to reduce the negative effect of diversity in work groups, such as group- and communication conflicts (Lau and Murnighan, 1998) or disrupted work group goals (Leicht-Deobald et al., 2021). Furthermore, collective digital fluency can lead to witnessing interactions between group members, resulting in a shared climate and perceptions (Felps et al., 2006). Ultimately, this can end in identity development within the work group. According to the Social Identity Theory (Turner and Tajfel, 1986), identifying with a specific group, for example, with exceptional technological capabilities, aims to protect and bolster one's self-identity (Islam, 2014). The theory states that creating a specific group identity involves differentiating individuals into an in-group from other out-groups. This process results in an identification with a collective identity based on a specific membership endowed with positive aspects (Turner et al., 1987).

Considering self-identity concerning digitalization, group disparities are a well-known issue. One example of such a disparity is the digital age divide, a situation in which technology usage patterns differ regarding the individuals' age (Saeed and Masters, 2021). Blank and Groselj (2014) found evidence regarding the influence of individual attributes and found that age and educational level caused differences in the digital divide. However, this divide may emerge from age stereotyping and the use of digital technologies (Levy, 2009). Therefore, researchers have directed attention to the digital divide across age groups (e.g., Smith, 2014; Wei, 2012). One study found that older individuals show self-fulfilling behavior in the form of technophobic behavior more frequently (Fitzgerald et al., 2014), and a meta-analysis found that older employees have significantly more issues using digital technologies efficiently (Hauk, 2018). Technophobic behavior and inefficient use of digital technologies can result in technostress, defined as the experience of stress due to an inability to adapt to new technologies (Tarafdar et al., 2015), which is more likely to occur in older employees (e.g., Smith, 2014; Wei, 2012).

Those age-technostress differences can lead to faultlines in work groups. Faultlines are *"hypothetical dividing lines that align members based on one or more members' attributes"* (Lau and Murnighan, 1998, p. 328). Age as a demographic characteristic is one of the most fundamental groups an individual can belong to. Because of the self-reflective social nature of humans, we detect similarities and differences with others and facilitate behavioral adjustments (Weiss and Weiss, 2019). Such a specific identity could steam from age-stereotyping in subgroups (Levy, 2009), where older employees show technophobic behavior (Fitzgerald et al., 2014), which in sub-sequence, leads to age-technostress faultlines within work groups[6]. Considering the digital age divide, I assume age-technostress faultlines within work groups by drawing on the Social Identity Theory (Turner and Tajfel, 1986), including the Faultline Concept (Lau and Murnighan, 1998). According to the theory, employees develop different identities regarding their age and technostress level resulting in diverse subgroups. Thus, I assume a negative effect of age-technostress faultlines on the collective digital fluency in work groups.

Despite the high relevance of digital fluency due to today's increasingly digitalized work environment, collective digital fluency has not yet been the subject of many studies. Furthermore, the effect of age-technostress faultlines on collective digital fluency has not been researched yet, revealing a highly relevant research gap to fill. Since this work addresses collective digital fluency, group members can be influenced by their shared perception regarding digitalization and their interaction with coworkers. Thus, the questions to be addressed are: *(a) how can we build collective digital fluency in diverse work groups?* And *(b) how can leaders support work groups' collective digital fluency with the help of a specific exchange climate?*

To address these questions, I first consider previous work crucial for comprehensively understanding collective digital fluency. Scholars have studied factors on the individual-level, such as social influences (Goode, 2010; van den Beemt et al., 2010; Zhao et al.,

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[6] An illustrative example of age-technostress faultlines is provided in Appendix D, Table 24.

2010), educational factors (Barron et al., 2010; Li and Ranieri, 2010), age (Guo et al.,2008; Hampel and Kunze, 2023; Li and Ranieri, 2010; Salajan et al., 2010), and the opportunity to use digital technologies (Ching et al., 2005; Goode, 2010; Li and Ranieri, 2010) on individuals' digital fluency. Despite these findings on the individual-level, to the best of my knowledge, related work has not addressed collective digital fluency and antecedents of digital fluency on the team-level. Nevertheless, focusing on the team-level is imperative since the work group is expected to be the primary form of collaboration in the future (Kanter, 2019).

A possible moderating factor on the effect of age-technostress faultlines on collective digital fluency in work groups could be the leader (e.g., Zohar and Tenne-Gazit, 2008). Since the leader and the group members are embedded within a social context, group behavior and relationships could be interdependent (Balkundi and Kilduff, 2006). In this sense, leader-member exchange, defined as the quality of the relationship between a leader and a team member (Martin et al., 2016), may affect subgroup formation because the leaders' behavior could result in an in- vs. out-group differentiation (Schriesheim et al., 1999). Due to dyadic exchanges, leaders differentiate how they interact with their team members and vice versa, resulting in unique relationships. Sherony and Green (2002) found a positive effect of the quality of leader-member exchange on the relationship quality between coworkers.

Furthermore, team members who have reported having a good leader-member exchange are also more trusted by other team members (Lau and Liden, 2008), which can result in a positive overall leader-member exchange climate. Again, a shared climate reflects employees' perceptions (Schneider and Bowen, 1985) and thus can moderate the effect of collective digital fluency. According to the Social Identity Theory (Turner and Tajfel, 1986) and the Faultline Concept (Lau and Murnighan, 1998), the leader-member exchange climate can subsequently influence the employees' specific group identity. It can moderate the formation of collective digital fluency. Thus, the present study investigates two possible antecedents of collective digital fluency: the internal group structure (e.g., faultlines; Qi et al., 2022) and the interaction with external influences such as the leader (e.g., leader-member exchange climate; Zohar and Tenne-Gazit, 2008).

Furthermore, this study contributes to the digital competencies and faultline research investigating collective digital fluency in three ways. First, digital fluency has been studied exclusively on the individual-level (e.g., Wang and Haggerty, 2011; Wei et al., 2020). By examining collective digital fluency in work groups, I extend the construct of digital fluency to the team-level. The team-level is of great scientific importance because it is one of the essential parts of organizational environments (Kanter, 2019; Thatcher and Patel, 2011), and increasing diversity in work groups will also play a significant role in the future (Buengeler et al., 2021). Due to the digitalization of business processes, work groups need to be digitally fluent because collective digital fluency helps employees engage and interact in digital activities. By digitally interacting in work-related settings, employees contribute to the group's goal (Briggs and Makice, 2012). Given the rareness of research regarding collective digital fluency and its antecedents in work groups, this study examines age-technostress faultlines and leader-member exchange climate. Figure 6 illustrates the hypothesized research model that aims to test a relationship between age-technostress faultlines and collective digital fluency. Concerning age-technostress faultlines, this research also contributes to a solid understanding of internal group structures by constructing age-technostress faultlines. Integrating demographic (age-) and competence (technostress-) factors is a novel approach to faultline construction. This addition to the faultline research branch is, at the same time, also a very relevant topic for everyday life, as demographic diversity (Fuchs et al., 2011) and digitalization will continue to increase (Lohmeier, 2023). Lastly, I extended the leader-member exchange construct by adding the leader-member exchange climate as a moderating factor. This extension is relevant because prior examination of the leader-member exchange (differentiation) construct has been insufficient in detecting concept variations and nuanced meanings in groups (Buengeler et al., 2021). To contribute to the concept's explanatory power and generalizability, I use the leader-member exchange climate and Intraclass Correlation Coefficient to calculate the climate. By approaching the explanatory power and generalizability in this way, I address Graen and Uhl-Biens' (1995) call pointing out the limited perceptual measures of general relationship quality.

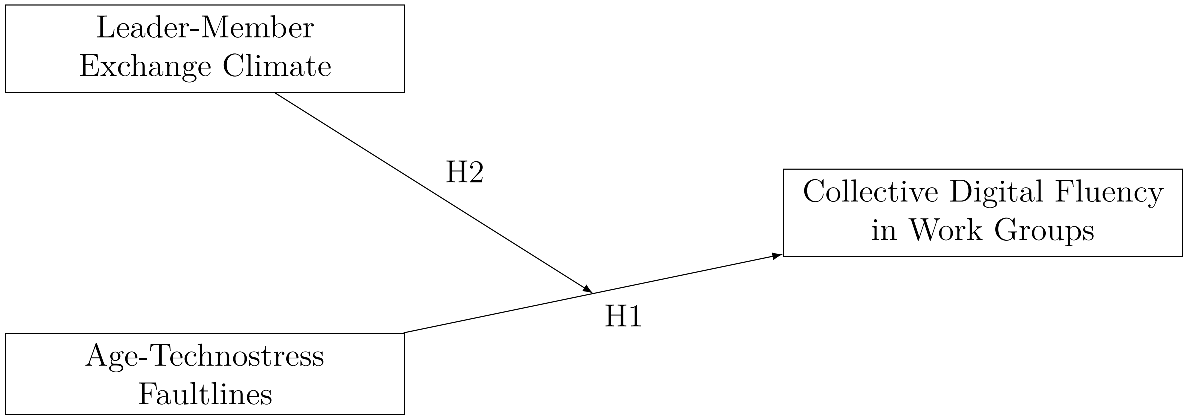

Figure 6. Research Model for Study 3.

Proposed Team-Level Relationship Between Age-Technostress Faultlines and Work Group's Collective Digital Fluency and Leader-Member Exchange Climate on the Effect of Age-Technostress Faultlines on Work Group's Collective Digital Fluency.

4.2 Theory and Hypotheses

To establish the theoretical model, I refer to the Social Identity Theory (Turner and Tajfel, 1986) encompassed within the Faultline Concept (Lau and Murnighan, 1998). The Faultline Concept builds on the Social Identity Theory by explaining why individual differences will likely transform into perceived subgroup splitting (Tiede et al., 2021). As a core element of the Social Identity Theory by Turner and Tajfel (1986), individuals define their identity concerning a similar social group through the collective characteristics of a group to which the individual feels to belong (Van Knippenberg and Hogg, 2003). Thus, the theory attempts to explain the event of group-based self-definition (Islam, 2014), which could also be applied to the Faultline Concept, where the sense of social belonging with similar subgroups is a core element (Tiede et al., 2021).

Therefore, the Social Identity Theory and the Faultline Concept offer insights into how employees group their membership regarding specific attributes. Those attributes could be the employees' age and technostress level. Through self-identification with others of the same age experiencing the same level of technostress, particular self-categorization and self-enhancement are likely to become salient (Ellemers et al., 2004). Also, these differences in self-identification can manifest in the digital divide, a differentiation due to technology usage patterns and the individuals' age (Saeed and Masters, 2021). Consequently, strong faultlines within work groups can manifest in in-group and out-group formation, resulting in limited communication and cohesion with the out-group (Wanless, 2016). Ultimately, this can negatively affect several team-level outcomes (Thatcher and Patel, 2012), for example, weak collective digital fluency in work groups. The following sections describe the assumed relations and explain the derivation of the hypotheses.

4.2.1 The Emergence of Age-Technostress Faultlines

Individual differences can lead to faultlines in work groups. Lau and Murnighan (1998) introduced the concept of group faultlines and suggested seeing the group not only considering one single attribute (e.g., age diversity) but as a unification of complex individuals; in which each individual may belong to many other subgroups, including for example, sex, race, education, and skills (Van Knippenberg and Schippers, 2007). This results in differentiated group members with different demographics and skills who potentially fracture into competing subgroups within a work group. This fracturing of group members due to shared attributes may impact group outcomes. To control for the complexity of different individuals in groups, I refer to faultlines and build on group members' age and skill acquisition alignment in the form of different levels of technostress (e.g., Lau and Murnighan, 2005; Thatcher et al., 2003).

Age as a demographic attribute is particularly salient because it is directly observable and enables easy identification with peers (Milliken and Martins, 1996). Therefore, regarding age differences, individuals prefer to identify themselves with individuals *"who share those attributes* [like the same age]*"* (Lawrence and Zyphur, 2011, p. 35). In addition, age is associated with social categorization processes (Van Knippenberg et al., 2004). Individuals use their age group as a criterion by highlighting their in-group similarities regarding other out-group attributes. Same-aged group members are more likely to share similar social, political, and economic environments and thus have more in common regarding norms, values, and experiences of current affairs (Balkundi et al., 2007).

Additionally, another attribute potentially leading to the development of subgroups and resulting in faultlines could be different levels of technostress. Technostress, the experience of stress due to an inability to adapt to new technologies (Tarafdar et al., 2015), may be caused by the constant adaption requirement to digital technologies (Oberländer et al., 2020). Caro and Sethi (1985) coined technostress as *"a perceived, dynamic adaptive state between the person and the environment, mediated by social-psychological processes and influenced by the nature of the technological environment"* (p. 292). Individuals could be allocated to different subgroups with different levels of technostress. Those differences in technostress can stem from individuals' beliefs about their digital skills (Shu et al., 2011) and negative experiences while handling digital technologies (Jurek et al., 2021). Hence, the alignment of the two attributes, age, and the technostress level, could split the work group into homogeneous subgroups forming age-technostress faultlines. As the individuals' age could be connected to the individuals' level of technostress, different faultlines could occur within a work group. For example, an age-technostress faultline in a work group is strong if older individuals have high levels of technostress and younger individuals have low levels of technostress (Appendix D, Table 24, work group 1). In comparison, a weak faultline is observed in a work group composition where older individuals have high AND low levels of technostress, and younger individuals also have high AND low levels of technostress (Appendix D, Table 24, work group 2).

Considering the Social Identity Theory by Turner and Tajfel (1986) and the Faultline Concept by Lau and Murnighan (1998), individuals categorize themselves into matching groups. Those matching groups are based on the self-categorization process. Same-aged individuals with the same technostress level identify themselves with the matching cohort leading to social fragmentation between different groups. Thus, given the link between age and technostress level differences and following the reasoning introduced by Hauk and colleagues' (2018) meta-analysis, older individuals report greater difficulties in interacting and handling digital technologies than younger individuals. Accordingly, older employees achieve lower levels of digital technology skills based on less experience handling those (Westerman and Davis, 2000), which can ultimately lead to technostress. In conclusion, same-aged employees form subgroups within work groups, resulting in different age groups in which older employees show greater levels of technostress. Those differences in age and technostress can lead to faultlines within work groups' collective digital fluency.

Using the faultline method, I examine the interplay between age and technostress, potentially extending *"our understanding of the role of age in the occupational technostress process"* (Hauk et al., 2019, p. 17). While a large body of age-faultlines research is available lately (e.g., Leicht-Deobald et al., 2021; Wegge and Meyer, 2020), the combination of age and technostress in the context of faultline research has not yet been addressed in depth. As faultlines account for a more complex picture of group diversity, it is a more suitable method to gain further insides into the reality of group diversity (Tiede et al., 2021). Thus, I propose that faultlines can spur social categorization processes (Kunze et al., 2013), resulting in subgroup formations.

4.2.2 The Influence of Age-Technostress Faultlines on the Collective Digital Fluency in Work Groups

In the following, I will introduce the possible influence of age-technostress faultlines on collective digital fluency theoretically. Thus, empirical results reveal a negative impact of faultlines on team outcomes such as group interaction and group performance (Meyer et al., 2014). Also, Lau and Murnighan (1998) specified that diverse work groups with strong faultlines have negative outcomes based on group and communication conflicts. Those conflicts may disrupt the collective work group goal (Leicht-Deobald et al., 2021) by hampering social coordination and integration (Meyer et al., 2014). Most related work indicates that demographic faultlines increase team conflicts and lower overall performance (Thatcher and Patel, 2012). It is important to note that the perception of demographic differences, such as different age groups, leads to a fraction within work groups (Lawrence and Zyphur, 2011). Since age is a primary surface-level attribute and thus easily detectable (Harrison et al., 2002), employees use age as an indicator of social identity. In this sense, individuals often associate age with crucial work outcomes such as promotion, salary (Ridgeway, 2001), or digital affinity leading to even more substantial differentiation. As the individuals' age could influence the individuals' technostress level, age-technostress faultlines can occur in work groups. Focusing on the team-level, other related work outcomes, influenced by age-technostress faultlines, could be group outcomes such as collective digital fluency.

Collective digital fluency, consisting of two sub-dimensions: digital self-efficacy and digital knowledge, can be derived from the general collective efficacy construct. Collective efficacy is *"defined as a group's shared belief in its conjoint capabilities* [digital fluency] *to organize and execute the courses of action required to produce given levels of attainments"* (Bandura, 1977, p. 447). Collective efficacy, described as a group's shared belief in their capabilities (Stajkovic et al., 2009), can also be the shared belief about the gained collective digital knowledge within a work group. Both digital knowledge and digital self-efficacy as sub-dimension of collective digital fluency could be aligned on the team-level. The resulting cohesiveness of a work group is positively associated with direct and indirect support within the group (Wanless, 2016). Also, cohesive groups have greater feedback exchanges, mutual trust (Slone et al., 2015), and social interaction between group members (Forsyth, 2021). In sub-sequence, a highly cohesive work group is strongly bonded with no or weak faultlines and thus characterized by unity.

Thus, emerging age-technostress faultlines between subgroups can limit group members' identification with collective digital fluency within work groups. Hence, the less a work group shares beliefs regarding collective digital fluency, the weaker the collective digital fluency. The groups' collective digital fluency can be traced back to the members' identification with their group. Based on the Social Identity Theory (Turner and Tajfel, 1986) and the Faultline Concept (Lau and Murnighan, 1998), a process is described in which an individual groups her/his membership regarding a specific attribute and offers a meaningful explanation. A particular social identity is taken on through self-identification with a specific subgroup within the work group (Ellemers et al., 2004). By belonging to either the older subgroup with higher levels of technostress or the younger subgroup with lower levels of technostress, age-technostress faultlines become salient and, in sub-sequence, could have an influence on collective digital fluency.

The salience of those faultlines can cause separation and limited communication within work groups (Lau and Murnighan, 1998), resulting in less information sharing with other group members (Mesmer-Magnus and DeChurch, 2009). Limited communication within a work group could have a negative effect on collective digital knowledge because important information could be suppressed. Also, this behavior is problematic because Beal and colleagues (2003) found that information sharing with other group members promotes a positive group climate, including trust and cohesion. Cohesion is the social bonding of group members through exchange and shared task commitment (Miyake and Kirschner, 2014). In a cohesive work group, individuals are united and connected because they feel a sense of belonging and bond with the group (Zamecnik et al., 2022). The sense of belonging and exchange could also have an influence on collective digital self-efficacy and collective digital knowledge by fostering a group climate by sharing knowledge and offering support on the team-level. Furthermore, cohesive work groups have been shown to use their resources more efficiently. After all, they are more familiar, trust each other, and share knowledge and ideas within a group (Beal et al., 2003) which could lead to better collective digital knowledge and collective digital self-efficacy.

Further benefits of cohesive work groups are effective teamwork (Salas et al., 2015). Due to the findings that highly cohesive work groups are associated with positive outcomes such as shared knowledge within work groups (Beal et al., 2003), age-technostress faultlines with less cohesive work group structure should have a negative influence on collective digital fluency. Thus, cohesiveness in the work group should be achieved for a work group to become effective regarding digitalization and, thus, collectively digitally fluent. This is supported by the finding that non-cohesive work groups create in-groups and out-groups, leading to separation and limited communication (Wanless, 2016). With less cohesion in work groups, collective digital knowledge and collective digital self-efficacy, summed in collective digital fluency, also decreases. Thus, based on the theories and literature presented, I posit that:

Hypothesis 1: Age-technostress faultlines within work groups will be negatively related to collective digital fluency in work groups.

4.2.3 The Moderating Effect of Leader-Member Exchange Climate on the Collective Digital Fluency in Work Groups

While faultlines within work groups significantly affect several outcomes at the team-level, such as direct and indirect support (Wanless, 2016), the question arises of *how to mitigate the effect of faultlines and strengthen the collective digital fluency within work groups.* In general, the leader can play a central role in the daily work routine. According to Graf and colleagues (2012), the individuals' definition of their identity and contribution to the work group is strongly related to the leaders' behavior. Leaders can support the emergence of collective identities by supporting the identification with a collective identity (Kark and Shamir, 2002) and are often seen as role models who embody the work group's core characteristics by, for example, stressing its uniqueness (Shamir et al., 1994) and consequently forming a sense of in-group identification. Hence, leaders can significantly impact employees and their experiences and behavior in work groups due to their central role and power (Yukl, 2008). Due to their central role, leaders can encourage interaction between individuals and support coordination and communication (Kozlowski and Bell, 2013; Schölmerich et al., 2017). They could also play a central role in forming a collective group identity, such as collective digital fluency, and weaken the negative effect of age-technostress faultlines by developing a specific climate. This specific climate could be the *leader-member exchange climate.*

Generally, leader-member exchange is a relationship-based approach defined as an overall relationship quality between a leader and a follower. The leader-member exchange and the organizational climate are strongly interlinked (Bos-Nehles and Audenaert, 2019) because leaders distribute *"information about organizational policies, procedures and practices"* as they *"act as interpretative filters of relevant events and facts"* (Valls et al., 2016, p. 317). By doing so, leaders shape their employees' perceptions, opinions, and viewpoints by informing them which behavior is expected, which is rewarded, and which is punished (Bowen and Ostroff, 2004). To have a clear understanding, I refer to the extension of the leader-member exchange construct to the leader-member exchange climate. I define this leader-member exchange climate as a shared exchange between leaders and their followers manifested in the companies' policies, practices, and procedures. Work group climate is an underlying, implicit team-level construct reflecting shared attitudes and behavior within an existing work group (Naumann and Bennett, 2000; Takeuchi et al., 2003). The resulting leader-member exchange climate signals employees how to develop high-quality leader-member exchange relationships (Valls et al., 2016) and vice versa.

To ensure a good overall leader-member exchange climate, the perceived support of the leader influences employees' perception of investment in a positive leader-member exchange climate (Kuvaas and Dysvik, 2010). Such a positive leader-member exchange climate could hamper the negative effect of age-technostress faultlines on collective digital fluency. Support for this hypothesized positive effect is the finding that the leader represents the organization (Eisenberger et al., 1986) and can influence the leader-member exchange climate such that a general understanding of the unification with the work group is apparent.

Based on the Social Identity Theory's (Turner and Tajfel, 1986) and the Faultline Concept's (Lau and Murnighan, 1998) premise that the individual sees himself concerning other social groups by identifying with a collective, depersonalized identity, the moderating effect of the leader-member exchange climate on the effect of age-technostress faultlines on collective digital fluency may be explained. In this sense, the effect of age-technostress faultlines on collective digital fluency could be influenced by the leader-member exchange climate such that a general understanding of mutual trust and a sense of belonging is apparent. Mutual trust and a sense of belonging could positively influence collective digital self-efficacy because the work group feels empowered to become digitally fluent. Also, faultlines within the work group can be mitigated by supporting a work group climate where group affiliation is postulated regardless of age or technostress level.

By interacting with the individuals positively, a leader can foster the needed general feeling of justice within a work group (Erdogan and Bauer, 2010) and thus build a solid ground for collective digital self-efficacy. As Colquitt and colleagues (2005) outlined, individuals greatly care about and react to the leaders' behavior within work groups as it is a cue that all individuals are valued and equal. In this matter, the feeling of mutual trust and fairness brought in by a high leader-member exchange climate could positively affect collective digital self-efficacy. Also, collective digital knowledge can be supported by fostering trust within a work group and sharing knowledge and ideas within a group (Beal et al., 2003) because employees are more in exchange. Trust is firmly anchored with the leader-member exchange construct because the construct is a trust-building process between leaders and employees (Bauer and Green, 1996; Scandura and Pellegrini, 2008). Trust is developed through exchanges between leaders and followers, and a continuing positive exchange is expected (Sue-Chan et al., 2012). Dulebohn and colleagues (2012) posit that leader-member exchange is also an interpersonal relationship characterized by mutual liking resulting in a commitment to the organization. Thus, the sense of belonging to and exchanging with others could have an influence on collective digital self-efficacy and collective digital knowledge by fostering a group climate by sharing knowledge and offering support at the team-level.

In this sense, the effect of the leader-member exchange climate can moderate the effect of age-technostress faultlines on collective digital fluency. Consequently, a low level of leader-member exchange climate can hinder the moderating effect on the effect of age-technostress faultlines on collective digital fluency as the leader is not supporting a general trust within the work group through interaction and hinders collective digital self-efficacy and collective digital knowledge. The function of group-based self-definition can be hampered by a low leader-member exchange climate such that a general understanding of mutual trust and a sense of belonging is weak. At the team-level of identity, individuals use trust in a group as a basis for inter-group affiliation by comparing their work group to an out-group (Martin et al., 2016).

The function of group-based self-definition can be influenced by the leader-member exchange climate such that a general understanding of mutual trust and a sense of belonging is apparent. By supporting a work group climate where group affiliation is postulated regardless of age or technostress level, faultlines within the work group can be hampered. Therefore, I assume that the leader-member exchange climate within a work group influences the effect of age-technostress faultlines on collective digital fluency.

Accordingly, I put forward the following hypothesis:

> *Hypothesis 2: Leader-member exchange climate moderates the relationship between age-technostress faultlines and collective digital fluency in work groups, such that this effect is negative when levels of leader-member exchange climate are low but positive when levels of leader-member exchange climate are high.*

4.3 Data and Methods

4.3.1 Data Collection and Sample

The main objective of this study is to empirically establish the effect of age-technostress faultlines and the moderating effect of leader-member exchange climate on the work group's collective digital fluency. The survey took place at a site of a large German company mainly active in the field of common-rail injectors in diesel technology. The company's location is in Bavaria, Germany, with approximal 7.000 employees. I focused on white-collar workers because white-collar work is highly dependent on technology. Thus, *"technology dependence has a direct and positive impact on technostress"* (Shu et al., 2011, p. 933). The main task field of the work groups consists of the production planning and research of powertrain solutions. The company agreed to participate in the study and received a benchmarking report. Before the data collection, the management board informed all employees and encouraged their participation. Employees have displayed a button on their home screen inviting them to participate in the online survey, which could be accessed through a hyperlink embedded within the home screen. They were also assured that strict confidentiality and anonymity requirements would be followed in the use of the data and that the company would not have access to the data in any form.

I excluded 45 individuals because of missing information regarding their group membership. For the calculation of faultlines, I excluded an additional 35 individuals due to missing age data[7]. I also excluded 666 individuals nested in 36 work groups with a

[7] While simulation studies show that missing values do not significantly affect the calculation of faultline strength based on ASW (Meyer and Glenz, 2017), the assignment to a subgroup for each group member and the subsequent analysis of communication between subgroups requires a complete data set.

group size greater than 15 individuals per group[8] because direct interaction within the work group cannot be assumed. Following Van Dick and West (2005), a characteristic of a team is that each member can directly interact with other team members. In this sense, a work group is defined as a group *"to which individuals are assigned, whom they identify with, and whom they interact with regularly in order to perform work-related tasks"* (West et al., 2001, p. 236). Also, participants that did not complete the survey until the last question were excluded (exclusion of -$N_{(individuals)} = 176$) from the analysis. Finally, in the present study, a total of 805 individuals nested in 119 work groups were examined from a large-sized German company. The subgroups included, on average, 6.7 individuals ($SD = 5.41$).

All participants answered demographic questions, including their education qualification, age, sex, tenure, working hours per week, proportionally remote work percentage, and whether they were leaders. 79% of the group members were male. Employees' ages ranged from 18 to 71 years, with a mean of 43 years. The average organizational tenure was 22 years ($SD = 11.11$). The most frequently represented educational qualification was master craftsman/technician (28.72%), apprenticeship (17.51%), and diploma/master's degree (13.60%). 15.89% of the participants were in a leadership position. The average weekly working time was 32 hours ($SD = 4.20$), and the average remote work proportion was 9.83% of the week.

4.3.2 Measures

To test the validity of the latent construct variables, separate confirmatory factor analyses (CFA) was conducted. Unless otherwise stated, 5-point Likert scales (1 = strongly disagree/never, 5 = strongly agree/always) were used for the following measures, and to ensure replicability, I used established questionnaire scales. All items were coded so that higher scores indicate higher levels of the construct. The detailed wording of all items can be found in Appendix B, Table 16, Appendix C, Table 21, and Appendix D, Table 23. Given that all variables included in this study were collected from the same

[8] Also, a well-known problem in faultline research is computational demands due to too large groups (groups size < 15 individuals) (Meyer and Glenz, 2013).

source, confirmatory analysis (CFA) was conducted to examine whether the variables were empirically distinct from each other, based on the fit indices including χ^2, Comparative Fit Index (CFI), Tucker-Lewis-Index (TLI), and the Standardized Root Mean Squared Residual (SRMR). CFI and TLI with values close to .95 indicate superior fit and the SRMRs' acceptable cut-off value was set at $< .08$ (Hu and Bentler, 1999). For the aggregation to the team-level, I used the Intraclass Correlation Coefficient ICC_1 (= the proportion of the total variance explained by the grouping structure) and ICC_2 (= the reliability of aggregated variables) (Hox et al., 2010; Snijders and Bosker, 2011) and for the interrater agreement ratio I used the Average Deviation Index ADM(J) (Burke et al., 1999).

4.3.3 Age-Technostress Faultlines

Age-Technostress faultlines were calculated based on every group member's age and experienced technostress. For calculating the faultline distance ($\text{Fau}_{\text{distance}}$) and faultline strength ($\text{Fau}_{\text{strength}}$), I followed the procedure by Bezrukova and colleagues (2009). $\text{Fau}_{\text{distance}}$ displays how far apart the subgroups are from one another based on the strongest group split (Bezrukova et al., 2009). $\text{Fau}_{\text{strength}}$ is defined as the subgroup variance ratio to the work group's total variance after detecting the strongest group split (Thatcher et al., 2003). Finally, the overall faultline score is calculated by the product of $\text{Fau}_{\text{distance}}$ (Bezrukova et al., 2009) and $\text{Fau}_{\text{strength}}$ (Thatcher et al., 2003). Also, I defined the attributes' weight and thereby referred to Meyer and Glenz (2013), who have recommended weighting the attributes according to their standard deviation (technostress $SD = .53$) and following Thatcher and colleagues (2003), I specified the weight for each diversity attribute to indicate how strong a difference is fractured into faultlines. Therefore, I used (1, .1), meaning that an age difference of 10 years is equally weighted as a difference in technostress. The resulting faultline values ($\text{Fau}_{\text{distance}}$*$\text{Fau}_{\text{strength}}$) varied from .008 to 1.0 ($mean = .08$; $SD = .11$), with higher values indicating stronger faultlines and more distant subgroups.

I also verified my findings with the *Average Silhouette Width* (ASW) method by

Rousseeuw (1987), which detects subgroups using stepwise cluster analysis (Li and Jones, 2019). Faultline strength ranges from -1 to 1, with -1 representing inconsistent subgroups, 0 representing no homogeneous subgroups, and 1 purely homogeneous. A value of 1 represents the perfect alignment of attributes, resulting in the maximum separation of a group into homogeneous subgroups (Meyer and Glenz, 2013). Hence, the higher the ASW value, the stronger the faultlines. The resulting faultline values (ASW) for all groups are presented in Appendix D, Table 25. The values range from 0 (e.g., group 24) to .75 (group 5), and the shades of blue indicate the differences in the values. The stronger the blue coloration, the stronger the faultline. While 7.56% of the groups have an ASW value of 0, 21.85% of the groups have an ASW value between 0 $<$ .0039, and 24.37% of the groups have an ASW value between .0039 and .0049, resulting in a total of 53.78% groups with weak faultlines under .1. Using Rousseeuw's method (1987), I found that statistically, age-technostress faultlines exist but on a weak level (53.78% of the faultlines are $<$ .1).

4.3.4 Collective Digital Fluency

(Cronbach's α = .88, composite reliability (CI) = .89). To empirically examine the team-level of collective digital fluency, I aggregated the data from the individual-level by calculating the Intraclass Correlation Coefficient ICC_1 (= the proportion of the total variance explained by the grouping structure) and ICC_2 (= the reliability of aggregated variables) (Hox et al., 2010; Snijders and Bosker, 2011). The ICC_1 indicates the existence of a group effect, whereas the ICC_2 estimates the reliability of the group means (Bliese, 2000). For the ICC_1, values based on a significant one-way analysis of variance are generally acceptable. For the ICC_2, values of more than .6 are usually considered sufficient (Chen et al., 2005). I also used the Average Deviation Index ADM(J) as an interrater agreement ratio (Burke et al., 1999). I used the 6-item scale with the two sub-dimensions of digital knowledge and digital self-efficacy by Kunze and Zimmermann (2000) to measure collective digital fluency. An example item of digital knowledge is *"I know what to do when using digital technologies without too much effort."* For digital self-efficacy, an example item is *"I feel confident that I can reliably achieve the desired work results with the help of* *digital technologies."* All item loadings for both sub-dimensions were significant and above the threshold of .5. For all items, Cronbach's α was greater than .88. The aggregation statistics also provided support for aggregation to the team-level of analysis ($ICC_1 = .05$; $ICC_2 = .60$; $\rho < .001$; ADM(J) = .81), underlying the suggestion that the aggregation to the team-level was a reasonable procedure.

4.3.5 Leader-Member Exchange Climate

($\alpha = .91$, $CI = .93$). I used the 7-item scale Graen and Uhl-Bien (1995) designed to measure leader-member exchange climate. One exemplary item is *"How well does your leader recognize your potential?"* I used all seven items[9] because their Cronbach's α was greater than .91. The aggregation statistics also provided support for aggregation to the team-level of analysis ($ICC_1 = .05$; $ICC_2 = .62$; $\rho < .001$; ADM(J) = .74) supporting the suggestion that the aggregation to the company level was a reasonable procedure.

4.3.6 Controls

I included four control variables because theoretical and empirical arguments suggest their relationships with the focal variables. First, I included the educational qualification of the employee as a control variable because scholars have stated positive associations between higher educational level and digital fluency (Henderson et al., 2017). Thus, the participants' educational level can influence their collective digital fluency. Second, sex was included as a control variable because empirical findings indicate that women and men could differ regarding intrinsic motivation to do something (Chen and Zhao, 2013) and their achievement motivation (van der Sluis et al., 2010). Sherman and colleagues (2000) reported that men tend to use digital technologies more often than women. The reported sex differences in technology use (Czaja et al., 2006; Jackson et al., 2008; Sherman et al., 2000) can result in differences in male or female-dominated collective digital fluency. Third, I controlled the amount of time spent in remote work per week, as the communication between separated employees is done more via e-mail, phone calls, and online meetings.

[9] Detailed information about the answer categories of the LMX-7 scale can be found in the Appendix C, Table's 21 note section.

With the use of digital technologies from remote work also comes an increase in collective digital fluency. This is in line with the study by Resnick (2002), who claimed that the use of digital technology affects employees' digital skills. In that, the interaction and use of digital technologies also lead to stronger collective digital fluency. Fourth, I included group size as a control variable. In their meta-analysis, Johnson and colleagues (1981) identified that smaller groups are associated with higher effectiveness and cooperative behavior. Thus, they concluded that the smaller the group, the greater the cooperation, which could affect collective digital fluency.

4.3.7 Analytical Procedure

To test my two hypotheses, I ran combined confirmatory factor analyses (CFA) for all used variables to establish my measurement model. Second, I applied structural modeling to state the significant relationships among the constructs, as shown in the research model (Figure 6, p. 91). To test my hypotheses proposed direct and moderation effect, I examine the leader-member exchange climate and the collective digital fluency in work groups. All variables in the conducted analyses are z-standardized prior to the regression analysis (Frazier et al., 2004). To inspect the general robustness of my results, I examine endogeneity by following the procedure suggested by Shaver (2005). The data was evaluated using Stata 17.0, and the faultline calculation was carried out with the open-source statistical environment R using the *saw.cluster package* (Meyer and Glenz, 2013).

4.4 Results

4.4.1 Descriptive Statistics

The variables' descriptive statistics, including means and standard deviations, are displayed in the following Table 7. I observe a significant positive correlation ($r = .27$, $\rho < .01$) between leader-member exchange climate and collective digital fluency. Also, education qualification is significantly positively correlated with collective digital fluency ($r = .18$, $\rho < .01$), leader-member exchange ($r = .25$, $\rho < .01$), and significantly negatively correlated with age-technostress faultlines (r = -.12, $\rho < .01$). Education qualification is negatively related to sex (r = -.13, $\rho < .01$). Furthermore, remote work is positively related to leader-member exchange (r = .07, $\rho < .05$), education qualification (r = .20, $\rho < .01$), and sex (r = .12, $\rho < .01$).

Table 7

Means, Standard Deviations, and Intercorrelations of Main Variables and Controls.

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*
1 Collective Digital Fluency	3.87	.74						
2 Age-Technostress Faultlines	.08	.11	.00					
3 Leader-Member Exchange Climate	3.53	.82	.27**	-.06				
4 Education Qualification	5.63	2.40	.18**	-.12**	.25**			
5 Sex	.22	.45	-.02	.00	-.01	-.13**		
6 Remote Work	9.83	20.99	-.03	-.06	.07*	.20**	.12**	
7 Team Size	6.73	5.94	-.00	-.03	-.06	-.05	.02	-.04

Note. $N_{(\text{individuals})} = 805$; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$. Values are based on two-sided significance testing; *M* = mean; *SD* = standard deviation; Education Qualification = 1 = no leaving certificate, 2 = lower secondary school leaving certificate, 3 = secondary school leaving certificate, 4 = entrance qualification for studies at universities of applied sciences, 5 = higher education entrance qualification, 6 = completed training, 7 = master craftsman/technician, 8 = bachelor's degree, 9 = diploma/master's degree, 10 = doctorate; Sex = 0 = male, 1 = female, 2 = divers.

4.4.2 Measurement Model Comparison

Given that all variables included in this study were collected from the same source, Discriminatory Factor Analysis (DFA) was conducted to examine whether the variables were empirically distinct from each other, based on the fit indices including χ^2, Comparative Fit Index (CFI), Tucker-Lewis-Index (TLI), and the Standardized Root Mean Squared Residual (SRMR). CFI and TLI with values close to .95 indicate superior fit, and the SRMRs' acceptable cut-off value is set at $< .08$ (Hu and Bentler, 1999). To strengthen my hypothesized model, I compare it with two alternative models. For the hypothesized model, sufficient values for all fit indices were obtained (CFI = .92, IFI = .90, TLI = .91, SRMR = .05). The alternative model 1 includes two common factors and has a slightly worse fit than the hypothesized model but still a good overall fit ($\Delta\chi^2 = 26.17$, $\Delta df = 2$). The second alternative model includes one common factor and has a slightly worse fit than the hypothesized model ($\Delta\chi^2 = 143.81$, $\Delta df = 3$). All fit indices for the measurement model comparison are displayed the following Table 8.

Table 8
Measurement Model Comparison.

	χ^2	*df*	$\chi^2 df$	$\Delta\chi^2$	Δdf	*CFI*	*IFI*	*TLI*	*SRMR*
Hypothesized Model	715.302	87	8.22			.92	.90	.91	.05
Alternative Model 1	741.473	89	8.33	26.17	2	.87	.86	.79	.07
Alternative Model 2	859.115	92	9.33	143.81	5	.82	.82	.78	.16

Note. $N = 794$; χ^2 = chi-square; df = degrees of freedom; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis-Index; SRMR = Standardized Root Mean Square Residual. All measurement models are compared to the hypothesized model.

4.4.3 Hypotheses Testing

Table 9 shows the results of the direct and moderated effects to test my two hypotheses. According to the first hypothesis, age-technostress faultlines positively correlate with collective digital fluency in work groups. Table 9 (Model 1) shows that age-technostress faultlines are not significantly associated with collective digital fluency in work groups ($\beta = .02$, $\rho = .03$). This finding does not support hypothesis 1. The second hypothesis states that the effect of age-technostress faultlines on collective digital fluency in work groups is moderated by the leader-member exchange climate. As shown in Table 9 (Model 2), the moderating effect of leader-member exchange climate has a significant effect on the effect of age-technostress faultlines on collective digital fluency in work groups (β = .21, ρ = .03). Thus, the second hypothesis supports a significant interaction effect. To further inspect whether the pattern of the interaction is in line with the prediction of the second hypothesis, levels at 'high' (+1 *SD* = .091) and 'low' (-1 *SD* = -.091) of the moderator leader-member exchange climate were calculated. Thus, I probed the significant interaction by plotting the interaction and performing a simple slope analysis (Cohen et al., 1983). My results showed that age-technostress faultlines were significantly related to collective digital fluency under high leader-member exchange (β = .59, ρ = .001) but not under low leader-member exchange (β = .21, n.s.). I also employed the graphical procedures to provide additional evidence of the moderating effect of the leader-member exchange climate. The interaction effect is shown in Figure 7.

4.4.4 Controlling for Endogeneity Biases

Lastly, I controlled for endogeneity biases to inspect the general robustness of the findings and statistically support the causality (Antonakis et al., 2010). Endogeneity biases are a common problem that arises from unmeasured omitted variables that could be related to the error term of the independent and dependent variables. I specified two additional models to identify endogeneity by following Shaver's (2005) procedure. The first alternative model allows an error correlation between age-technostress faultlines and the collective digital fluency in work groups. I use education qualification as an instrument, as it shows a high correlation with age-technostress faultlines (r = -.12, $\rho <$ .01). In this alternative model, the error correlation was non-significant. The relationship between age-technostress faultlines and collective digital fluency remained positive (β = .02, n.s.). The second alternative model allows an error correlation between leader-member exchange climate and collective digital fluency while using education as an instrument. It shows again high correlations with leader-member exchange (r = .25, $\rho <$ .01). The error correlation was non-significant. The relationship between leader-member exchange climate and collective digital fluency remained negative and significant (β = -.23, $\rho <$ .05). The analysis results suggest that my findings are robust, even when controlling for a potential endogeneity bias. Overall, I can consequently reject hypothesis 1 and confirm hypothesis 2.

Table 9
Regression Analysis.

		Collective Digital Fluency					
		Model 1			Model 2		
Predictors		*Coef.*	*Robust Std. Err.*	*95% CI*	*Coef.*	*Robust Std. Err.*	*95% CI*
	Constant	.00	.03	[-.06 ; .06]	.00	.03	[-.06 ; .07]
Controls							
	Education Qualification	.18	.03***	[.11 ; .25]	.13	.03***	[.06 ; .20]
	Sex	.02	.03	[-.04 ; .09]	.02	.03	[-.04 ; .09]
	Remote Work	-.05	.03	[-.11 ; .01]	-.05	.03	[-.12 ; .00]
	Work Group Size	.00	.03	[-.06 ; .07]	.16	.03	[-.04 ; .08]
Main Effects							
	Age	-.23	.03***	[-.30 ; -.17]	-.25	.03***	[-.31 ; -.18]
	Technostress	.06	.03	[-.07 ; .11]	.06	.03	[-.09 ; .10]
H1	Age-Technostress Faultlines	**.02**	**.03**	[-.04 ; .08]			
Interaction Effect							
H2	Age-Technostress Faultlines x Leader-Member Exchange Climate				**.21**	**.03*****	[.14 ; .27]
F		5.51			10.09		
R^2		.03			.10		
ΔR^2					.07		

Note. Model 1 - 2 $N_{(Groups)} = 119$; $N_{(individuals)} = 805$; * $\rho < .1$; ** $\rho < .05$; *** $\rho < .01$, two-tailed.

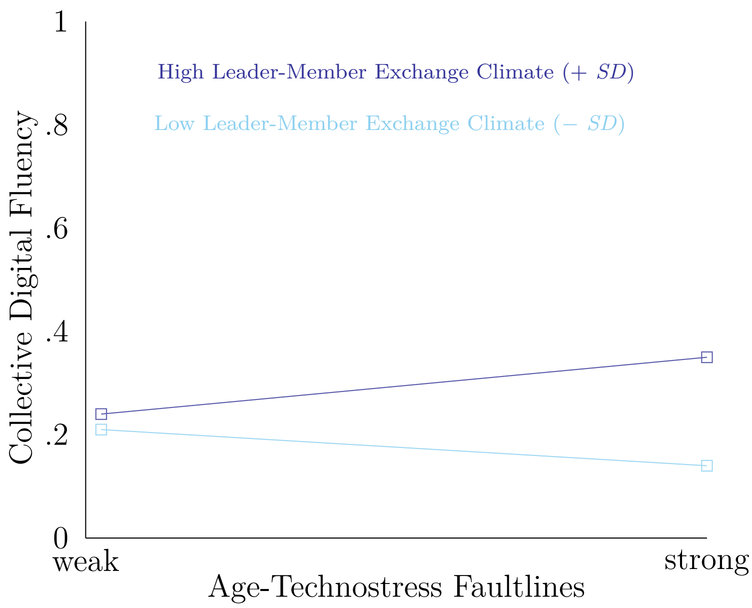

Figure 7. Simple Slopes for Study 3.
Impact of Leader-Member Exchange Climate on the Relationship between Age-Technostress Faultlines and Collective Digital Fluency.

4.5 Discussion

This study investigates the effect of age-technostress faultlines on collective digital fluency at the team-level of analysis. More precisely, I develop a model to examine and answer the questions: *(a) how can we build collective digital fluency in diverse work groups? And (b) how can leaders support work groups' collective digital fluency with the help of a specific exchange climate?* Thus, I examine how age-technostress faultlines may be built, how these faultlines may impact employees' collective digital fluency, and how leader-member exchange climate may moderate this relationship. To pursue the research questions, I ground my work in Turner and Tajfel's Social Identity Theory (1986) and Lau and Murnighan's Faultline Concept (1998), both theories of social categorization, and investigate age-technostress faultlines and their effects on collective digital fluency (hypothesis 1). Second, I argue for the moderation of leader-member exchange climate on the relationship of age-technostress faultlines on collective digital fluency also based on Turner and Tajfel's Social Identity Theory (1986) and Lau and Murnighan's Faultline Concept (1998) (hypothesis 2). Surprisingly, I found no direct relationship between age-technostress faultlines and collective digital fluency. Furthermore, I found support for the second hypothesis indicating that high leader-member exchange moderates the relationship between age-technostress faultlines and collective digital fluency. Additional statistical analyses underline the robustness of these findings. These results contribute to the digital competencies, faultline, and leadership literature by substantiating and extending prior research in several theoretical and practical ways.

4.5.1 Theoretical Implications

My findings contribute to the latest literature on organizational behavior and digital competencies with their antecedents in organizations (e.g., Leicht-Deobald et al., 2021; Zimmerman, 2000). Previous research on digital competencies has mainly been carried out on the individual-level, investigating influential factors on individuals' digital fluency (e.g., Hampel and Kunze, 2023; Wang and Haggerty 2011; Wei et al., 2020). For example, Wei and colleagues (2020) examined how digital fluency moderates the relationship between employees' social media usage and agility at the workplace. Also, Wang and Haggerty (2011) reviewed differences in individuals' work outcomes based on different individuals' virtual capabilities. Moreover, Hampel and Kunze (2023) investigated the effect of employees' age, negative age stereotypes, and developmental supervisor support on employees' digital fluency. On the individual-level, they could find that negative age stereotypes amplify the negative relationship between employees' age and digital fluency. However, recent research on digital fluency tends to focus on a multi-level framework. It investigates individual-level, team-level, and organizational-level to address the complexity of digital transformation (e.g., Trenerry et al., 2021). Consistent with this direction, I aim to advance the digital competencies literature by creating collective digital fluency at the team-level. In addition, I am also responding to the call of Kozlowski and Klein (2000) for a level approach to investigate organizations with different facets. Thus, I contribute to the digital fluency construct by empirically testing collective digital fluency with its two sub-dimensions, collective digital self-efficacy, and collective digital knowledge, as a potential outcome.

First, I could show that leader-member exchange climate positively moderates the relationship between age-technostress faultlines and collective digital fluency when levels of leader-member exchange climate are high but not when levels of leader-member exchange climate are low. This may occur because leader-member exchange could be an important contextual factor ensuring that resources and support are available for employees (Harris and Kacmar, 2005). Also, high levels of leader-member exchange build a social context resulting in opportunities, which feeds the scope of employees and leaders (Ozer et al., 2014), which in sub-sequence, enables employees and leaders to better deal with their work. Furthermore, leader-member exchange could serve as a supportive context helping to ensure rewards and cope with work demands (Harris and Kacmar, 2005).

Previous studies found leader-member exchange as a meaningful moderator. Harris and Kacmar (2005) explored that a social stressor was less strongly associated with anxiety among employees reporting high levels of leader-member exchange. Also, Harris and colleagues (2008) could show that leader-member exchange mitigates the effect of strain on turnover intention. Moreover, Tang and Vandenberghe (2021) found that leader-member exchange buffered the effect of role overload on in-role performance. Hence, the studies showed that leader-member exchange is an effective moderator and can have a buffering effect on interrelationships. In this study, however, leader-member exchange climate served beyond a buffing effect but as a reinforcing effect.

Based on this result, it can be assumed that leader-member exchange climate could be a highly relevant construct influencing the effect of age-technostress faultlines on collective digital fluency. Thus, the leader-member exchange climate could support a general understanding, mutual trust, and a sense of belonging to the work group. This, in turn, can lead to work group members trusting each other and strengthening their inter-group affiliation (Martin et al., 2016), resulting in a collective and supporting work group climate. Maintaining a high level of leader-member exchange climate could hamper social categorization processes forming faultlines. This result is consistent with Dulebohn and colleagues' (2012) findings that leader-member exchange promotes mutual liking and a personal commitment to the organization and, thus, to the work group.

Second, concerning faultline research, another contribution of my study is developing and testing age-technostress faultlines. From an application-oriented perspective, age-technostress faultlines may be highly crucial in today's digitalized and aged workforce. This seems to be applicable for at least two reasons. On the one hand, there is a history of research investigating easily observable demographic faultlines such as age, sex, and education (e.g., Lau and Murnighan, 1998), showing that demographic faultlines could influence organizational outcomes (Pearsall et al., 2008). On the other hand, faultline research is shifting, prioritizing contextual factors (e.g., Tiede et al., 2021; Yang and Kim, 2021). As stated by Tiede and colleagues (2021), the perception of group faultlines could serve as a contextual factor and has been shown to influence psychological health within a work group. Such contextual factors could be the individual technostress level. Also, faultline research has mainly focused on outcomes such as innovation, creativity, and performance on the team-level (Pearsall et al., 2008). I aim to extend this focus regarding digital competencies and faultline research by investigating collective digital fluency as an outcome of faultlines.

Lastly, the differentiation into potential and active faultlines is advisable concerning research on faultlines. Potential faultlines are based on objective characteristics of individuals, such as demographic attributes. Potential faultlines have a weaker influence on the dependent variable under investigation than active faultlines. Thus, potential faultlines must turn into active faultlines to engender higher conflicts within work groups with perceived differences between subgroups. Otherwise, the work group will continue functioning as usual (Chiu, 2010; Pearsall et al., 2008). The distinction between potential and active faultlines is necessary to capture the effect of faultlines and investigate their continued functioning in a group setting. This is also in line with Cronin and colleagues (2007) stating that faultline research mostly neglects whether faultlines are activated and suggest using perceived faultlines to measure active faultlines (Bezrukova and Jehn, 2003; Cronin et al., 2007). By implementing leader-member exchange climate as a moderating variable, the potential faultlines turned into active faultlines and, thus, contributed to a better understanding of the relationship between age-technostress faultlines, leader-member exchange climate, and collective digital fluency.

4.5.2 Practical Implications

Since the role of leader-member exchange climate has a significant effect, influencing the effect of age-technostress faultlines on collective digital fluency, organizations should create and sustain leader-member exchange climate. As the study results highlight the crucial role of a high level of leader-member exchange, practical implications for organizations and the human resource unit follow.

First, it holds a powerful position due to its capability to implement and form organizational behavior. An open approach to a leader-member exchange climate can be grounded in the organization's tenet. Macey and colleagues (2011) suggest that organizations can build a culture of trust in management by strengthening their recruitment and attracting applicants who fit into and have internalized the organization's culture. In this regard, the onboarding process could uniquely familiarize employees with the organizational tenet. Furthermore, with its human resources unit, the organization has the vital role of structuring and supporting a good leader-member exchange climate by, for example, investigating the leader-member exchange climate in their annual employee surveys (Nishii and Mayer, 2009). A helpful approach could be to remove structural barriers, such as reducing work group sizes and providing leaders with more time, knowledge, and resources to manage their work groups (Martin et al., 2016). Mainly work-related interactions can be supported by encouraging leaders' role-modeling, coaching, and mentoring their employees. This can be achieved in experimental settings or in Assessment Centers (Agarwal et al., 2012; Zagenczyk et al., 2009).

Second, specific leader-member exchange training could be implemented to improve the leader-member exchange climate. Thus, organizations could develop training settings where leaders practice supportive work behavior and skills associated with interactive behavior (Zagenczyk et al., 2009). Also, techniques to enhance employees' job satisfaction, trust, motivation, and empowerment are highly relevant (Korsgaard et al., 2002). Hence, leader-member exchange training has been proven to be effective for work-related relationships, job satisfaction, and productivity at the workplace (Scandura and Graen, 1984). According to Nishii and Mayer (2009), leaders can be trained to develop high-quality leader-member exchange relationships yielding direct benefits of the leaders' training for the employees (e.g., Graen and Uhl-Bien, 1995). Topics of such training could be tools to establish a strong exchange culture, the need for regular interactions, and fair decisions communicated transparently (Erdogan and Bauer, 2010). Moreover, the training could cover exercises for practicing interaction between leaders and their employees to improve their relationship (Martinko and Gardner, 1987), helping to develop a trust-building process (Bauer and Green, 1996), leading to high levels of leader-member exchange climate. Based on their study findings, Sears and Hackett (2011) suggested that leader-member exchange training should include modules to strengthen bonding with subordinates.

Hence, a core element of a good leader-member exchange climate is the dyadic exchange between a leader and the employee (Martin et al., 2016). This means the managed individual is also responsible for ensuring a good exchange. Thus, employees who are forthcoming with information and decisions contribute to a good leader-member exchange climate. A promising approach is seeking autonomy, feedback, and interaction with others and seeing the leader as fair and unbiased toward all team members (Hooper and Martin, 2008). Thus, regarding the result that leader-member exchange climate has an influence on the interaction between age-technostress faultlines and collective digital fluency, the employee should also contribute to an enhanced interaction.

4.5.3 Limitation and Direction for Future Research

Despite the strengths of this study, including the investigation of digital fluency on the team-level, age-technostress faultlines, and leader-member exchange climate, the study has some limitations that should be addressed in further research. First, although age-faultlines research is of high scientific interest (Leicht-Deobald et al., 2021; Wegge and Meyer, 2020), the direct effect of the constructed age-technostress faultlines yielded non-significant results. Hence, there may be other and potentially even more influential factors causing the formation of faultlines. Thus, this could reveal that psychological variables may be more likely to form faultlines than demographic characteristics (e.g., age) (Tiede et al., 2021). As Su and colleagues (2022) stated, *"team members' characteristics and their composition should be systematically considered in multiple ways"* (p. 26). Influential psychological factors that may cause the formation of faultlines could be friendship (Qi et al., 2022) or conflict/competition between work groups (Hart and Van Vugt, 2006). Faultline research is still at an early stage in uncovering the process of faultline development and possible faultline triggers. Future studies investigating faultlines could, for example, focus on social structures that lead to faultline formations and possible factors that could activate faultlines, such as social interaction (e.g., different qualities of leader-member exchange).

Second, although simulation studies have shown that missing data do not significantly affect the results using the ASW method by Rousseeuw (1987), I aimed for a complete data set forming my variables of interest. Hence, I excluded 922 data points because of missing information for age (-N = 35), group membership (-N = 45) and technostress variables, incomplete data sets (-N = 176), and individuals within a work group size greater than 15 individuals (-N = 666). Concerning the missing information, respondents often perceive demographic questions as very personal. Thus, in surveys carried out at the workplace, employees tend to refuse to answer demographic questions due to privacy concerns, the fear of being identified by their leader or management, and subsequently facing personal consequences. Future work should be aware of this issue and include not only scientifically substantiated surveys with inverted items masking the research question but also work-related information extracted from management reports and interviews. In addition, in this study, I found that the public marketing of the study by the member board greatly influenced the acceptance and completion rates of the questionnaires. Therefore, I advise including the member board in the advertising of the survey to build trust and confidence in the survey.

Third, for calculating the age-technostress faultlines, I referred to Meyer and Glenz's (2013) procedure and used the recommended weighting of the attributes according to their standard deviation. I used (1, .1), indicating an age difference of 10 years corresponds to a difference of X in technostress. While this is the standard method, it is unclear whether this is the optimal weighting of attributes in faultline research. Different weighting methods should be compared to identify the optimal weighting of attributes, as suggested by Schölmerich and colleagues (2017), to measure faultlines and their outcomes. However, to strengthen my methodical approach, I additionally calculated the age-technostress faultlines following the procedure by Bezrukova and colleagues (2009).

Finally, although I believe the study results can be generalized to other organizations, I limited my empirical focus to one company's location leading to the limitation of the data origin. The data for this study was collected from one company based in Bavaria, Germany. Results relying only on one source may lack generalizability to other settings such as other companies, countries, and cultural contexts. Further studies should be conducted in different settings for extended periods to ensure external validity. For example, faultlines may become stronger over time as work group dynamics unfold. Additional longitudinal studies are needed to test the dynamic relationship within faultlines but also among my focal variables or may not be as relevant in smaller companies. Due to the reliance on only one data source, reverse causality may be a problem. A change in my dependent variable (collective digital fluency) could cause a change in my independent variable (age-technostress faultline), as the perception of collective digital fluency could mitigate faultlines. Future research should aim at replicating the study using additional measures and longitudinal procedures.

Despite these limitations, research on faultlines and subgroup formation continues to have a solid empirical and practical impact on work groups (Meyer et al., 2014). In sub-sequence, this research area has good prospects for future development. Especially by combining faultline research and digital competencies research, a research branch with importance for science and practice is emerging.

4.6 Conclusion

Currently, two societal trends are taking place in the workforce: working in diverse work groups with the rapid development of digital technologies in almost every working area (e.g., Liu et al., 2021; Toossi, 2012). Thus, acquiring collective digital fluency is crucial to stay competitive as a unit. In this matter, it is even more critical to understand how organizations can promote employees' collective digital fluency and contribute to digital fluency competencies research and faultline research. This study investigates age-technostress faultlines and the moderating effect of the leader-member exchange climate on collective digital fluency. The results showed a significant effect of high levels of leader-member exchange climate on the relationship between age-technostress faultlines and collective digital fluency. Therefore, organizations and leaders should actively seek deep leader-member exchanges to build a positive leader-member exchange climate. With this study, I contribute to a better understanding of contextual factors in employees' acquisition of collective digital fluency and point to the possible crucial role of the leader-member exchange climate.

4.7 Study Results in the Context of Digital Fluency

The conducted Study 3, *The Role of Age-Technostress Faultlines within White-Collar Work Groups and the Leader-Member Exchange Climate's Influence on the Acquisition of Collective Digital Fluency*, takes the last step towards a more profound understanding of the digital fluency concept in this dissertation. By identifying that a high level of leader-member exchange climate could potentially hamper age-technostress faultlines and thus moderate the effect of age-technostress faultlines on collective digital fluency, another contextual factor is revealed. It should be borne in mind that a moderating effect was only identified at a high level of leader-member exchange climate and not at a low level of leader-member exchange climate. With Study 3, the last level of the three level structure (Figure 2, p. 10) unfolds effects at the team-level. And demonstrates by and large that different levels of investigation can improve our understanding of digital fluency and possible antecedents in the organizational context. This insight helps scholars and practitioners gain a profound understanding of digital fluency on the team-level and the crucial role of a high leader-member exchange climate and subsequently paves the way to a better understanding of the conditions of digital fluency acquisition. In sub-sequence, new findings and influencing factors relating to digital fluency have now been identified at the individual-level (Study 1), dyadic-level (Study 2), and team-level (Study 3) and are summarized and integrated in the following Chapter 5.

5 GENERAL DISCUSSION

5.1 General Summary and Integration

Digitalization has entered our professional and private lives. Even more, digitalization is expected to continue gaining momentum and place ever-new demands on individuals. In 2022, 79.51% of Germans have used the Internet, bringing the total to 67 million individuals online (Lohmeier, 2023). The already high and growing number of Internet users in Germany also illustrates that digitalization will continue to play an essential role in the future. Accordingly, to meet current and future demands, those Internet users must be digitally fluent in using digital technologies professionally.

However, this practical relevance is not reflected in the number of scientific publications. Quite the opposite, research on digital fluency and digital fluency antecedents is limited. Especially in organizational behavior studies, employees' digital fluency is not vigorously addressed, and a multifaceted view of digital fluency and its possible influencing factors has yet to be taken thoroughly. As stated by Trenerry and colleagues (2021), *"there is less understanding of how workers and organizations can best respond to disruptive technological change"* (p. 2). This lack of a holistic view of digital fluency can be identified as a shortcoming that organizational behavior studies still need to improve. To further the understanding of digital fluency and its possible antecedents, I conducted three studies focusing on the individual-, dyadic-, and team-level to narrow this knowledge gap and provide a more comprehensive picture of digital fluency.

The Pre-Study (Chapter 1.2) functions as a first justification for why it is necessary to deal with digitalization, its influence on society, and thus also on the individual in the work context. A first indication of the possible influence of digitalization is researched phenomena such as technostress (Ragu-Nathan et al., 2008), replacement fear (Bregenzer and Jimenez, 2021), and digitalization anxiety (Pfaffinger et al., 2021). Using a linguistic big data approach (Google Ngram analysis), this study analyzed the correlation between digitalization and anxiety and depression over the last 50 years. Based on the frequency of keywords related to technology and digitalization, we found a general increasing trend in the past 50 years leading up to 2020. Furthermore, our results indicated an increasing trend of mental-health-related words describing depression and anxiety. In addition to this investigation of a general trend, we studied the association between ongoing digitalization and the growing prevalence of anxiety and depression. This initial assessment and the additional literature review underscore the importance of digitalization and the potential link to mental health. One possible coping mechanism to meet the demands of digitalization could be the digital skill: digital fluency. To investigate the construct of digital fluency and possible relevant factors influencing digital fluency, I conducted three studies in the field of organizational behavior research.

Using the findings from our Pre-Study as motivation, in the first study (Chapter 2), I dug deeper into the individuals' preferences and willingness to perform to understand the employee at the individual-level better. The first research question I addressed in this study deals with training settings, their influence on individuals' willingness of training participation, and which factors moderate this link. In the study, I refer to the Person-Organization Fit (Chatman, 1989), which I further developed into the Person-Training Fit to adapt to the personality and training research. By doing so, I propose that willingness of training participation is essential to participate successfully in training. Following this reasoning, the willingness of training participation and actual training participation might be the first step to becoming digitally fluent. However, research investigating the correlation between individuals' personality and training settings is still scarce. Based on my theoretical assumptions, I found a positive effect of the personality dimension extraversion and a negative effect of the personality dimension neuroticism on employees' willingness of training participation in a sample of 1.007 white-collar employees from a German technology company. Whereas both moderation effects (hypothesis 1 and hypothesis 2) are not significant, the first study's results add to the dynamic effect between different personality dimensions and the individuals' willingness of training participation.

Nevertheless, different training settings could also be crucial in affecting the individuals' willingness of training participation, and I agree with Harrison and colleagues' (2002) call for a comprehensive understanding of the dynamic between training settings and personality dimensions.

Besides the first studies theory enhancement from Person-Organization Fit (Chatman, 1989) to a more suitable Person-Training Fit, I also improved the method by applying the Experimental Vignette Methodology (EVM; e.g., Atzmüller and Steiner, 2010) in the field of digital fluency. A benefit of the EVM is that it captures the individual's heuristics in a less biased snapshot than a survey (Beck, 2010; Bradbury-Jones et al., 2014). While it is primarily used in clinical psychology research (Aguinis and Bradley, 2014), I applied the EVM in the field of organizational behavior research. A further methodological advancement was the combination of the EVM with anchor vignettes as a double consistency check. By doing so, my study is among the first to create additional design elements and increase the internal validity and reliability of the survey conducted in the organizational field (e.g., Steiner et al., 2016).

The second study (Chapter 3) builds on the findings from the first study. By showing that the employee's personality has an influence on the willingness of training participation, I investigated the question of which further factors may impact the development of digital fluency. Further factors could be identified by investigating the dyadic-level. Using the Empowerment Theory (Zimmerman, 1995) as a theoretical background, I aim to answer the research question of how the leader's behavior and personality may impact employees' acquisition of digital fluency. As a proximal and potentially highly influential factor, I hypothesized that the leader could empower employees' digital fluency. As assumed, I found a positive effect of empowering leadership and leaders' conscientiousness on employees' digital fluency. Also, I found support for a negative main effect of leaders' neuroticism on employees' digital fluency. A sample of 486 white-collar employees of a medium-sized German technology company provided the data for the analysis of this study.

In my second study, I combined leadership research with digital competencies literature and focused on different influential factors of the leader. By doing so, I contribute to the growing evidence that leaders with empowering leadership behavior affect employees' skill acquisition [digital fluency] (Bauwens et al., 2021; Cheong et al., 2019; Kim and Beehr, 2021). Following this research stream, my study further reveals that the leaders' personality also affects employees' digital fluency but to a lesser extent. These findings lead to the theoretical implication that empowering leadership can be a reliable dependent variable for the employees' acquisition of digital fluency.

Besides the theoretical implications, I also advanced the empirical section by exploring the distinctiveness of the constructs: empowering leadership, leader-member exchange, and trust in leader. This procedure is also motivated by Lee and colleagues' (2018) statement that the differentiation between these constructs has rarely and inconclusive been tested empirically and needs to be investigated in more detail. As the incremental variance is generally questionable (Lee et al., 2018), I calculated the relative explanatory power using Relative Wights Analysis (RWA) and tested for incremental validity. As a result, I aimed to answer the call from several scholars (e.g., Cheong et al., 2019; Lee et al., 2018; Sharma and Kirkman, 2015) to determine whether empowering leadership accounts for the unique variance. Thus, the second study in this dissertation is among the first to explicitly address the differentiation of the constructs of empowering leadership, leader-member exchange, and trust in leader.

In the third study (see Chapter 4), I extended the digital fluency construct to the collective digital fluency construct to gain more insights about digital fluency on the team-level. Hence, the study focuses on the research questions of how collective digital fluency can be built in diverse work groups and how leader-member exchange climate may support work groups' collective digital fluency. I built on social categorization theories by combining faultline research, digital competencies research, and leadership research and integrating Turner and Tajfel's Social Identity Theory (1986) and Lau and Murnighan's Faultline Concept (1998). Embedded at the team-level, I focused on subgroup structures, namely age-technostress faultlines within groups and the moderating effect of the leader-member exchange climate. Using age-technostress faultlines, I predicted that those faultlines within work groups would be negatively related to a collective goal such as collective digital fluency. I also assumed that the leader-member exchange climate could moderate the effect of age-technostress faultlines on collective digital fluency. I found support for a moderating effect on the relationship between age-technostress faultlines and collective digital fluency in work groups. The moderating effect was only significant at a high level of leader-member exchange climate but not at a low level. The study was based on a sample of 805 employees with 119 work groups from a large-sized German technology company.

As one main goal of the third study was to investigate the effects on the team-level regarding digital fluency, I constructed age-technostress faultlines. I combined the age-technostress faultlines with digital competencies research to learn more about potential effects at the team-level. By doing so, I contribute to extending the digital fluency construct to a rarely investigated level – the team-level. Existing research on digital competencies has mainly focused on the individual-level (e.g., Wang and Haggerty 2011; Wei et al., 2020). Consistent with recent research, where a focus shift toward a multi-level framework is apparent, I extended work group research by addressing the complexity of digitalization within the organization by combining age-technostress faultlines with leader-member exchange climate and collective digital fluency.

In addition to the theoretical investigation of age-technostress faultlines, I calculated the strength of age-technostress faultlines by using the Average Silhouette Width (ASW) method by Rousseeuw (1987). I could show that statistically, age-technostress faultlines exist but on a weak level (53.78% of the faultlines are < .1). All three studies showed that different factors on various levels could influence digital fluency and its possible precursor willingness to participate in training. Thus, connecting the different levels can create a better understanding of the construct of digital fluency and its possible antecedents.

5.1.1 Integration of all Three Studies

In summary, the Pre-Study and the three field studies showed that digital fluency is a skill considerably in demand for today's workforce. Its acquisition should be assessed from different level perspectives as various influencing factors characterize the workplace. As diverse factors can influence digital fluency, the three combined studies are the first accumulated approach to investigate digital fluency and its antecedents from different perspectives. A better understanding can be generated with a more comprehensive view caused by bridging the three levels and considering influential factors in the workplace. In my dissertation, I integrated studies on training, social psychology, leadership, and faultlines to understand the complex interactions in the organizational setting better. Building on real-world survey data, I examined factors influencing digital fluency based on the three level structure introduced before. By focusing on and integrating these three levels, I referred exclusively to data from employees working in the white-collar sector (see also Chapter 5.2) because white-collar work is being profoundly affected by digitalization (Düll et al., 2016), and the daily work requires a solid level of digital fluency.

Furthermore, researching a specific workforce leads to better comparability of the results of the three studies. To illustrate the three levels, I summarized and controlled for the demographic data for all three studies in Table 10, which shows the participant's age, subjective age, weekly working hours, tenure, sex, leadership position, and education qualification. My dissertation results are based on a total sample of $N = 2298$ employees.

Comparing the three studies' samples, the demographic features are relatively similar. The only exception is the third study, in which employees have worked for the employer for an average of 22 years ($SD = 11.11$), whereas employees in the first two studies worked for the employer for an average of 11.7 ($SD = 9.41$) and 12 ($SD = 9.08$) years. Since this dissertation explores different factors influencing digital fluency, striving for consistency across all studies' samples is recommended. If samples are not similar, it is essential to consider that a sample bias may account for differences in various relevant outcomes (Van de Vijver and Tanzer, 2004). Differences in demographic characteristics could cause the incompatibility of the samples. A detailed review of the sample bias would be beyond the scope of this dissertation. A more detailed description of typical sources for biases can be found in Van de Vijver and Poortinga's (1997) work. In short, for comparison purposes, it is advisable to control for similar sample features regarding age, educational qualification, sex, and other relevant demographic data.

Table 10
Demographic Comparison for the Studies 1 to 3.

	Study 1		Study 2		Study 3	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age in Years	39	10	41.70	12.36	43.29	11.56
Subjective Age in Years	34.82	12	36.62	11.77	39.14	11.97
Working Hours per Week	37.4	6.11	35.71	4.91	32	4.2
Tenure in Years	11.7	9.41	12	9.08	22	11.11
	N	*%*	*N*	*%*	*N*	*%*
Females/Males/Divers	216/784/7	21.5/77.8/.7	108/377/1	22.4/77.4/.2	156/635/14	19/79.4/1.6
Leadership Position Yes/No	218/789	21.7/78.3	103/383	21.1/78.9	127/678	15.8/84.2
Education Qualification 1					4	.3
Education Qualification 2	12	1.2	3	.6	118	14.6
Education Qualification 3	7	.7	39	8.1	140	17.5
Education Qualification 4	32	3.2	43	8.7	15	1.8
Education Qualification 5	18	1.7	21	4.4	14	1.7
Education Qualification 6	12	1.2	20	4.3	140	17.5
Education Qualification 7	98	9.7	123	25.1	229	28.7
Education Qualification 8	34	3.4	74	15.3	23	2.9
Education Qualification 9	667	66.3	154	31.5	109	13.6
Education Qualification 10	127	12.6	9	2	13	1.4
Total Sample N	**1.007**		**486**		**805**	

Notes. Data collection from 2020 to 2022; primarily white-collar employees; Education qualification: 1 = no leaving certificate, 2 = lower secondary school leaving certificate, 3 = secondary school leaving certificate, 4 = entrance qualification for studies at universities of applied sciences, 5 = higher education entrance qualification, 6 = completed training, 7 = master craftsman/technician, 8 = bachelor's degree, 9 = diploma/master's degree, 10 = doctorate.

5.1.2 Integration of Digital Fluency and Mental Health

Besides the increase in digitalization, mental health issues such as anxiety and depression are also rising (Liu et al.,2020). Both anxiety and depression affect hundreds of millions of people worldwide and are also known as the *"Global Burden"* (Liu et al., 2020, p. 134). Our Pre-Study (Chapter 1.2) provides further evidence that digitalization and anxiety/depression are rising. This increase is prominently illustrated in Figure 8. Besides this general finding of an increase over the last 50 years, the results of our Pre-Study showed a correlation between rising digitalization and increased mental health issues. Using this big data approach described in Chapter 1.2, we found a strong positive correlation between published word frequencies describing digitalization (r = .89, ρ < .001) and anxiety (r = .87, ρ < .001), and depression (r = .79, ρ < .001) over the last 50 years (see Appendix A, Table 11).

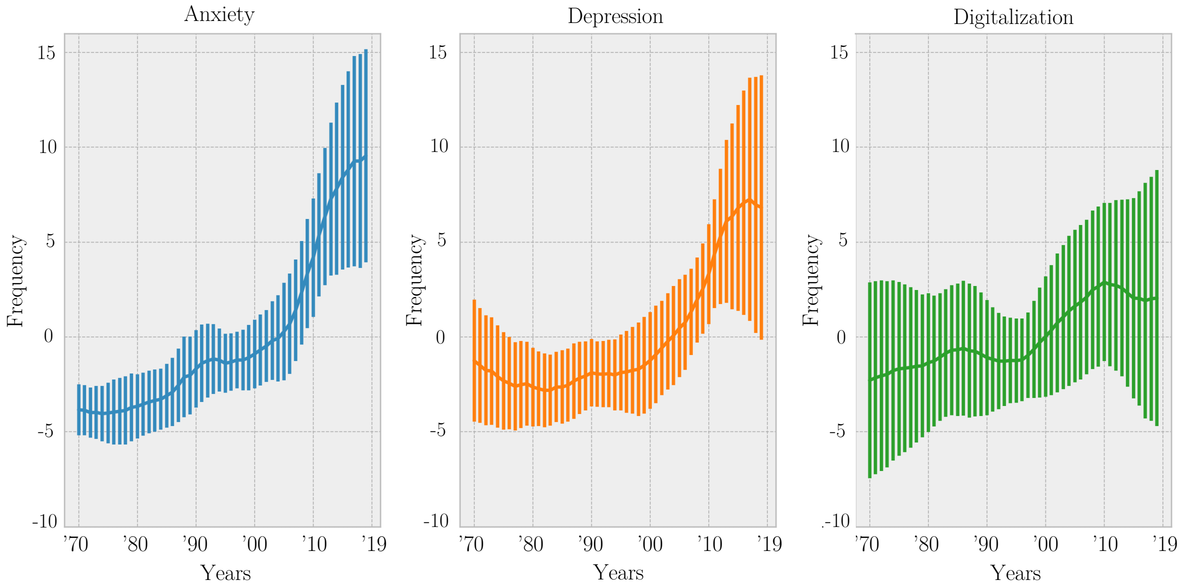

Figure 8. Google Ngram Comparing Results.
Mean and Standard Deviation of Frequency for Anxiety, Depression, and Digitalization Words over the Last 50 Years. Anxiety = Blue Coloration, Depression = Orange Coloration, and Digitalization = Green Coloration. Includes British English, German, Spanish, Russian, French, and Italian.

The rising prevalence of mental health issues is expected to be characterized by a further increase (Patel et al., 2018). Possible causes could be the COVID-19 pandemic (Brooks et al., 2020; Taquet et al., 2021) and ongoing digitalization. However, focusing on this dissertation's main topic, work environments face challenges that may impact mental health. These challenges include but are not limited to constant connectivity (Büchler et al., 2020), technostress (Tarafdar et al., 2015), and blurring the boundaries between work and private life (Boswell and Olson-Buchanan, 2007), which can result in work-life imbalance. Specifically for technostress mental consequences associated with technostress are loss of motivation, feeling of exhaustion, and burnout (Ayyagari et al., 2011; Ragu-Nathan et al., 2008). In the organizational context, technostress has been observed to cause job dissatisfaction (Ragu-Nathan et al., 2008), frustration with the work situation (Tarafdar et al., 2011), and ultimately the fear of being replaced (González-López et al., 2021). These findings highlight that, despite its positive effects, digitalization can also have a negative impact on employee well-being. In some cases, the digitalization of the workplace may cause or aggravate mental health problems.

Due to its relevance for mental health, technostress should be examined more closely. Technostress is defined as the experience of stress due to an inability to use digital technologies effectively (Tarafdar et al., 2015). The acquisition of digital fluency could mitigate the negative effects of technostress. To address this mitigation by acquiring digital fluency, scholars (e.g., Fuglseth and Sørebø, 2014; Ragu-Nathan et al., 2008; Tarafdar et al., 2011) have investigated technostress inhibitors that could reduce the negative consequences of technostress. Three technostress inhibitors based on Ragu-Nathan and colleagues' (2008) research are (a) *technical support provision*, (b) *literacy facilitation* (e.g., digital fluency), and (c) *involvement facilitation*.

Focusing specifically on literacy facilitation, I argue that this could also include skills such as digital fluency. By gaining literacy facilitation and becoming digitally fluent, individuals could mitigate technostress and protect themselves from anxiety and depression simultaneously. Therefore, understanding digital fluency and its antecedents is relevant to organizational behavior studies, clinical psychology, and psychiatry. This is especially relevant as digital treatments have been proposed as a solution for curative mental health (Teepe et al., 2021). However, offering digital treatment to an employee facing replacement fear or technostress may aggravate symptoms additionally. I also advise further exploration of digital fluency because this dissertation has limitations and areas of improvement, which will be addressed in the following Chapter 5.2.

5.2 Overall Limitations and Avenues for Future Research

Detailed limitations can be found in each study's respective sections (see Chapter 2.5.3, Chapter 3.5.3, and Chapter 4.5.3). While Chapter 5.1.1 describes the advantages of consistent sampling in all three studies (e.g., comparability; Van de Vijver and Tanzer, 2004), the collected sample composition also has disadvantages. First, a general limitation regarding the sample is its limited ability to generalize to other contexts and industries. All three studies surveyed employees in Germany's metal and electrical industry, representing a unique industry. Due to this unique sample, we may need to consider that the sample is relatively homogeneous regarding its demographic characteristics, such as age in years, subjective age, working hours, sex, leadership position, and education qualification (see Table 10). Characteristically for German companies, all three samples have a high proportion of Germans (Study 1 = 90.3% Germans, Study 2 = 96.1% Germans, and Study 3 = 94.4% Germans), indicating a homogeneous national culture, which may affect the generalizability of the findings to other organizations and cultural contexts. Accordingly, I must acknowledge that the results could differ for samples from other countries, cultures, industries, or companies.

To solidify the generalizability of the findings, studies should be exerted and replicated in different contexts with different cultures. The external validity may be increased using data from other organizations implemented in diverse national settings. So far, existing research on digital fluency has been conducted in a sample of employees in the United Kingdom (Kornelakis and Petrakaki, 2020), Chinese employees (Wei et al., 2020), and medium-sized Canadian enterprises (Bourdeau and Vieru, 2020). Given these different studies, my dissertation contributes to a more comprehensive picture of the construct of digital fluency by adding three German-dominated employee samples.

Second, another limitation of this dissertation is the different influences of deep- and surface-level attributes. Deep- and surface-level attributes have received extensive research attention, and results are strongly fissured (see Bell, 2007; Harrison et al., 1998; Liao et al., 2008). Guillaume and colleagues (2012) stated that deep-level and surface-level attributes are highly influential and, thus, should be controlled in studies concerning individuals. When exploring individual preferences (see Study 1) and social interactions (see Studies 2 and 3), deep-level attributes must at least be considered. Even though in Study 1 and Study 2, I focused on personality as a deep-level diversity attribute, related studies suggest that several other deep-level attributes, such as values and abilities (Bell, 2007; Harrison et al., 2002; Liao et al., 2008), could have neglected influences (Barsade et al., 2000). In contrast to deep-level attributes, surface-level attributes such as gender and age are particularly salient (Harrison et al., 2002), influence social interactions and reactions, and could have undetected effects in all three studies.

To reveal the most valid results, I differentiated between deep-level and surface-level attributes and used standardized, replicable questionnaires with well-established items. Implementing standardized questionnaires is one valid method to investigate the latent constructs used in the studies. For example, for personality as a deep-level attribute, I used the GSOEP Big Five Inventory by Hahn, Gottschling, and Spinath (2012) and the NEO-FFI-30 by Körner and colleagues (2008) based on work by Allport and Odbert (1936). By using established questionnaires, I built on strong evidenced average internal consistency indicated by satisfactory Cronbach's α and guaranteed the quality criterion of evaluation objectivity, the objectivity of the execution, and the objectivity of interpretation.

I included all relevant items from every scale used to strengthen my method. Especially when investigating deep-level attributes or socially desirable behavior, inverted items are a well-established way to achieve face validity. I did not modify the items in any of the three studies (except for [Our organization] to [My company] for the technostress scale by Ragu-Nathan and colleagues, 2008). This implies a better replication for other researchers, including a better comparison of my results, and reduces the probability that constructs other than the desired constructs are queried. To ensure that the test quality criteria of the different scales are met, I strongly advise against modifying existing psychological tests (for a differentiated discussion, see Eid and Schmidt's (2014) standard work), as measurements are often described as having been *"adapted."* This also includes a minimal change in the wording or the omission of items. I would also like to point out that modified items are not reported in many publications, especially in the organizational sciences literature. In screening 264 articles, Heggestadt and colleagues (2019) found that 215 articles (81.4%) included at least one adapted scale. In 11.5% of all screened articles, scholars indicated they had adopted a scale but did not provide enough information to determine the exact change. Thus, I refer to well-established questionnaires to account for the valid measurement of deep-level and surface-level attributes. I have documented all used scales in Appendices B – D[10].

Third, the three studies are designed to identify and test causal relationships. For

[10] See also Tables' 16 note section for the history of item development by the authors Kunze and Zimmermann (2020).

instance, in Study 2, I assumed that the leaders' personality and behavior have an effect on employees' digital fluency. To account for the assumed effect, an exogenous manipulation of the independent variable X would be ideal (Morgan and Winship, 2007), but this axiom is not realistic in field studies. Thus, endogeneity is a common estimation problem that renders parameter estimates uninterpretable and could arise from unmeasured omitted variables that could be related to the error term of both the independent and dependent variables (Antonakis et al., 2010). Antonakis and colleagues' (2010) review of 110 published papers in peer-reviewed journals uncovered that up to 66% to 90% of scholars failed to account for and control the endogeneity problem. The fact that the endogeneity problem is common has to do with the fact that, in most cases, the variables M and Y are collected using the same method (Shaver, 2005). This also applies to the three studies of this dissertation. I collected my data with the help of online questionnaires in which white-collar workers were interviewed.

To address the endogeneity problem, I draw on existing theories and applied statistical methods. For example, in Study 2 and Study 3, I examine endogeneity by following the procedure suggested by Shaver (2005) to inspect the general robustness of my results. In Study 2, I specified three additional models. The first alternative model allowed an error correlation between empowering leadership and the employees' digital fluency. I used leader-member exchange as instrument, as it shows a high correlation with empowering leadership. The analysis results suggested robust findings, even when controlling for a potential endogeneity problem (for more details, see Chapter 3.4.4). I followed the same procedure by Shaver (2005) for Study 3 and can, therefore, partially exclude the influence of the endogeneity bias. In conclusion, the probability that the results of the second and third studies are affected by endogeneity bias is at least minimized using Shaver's (2005) procedure.

Besides these limitations, the findings of this dissertation offer prosperous avenues for future research. One promising avenue for future research is to extend the digital fluency measurement scale by Kunze and Zimmermann (2019) with other measurement methods. In their work, Kunze and Zimmermann (2019) developed digital fluency as a second-order construct of the two first-order constructs – digital knowledge and digital self-efficacy. Based on work by Briggs and colleagues (2012) and Niessen (2019), Kunze and Zimmermann (2019) designed the six-item scale with promising factor loadings ($\lambda =$ .73 – .97, with one item $\lambda = .59$, which was modified in a follow-up study; see Tables' 16 note section). In this dissertation, all factor loadings for the digital fluency scale were statistically sufficient[11]. To make as accurate a statement as possible about a person's actual digital fluency score, it is advisable from the test theory perspective to conduct an interindividual profile analysis (for statistical derivation: Eid and Schmidt (2014), p. 384). Thus, based on two subtests, it is controlled whether individuals' true trait expressions differ on all subtests or not (Eid and Schmidt, 2014). For this analysis, different corresponding statistical measurements could add significant value.

Regarding a person's actual digital fluency score, future studies could integrate other scales or practical measurements to investigate the individual's actual digital fluency score. For instance, additional data sources could be included to avoid potential common method variance and limited observed variability and generalizability. Such data sources should go beyond self-report data sources and be complemented by, for example, partner-observed data sources. Examples of such data sources could be colleagues' ratings, the leaders' ratings, or the company's annual work report and results from digital technology workshops. Whereas with a questionnaire, the typical behavior and experience (individuals' experience of digital fluency) are recorded (Eid and Schmidt, 2014), the external rating in the form of 360-degree feedback could add reliability.

I recommend using the scale by Zimmermann and Kunze (2019) and adding a measurement instrument that measures real digital fluency skills in specific (work)situations. I encourage future research to advance our understanding of digital fluency, for instance, by developing additional tests of digital fluency in work and personal contexts. The PIAAC (Program for the International Assessment of Adults Competencies; Li et al., (2022)) is one test that can be used as a template to develop a new measure of digital fluency. For new measures of digital fluency and further studies, it is advisable to use multiple data

[11] According to Koop and Lois (2014), a satisfactory factor loading is $\lambda > .5$.

sources and test results to capture the individuals' real digital fluency.

Besides implementing several data sources, future studies should consider additional influential factors outside the organization, such as *Zeitgeist*, political contexts, and work trends. The COVID-19 pandemic is a recent example of how external influence can strongly impact the organization. The influence of COVID-19 pandemic has spurred digitalization in many areas of professional life, leading to online meetings and remote work remaining an accepted and regularly used form of work. Even though digitalized work settings continue to be widely used, Kunze and colleagues (2020) found in a longitudinal study during the COVID-19 pandemic that more than 45% of employees would like more support for the political manifestation of home office rules. The call for a political manifestation could impact how digital fluency is perceived, political changes are being made, and what excess and support are being given to employees in digitalized settings. For instance, Hampel and Kunze (2023) showed that age stereotypes amplify the negative relationship between employees' age and digital fluency. Education about age stereotypes and their possible negative effects could also be implemented as one support given to employees.

Another avenue for future research on digital fluency could be investigating group interaction in online meetings. The new possibilities for online meetings nudged by the COVID-19 pandemic will continue to be a heavily used medium even after the pandemic has subsided. As stated by Murmu and Neelam (2022), *"it has become increasingly necessary to research and comprehend the dynamic interaction that contributes to the development of virtual teams in the modern workplace, as their use has expanded in the workplace"* (p. 46). Online meetings as a form of communication will continue to flourish. And as concluded by Oeppen and colleagues (2020), "*it is difficult to predict the future application of this resource* [online meeting]" (p. 645). While group interaction is a highly complex phenomenon, further investigation should focus on faultlines within online work groups regarding digital fluency. One example of such a digital collaboration in the workplace could be electronic brainstorming (Maaravi and colleagues, 2021), which would be worth investigating.

Lastly, another promising extension of digital competence research focusing on digital fluency would be to consider the role of the leader in online meetings. The combination of digital fluency, the online meeting situation, and the leader's role have not been the subject of research to date. In Study 2, I could unveil a significant effect of the leaders' behavior (r = .23, ρ < .01) and the leaders' personality (conscientiousness: r = .36, ρ < .01; neuroticism: r = -.25, ρ < .05). In Study 3, I could show a significant effect of the high level of leader-member exchange climate on the effect of age-technostress faultlines and collective digital fluency (β = .21, ρ = .03, Figure 7).

Based on these findings, it is surprising that there are just a few attempts to address the role of the leader in digitalized settings. Arham and colleagues (2022) stated that *"compared to conventional leadership, the need for digital leadership appears, as today's organization tends to transform into digital workplaces"* (p. 2756). The authors call for a *"leader who can guide them* [employees] *in understanding the significance of digitalization in the twenty-first century"* (p. 2756). While there is a long history of investigation of different leadership styles, for example, transactional leadership (Bass, 1990) and transformational leadership (Howell and Avolio, 1993), little is known about leadership styles in the context of digitalization. Recent investigations pointed to digital leadership as a relevant approach. Digital leadership is described as the combination of transformational leadership and the use of digital technology (De Waal et al., 2016; Erhan et al., 2022). Erhan and colleagues (2022) defined digital leadership as the leaders' innovation ability, cooperation, strong network abilities, and participation in the work context. However, there is still a lack of research on how digital leadership could be shaped and its impact on work outcomes (e.g., Mihardjo and Rukmana, 2019). By the time of writing this dissertation, no research had been conducted on the relationship between the leader and employees' acquisition of (collective) digital fluency. Therefore, I recommend that future studies focus on the role and impact of digital leadership on individuals and work groups. Besides investigating empowering leadership, leader-member exchange (climate), and trust in leader, it is worth investigating whether empowering leadership or digital leadership is more effective leadership behavior in digitalized work settings.

In conclusion, the overall limitation and avenues for future research indicate that there are still knowledge gaps and room for improvement that wait to be filled by future studies. Accordingly, upcoming studies are expected to address the new challenges evoked by digitalization.

5.3 Practical Implications

Besides theoretical implications, this dissertation offers several practical recommendations for practitioners, including human resource management and top management staffing. Because the future will be characterized by a rapidly developing digital trend (Liu et al., 2021; Toossi, 2012), organizations face a fast-changing environment with the pressure to stay competitive. The findings of this dissertation suggest that different external influences could affect the employees' acquisition of digital fluency at the workplace. In the following sections, I provide hands-on guidance on how organizations can support employees in acquiring digital fluency at the individual-, dyadic-, and team-level. Practical organizational changes and recommended practices are displayed in the following Figure 9.

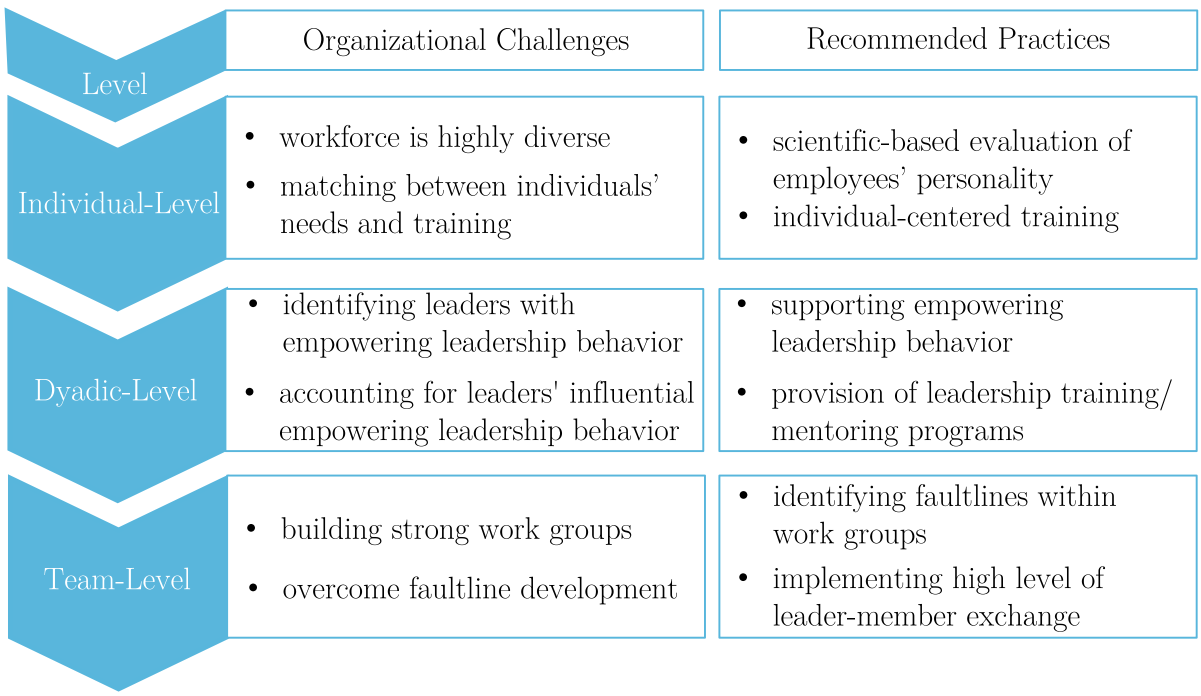

Figure 9. Practical Implications of Dissertation.

5.3.1 Personality and Digital Fluency

The first study's findings highlight the possible positive effect of the employees' personality on the individuals' willingness of training participation. The effect of the individual's personality on the willingness of training participation should be focused on in more detail and could result in restructuring systematic recruiting and onboarding processes. In the initial period of onboarding processes, a scientific-based assessment of the new employee to orient and train them can be realized through validated (online) personality tests. Based on the clustering into different personality facets, a deeper understanding of the new employee and their needs can be developed. In addition to the classification into the different personality facets, a value-neutral categorization should also take place, and it should be clarified which preferences and behaviors are associated with differently pronounced personality facets.

Since employers aim to keep employees within the organization and lower the costly turnover intention, creating an initial foundation for the long-term socialization of employees is also of high interest. This is also in line with Wanberg and Kammeyer-Mueller (2000), who illustrated the relevance and effect of personality in the socialization process within an organization. The individuals' socialization with the organization can be described along Van Maanen and Schein's (1977) socialization tactics, which are: (a) collective vs. *individual socialization*, (b) formal vs. informal, (c) sequential vs. random steps, (d) fixed vs. variable, (e) serial vs. disjunctive, and (f) investiture vs. divestiture socialization processes (p. 37). Based on the results of my first study, I recommend for its practical implementation individual socialization, focusing on the individuals' personality to influence their willingness to participate in training.

In practice, large companies mostly use trainee academies, structured onboarding, systematic further education settings, and training. Those different forms of organizational training are designed along the one-fits-all approach, which brings better performance comparability and handling, easier feasibility, and lower costs for the organization. However, regarding the effectiveness of the training, striving for more vital individualization and the results from my first study indicate not to follow the one-training-fits-all approach.

Individualized training is supposed to achieve a higher willingness to participate, where employees might feel greater support and, subsequently, might be more intrinsically motivated (Guillaume et al., 2014). As a practical implication on the individual-level, the individual's personality scaled into its five dimensions: neuroticism, extraversion, conscientiousness, agreeableness, and openness (Goldberg, 1990), based on Allport and Odberts' (1936) work, should be considered when designing practical organizational training and organizational processes.

5.3.2 Leadership and Digital Fluency

While the individuals' personality has been proven vital, the leaders also play a central role in daily working life. Leaders have decision-making responsibilities and a relevant influence on the follower's skills and performance orientation. The follower's skills include the acquisition of digital fluency; therefore, practical implications for guiding and supporting employees in acquiring digital fluency need to be discussed.

First, as concluded in the second study (Chapter 3), leaders' behavior in the form of empowering leadership significantly affected employees' digital fluency. This effect is even stronger than the effect of leaders' personality dimensions: conscientiousness and neuroticism. Especially because leadership behavior appears particularly effective, practical implications for its training and appropriate application should be laid out. A leadership behavior that has been shown to be effective is empowering leadership. Empowering leadership can be assessed during yearly feedback loops and promotion processes to recruit individuals with empowering behavior and support individuals to form empowering behavior. Easily implementable management tools are the annual personnel questionnaire, 360-degree feedback, and mentoring programs provided exclusively for leaders (e.g., Day, 2000). Such education programs and leadership centers (e.g., Chuang et al., 2016; DeRue et al., 2009) should encourage leaders to define themselves as valuable leaders and provide guidance and best practice examples applicable in the working context.

Empowering leadership is the composition of behavior facets that support the employee, including behavior that enhances the meaningfulness of the employee's work

(Ahearne et al., 2005). Constant interaction and reassurance between the leader and the employee can result in a good exchange about the meaningfulness of work tasks and the work as a whole. Other facets of empowering behavior include fostering the employees' participation in work tasks, expressing confidence in employees' performance, and helping to shield employees from unnecessary distracting tasks such as bureaucracy (Ahearne et al., 2005). To develop and practice empowering leadership, employers should support leaders to ensure they correctly train and show empowering leadership.

5.3.3 Faultlines and Digital Fluency

Work groups are a basic form of collaborative work. International organizations, work groups distributed worldwide, and home office work triggered by the COVID-19 pandemic result in different work group situations. Besides these external factors, internal factors within a work group also contribute to diverse work group setups. As work groups are a widespread form of collaboration with different forms of diversity, different outcomes can be expected.

Regarding the third study's results (Chapter 4), human resource managers must thoroughly investigate and account for the diversity within work groups. Organizational representatives should be aware that employees tend to identify less with the work group with strong faultline levels. Organizations should implement diversity-management practices to address strong faultlines with interventions focusing on valuable individual differences (Li et al., 2019) and trust (Newstrom and Scannell, 1980) to develop a mutual liking. Personal liking could be promoted via personal bonds. Organizations could host social gatherings and team-building experiences to identify and develop a positive view of differences within a work group (Cronin et al., 2007). Also, organizations should ensure training programs focusing on work group identification to weaken the faultline effect (Qi et al., 2022). Besides this well-known effect of faultline formation within work groups, in the third study, the moderating effect of leader-member exchange showed a significant effect on the effect of age-technostress faultlines on collective digital fluency. The significant effect of a high level of leader-member exchange results in the following practical implications for individuals who seek to adopt a high level of leader-member exchange.

Leader-member exchange is characterized by the quality of the relationship between leader and follower (Martin et al., 2016). To advance the quality of the relationship, social support, and job opportunities are essential (Graen and Uhl-Bien, 1995). Both can be coached in training and follow-up monitoring. In training-on-the-job, leaders could practice acting reasonably and showing leading behavior in different job situations (Henderson et al., 2017). Also, part of the training could be information and best practice examples of how to apply non-tangible rewards, including respect, trust, and obligation. Like every social behavior, the leader-member exchange can be trained in Assessment Centers and workshops. A prerequisite, however, is mutual trust and an atmosphere where functional behavior can be practiced. A framework for this atmosphere can be set by the company's culture, supporting coaching, interaction, and employee development.

By addressing organizational challenges, this dissertation can provide relevant and timely implications for practitioners to shape the future of work. The recommended practices (see Figure 9) are (a) scientific-based evaluation of employees' personality, (b) individual-centered training, (c) supporting empowering leadership behavior, (d) providing leadership training and mentoring programs, (e) identifying faultlines within work groups, and (f) implementing a high level of leader-member exchange (climate) within diverse work groups.

5.4 Concluding Remarks

Not surprisingly, digital competencies research on digital fluency has begun to thrive, given that digital technologies are more central to today's workforce than ever. Employees' work is confronted with new demands and is profoundly changing. The steady increase in digitalization is also mirrored by the fact that in 2025, 75 billion connected digital devices worldwide will be available to individuals (Clement, 2020). Understanding the antecedents of digital fluency to help employees acquire digital fluency is even more crucial. My dissertation adds value to the research discussion on influential factors in acquiring digital fluency. I hope my findings lead to a lively discussion and a growing interest within the research community regarding the opportunities and challenges of digitalization. Also, a discussion accessible to a wide range of society might lead to a more practical integration in work settings. This could lead to greater awareness, not only of digital fluency but, and this is the focus of this dissertation, of different important antecedents of digital fluency impeded in the workplace.

6 DECLARATION OF AUTHORSHIP

I, Edda Margareta Glase, declare that this dissertation entitled, "*Digital Fluency - Inspecting the Role of Supporting Factors in the Organizational Context: A Multi-Level Approach,*" and the work presented are my own, with the exception given below. I have mentioned all used sources and correctly cited them by quoting the work of others. The Google Ngram Pre-Study is co-authored work with M.Sc. Gisbert Wilhelm Teepe and Prof. Dr. Ulf-Dietrich Reips. The detailed author's contributions to the studies are listed below[12].

Pre-Study - Increasing Digitalization is associated with Anxiety and Depression: A Google Ngram Analysis

Conceptualization: Gisbert Wilhelm Teepe, Edda Margareta Glase

Formal Analysis: Edda Margareta Glase

Methodology: Gisbert Wilhelm Teepe, Edda Margareta Glase

Project Administration: Gisbert Wilhelm Teepe, Edda Margareta Glase

Data Collection: Edda Margareta Glase

Writing - Original Draft: Gisbert Wilhelm Teepe, Edda Margareta Glase

Writing - Review & Editing: Gisbert Wilhelm Teepe, Edda Margareta Glase, and Prof. Dr. Ulf-Dietrich Reips

Study 1 - Is It All About Matching? Personality and Its Implications for Willingness of Training Participation: An Empirical Vignette Study

Conceptualization: Edda Margareta Glase

Formal Analysis: Edda Margareta Glase

Methodology: Edda Margareta Glase

Project Administration: Edda Margareta Glase

Data Collection: Edda Margareta Glase

[12] The Pre-Study is published work. Study 1 - Study 3 are in the process of editing or publication.

Writing - Original Draft: Edda Margareta Glase

Writing - Review & Editing: Edda Margareta Glase, Prof. Dr. Florian Kunze

I would like to thank Prof. Dr. Florian Kunze and Prof. Dr. Sabine Hochholdinger for their insightful and very helpful comments.

Study 2 - The Role of Empowering Leadership and the Leaders' Personality and Its Influence on the Acquisition of Digital Fluency Among White-Collar Workers

Conceptualization: Edda Margareta Glase

Formal Analysis: Edda Margareta Glase

Methodology: Edda Margareta Glase

Project Administration: Edda Margareta Glase

Data Collection: Edda Margareta Glase

Writing - Original Draft: Edda Margareta Glase

Writing - Review & Editing: Edda Margareta Glase, Prof. Dr. Florian Kunze

I would like to thank Prof. Dr. Florian Kunze again for his very helpful comments and the exchange regarding the theory section of Study 2.

Study 3 - The Role of Age-Technostress Faultlines within White-Collar Worker Groups and the Leader-Member Exchange Climate's Influence on the Acquisition of Collective Digital Fluency

Conceptualization: Edda Margareta Glase

Formal Analysis: Edda Margareta Glase

Methodology: Edda Margareta Glase

Project Administration: Edda Margareta Glase

Data Collection: Edda Margareta Glase

Writing - Original Draft: Edda Margareta Glase

Writing - Review & Editing: Edda Margareta Glase, Prof. Dr. Florian Kunze

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8 APPENDICES

APPENDIX A

Table 11

Pre-Study Google Ngram: Intercorrelations of Main Variables and Controls.

		1	*2*	*3*	*4*
	1 Anxiety				
	2 Depression	.98***			
	3 Digitalization	.81***	.81***		
	4 Years	.87***	.79***	.89***	
Control					
	5 Religion	-.18	-.25*	-.01	.22

Note. * $p < .1$; ** $p < .05$; *** $p < .01$. Correlation matrix over all languages for mean frequency of word groups (z-transformed) from 1970 until 2019.

APPENDIX B

Table 12
Anchor Vignettes.

	Title	Dim.	Description
1	Close/ lose contact	0	I would like to stay in close contact with the trainer.
		1	I would like to contact the trainer for only a few questions.
2	Individual/ group	0	I would like to exchange ideas in a group and share expertise with others.
		1	I would like to deal with the topic alone and at my own pace.
3	Digital/ analog	0	I would like to participate in a seminar room.
		1	I would like to participate online in front of a PC.

Note. Anchor vignettes were developed by the author of the dissertation as part of the first study.

Table 13
Training Vignettes.

	Vignette	Description
1	CET: High independence from subordinates	In this training setting, I would be able to deal with the topic alone and at my own pace. The training would take place online.
2	CET: High interaction with subordinates	In this training setting, I would be able to exchange ideas in a group and share expertise with others. The training would take place online.

Note. Training vignettes were developed by the author of the dissertation as part of the first study.

Table 14
Items of the Latent Construct Personality by Hahn and Colleagues (2012).

	I see myself as someone who ...
Extraversion	
1.1	is communicative, talkative.
1.2	is outgoing, sociable.
1.3	is reserved.*
Neuroticism	
2.1	worries a lot.
2.2	gets nervous easily.
2.3	is relaxed, handles stress well.*

Note. The asterisk indicates inverted items. Short measurements of personality - validity, and reliability of the GSOEP Big Five inventory by Hahn and colleagues (2012).

Table 15

Items of the Big Five Aspects Scale by DeYoung and Colleagues (2007).

Factor	Description	Aspect	Characteristics of Aspects
Neuroticism	Broad tendencies towards negative emotionality.	Volatility	Active response to threats, outward expression of negative affect, emotional lability, irritability, anger, impulsiveness.
		Withdrawal	Passive avoidance, negative affect directed inwards, anxiety, depression, vulnerability.
Extraversion	Tendencies towards positive emotionality and engagement.	Enthusiasm	Friendliness or sociability, and positive emotions associated with anticipation or enjoyment or reward.
		Assertiveness	Agency, social dominance, leadership, drive, motivation to attain rewards.
Openness	Open-mindedness towards experiences.	Openness	Appreciates beauty, creativity, daydreams, artistry, aesthetic sense, and reflection.
		Intellect	Intellectual engagement and abilities, erudition, ingenuity, quickness.
Agreeableness	Variations in cooperation and concern for social harmony.	Compassion	Relatively automatic empathy and concern for the emotions of others, emotional affiliation, and care.
		Politeness	Cognitive respect for needs and desires of others and a tendency to refrain from aggression. Fairness, morality, and conformity to societal norms.
Conscientiousness	Variations in inhibitory control and role following.	Orderliness	Inhibitive and methodical traits, neatness, perfectionism, attention to rules.
		Industriousness	Proactive, achievement-orientated, self-discipline, purposefulness, deliberation.

Note. BFAS = Big Five aspects scale by DeYoung and colleagues (2007).

Table 16

Items of the Latent Construct Digital Fluency by Kunze and Zimmermann (2020).

Digital Knowledge	
1.1	I know how to use digital technologies without too much effort.
1.2	I know what to do when using digital technologies without too much effort.
1.3	I know when it makes sense to work with digital technologies without too much effort.
Digital Self-Efficacy	
2.1	I feel confident that I can use digital technologies to improve my job performance.
2.2	I feel confident that I can reliably achieve the desired work results with the help of digital technologies.
2.3	I feel confident that I can efficiently analyze digital information (e.g., on websites, blogs, social media)*.

Note. Digital Fluency scale by Kunze and Zimmermann (2020). *In the first version of the scale, the original wording of item 2.3 was *"I feel confident that I can efficiently and critically analyze digital information (e.g., on websites, blogs, social media) for my work."* ($\lambda = .59$) and was further developed by the authors into item 2.3 in a follow-up study.

Table 17

Items of the Latent Construct Willingness of Training Participation by Van Vianen (2011) and Van Dam (2003).

On request of my company, I am willing to ...	
1	take a course or training that is outside of my field of expertise.
2	do additional courses and training.
3	follow courses or training to broaden my professional knowledge.
4	take training to improve my general skills.
5	learn something new.

Note. Van Vianen 2011 and Van Dam (2003). Training and development willingness, JOB.

Table 18

Means, Standard Deviations, and Intercorrelations of Vignettes and Anchor Vignettes.

	M	*SD*	*1*	*2*	*3*	*4*
1 *CET: High Independence from Subordinates*	3.90	.95				
2 *CET: High Interaction with Subordinates*	3.68	.88	.02			
3 *Anchor Vignette I*	1.52	.50	-.27**	.05		
4 *Anchor Vignette II*	1.51	.50	.41**	.15**	-.37**	
5 *Anchor Vignette III*	1.25	.43	.33**	-.25**	-.28**	.41**

Note. $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$. Anchor vignette I = much contact (0) vs. little contact (1), anchor vignette II = alone (0) vs. in a group (1), anchor vignette III = digital (0) vs. analog (1).

APPENDIX C

Table 19

Items of the Latent Construct Empowering Leadership by Ahearne and Colleagues (2005).

Enhancing the Meaningfulness of Work	
1.1	My manager helps me understand the importance of my work to the overall effectiveness of the company.
1.2	My manager helps me understand how my job fits into “the bigger picture.”
1.3	My manager helps me understand how my objectives and goals relate to that of the company.
Fostering Participation	
2.1	My manager often consults me on strategic decisions.
2.2	My manager makes many decisions together with me.
Expressing Confidence	
3.1	My manager believes that I can handle demanding tasks.
3.2	My manager believes in my ability to improve even when I make mistakes.
Providing Autonomy from Bureaucratic Constraints	
4.1	My manager makes it more efficient for me to do my job by keeping the rules and regulations simple.
4.2	My manager allows me to do my job my way.
4.3	My manager allows me to make important decisions quickly to satisfy customer needs.

Note. Empowering leadership scale by Ahearne and colleagues (2005).

Table 20

Items of the Latent Construct Personality by Körner and Colleagues (2008).

I see myself as someone who ...	
Conscientiousness	
1.1	tends to be organized.
1.2	is persistent, works until the task is finished.
1.3	is reliable, can always be counted on.
1.4	keeps things neat and tidy.
1.5	can be somewhat careless.*
1.6	has difficulty getting started on tasks.*
Neuroticism	
2.1	worries a lot.
2.2	tends to feel depressed, blue.
2.3	is emotionally stable, not easily upset.*
2.4	is relaxed, handles stress well.*
2.5	feels secure, comfortable with self.*
2.6	is temperamental, gets emotional easily.

Note. The asterisk indicates inverted items. Personality scale (NEO-FFI-30) by Körner and colleagues (2008).

Table 21

Items of the Latent Construct Leader-Member Exchange by Graen and Uhl-Bien (1995).

1	Do you usually know how satisfied your leader is with what you do?
2	How well does your leader understand your job problems and needs?
3	How well does your leader recognize your potential?
4	What are the chances that your leader would use his/her power to help you solve problems in your work?
5	What are the chances that he or she would "bail you out" at his or her expense?
6	I have enough confidence in my leader that I would defend and justify his or her decision.
7	How would you characterize your working relationship with your leader?

Note. LMX-7 scale by Graen and Uhl-Bien (1995). Response format: item 1 = rarely, occasionally, sometimes, fairly often, very often; item 2 = not a bit, a little, a fair amount, quite a bit, a great deal; item 3 = not at all, a little, moderately, mostly, fully; item 4 and 5 = none, small, moderate, high, very high; item 6 = strongly disagree, disagree, neutral, agree, strongly agree; item 7 = extremely ineffective, worse than average, average, better than average, extremely effective.

Table 22

Results of Relative Weights Analysis Comparing Empowering Leadership, Leader-Member Exchange, and Trust in Leader.

Outcome Variable	Empowering Leadership	Leader-Member Exchange	Trust in Leader
Employees' Digital Fluency	55.93%	15.22%	28.85%

Note. Values indicate relative weights as a percent of R^2.

APPENDIX D

Table 23

Items of the Latent Construct Technostress by Ragu-Nathan and Colleagues (2008).

Technoinsecurity	
1.1	I feel a constant threat to my job security due to new technologies.
1.2	I have to constantly update my skills to avoid being replaced.
1.3	I am threatened by coworkers with newer technology skills.
1.4	I feel there is less sharing of knowledge among coworkers for fear of being replaced.
1.5	I do not share my knowledge with my coworkers for fear of being replaced.*
Technostress Inhibitor	
2.1	[My company] emphasizes teamwork in dealing with new technology-related problems.
2.2	[My company] provides end-users training before the introduction of new technologies.
2.3	[My company] fosters a good relationship between IT department and end users.
2.4	[My company] provides clear documentation to end users on using digital technologies.
2.5	[My company] encourages knowledge sharing to help deal with new technology.*

Note. Technostress scale with the subdimensions techno-insecurity and technostress inhibitor by Ragu-Nathan, Tarafdar, and Ragu-Nathan (2008). The asterisk indicates inverted items. Original scale wording [Our organization].

Table 24

Hypothetical Example to Illustrate the Age-Technostress Faultlines.

		Employee				
Work Group	*Attributes*	*A*	*B*	*C*	*D*	*Faultline Strength*
1	Age (in years)	50	51	20	25	Strong
	Technostress (high/ low)	High	High	Low	Low	
2	Age (in years)	50	20	25	51	Weak
	Technostress (high/ low)	High	High	Low	Low	

Note. The two hypothetical work groups have the same level of diversity in terms of technostress. However, work group 1 has a much stronger faultline than work group 2, as age and technostress are aligned.

Table 25

Average Silhouette Width (ASW)-Values for Age-Technostress Faultlines.

Work Group		Work Group		Work Group	
Group 1	.00496	Group 41	.16914	Group 81	.00496
Group 2	.40110	Group 42	.18317	Group 82	.00397
Group 3	.36099	Group 43	.5	Group 83	.40094
Group 4	.40297	Group 44	.22332	Group 84	.15207
Group 5	.75	Group 45	0	Group 85	.00330
Group 6	.00397	Group 46	.00397	Group 86	.00496
Group 7	.00434	Group 47	.00496	Group 87	.00496
Group 8	.5	Group 48	.00397	Group 88	.20193
Group 9	.31276	Group 49	.00496	Group 89	.18199
Group 10	.22686	Group 50	.15613	Group 90	.5
Group 11	.28784	Group 51	.56142	Group 91	.20148
Group 12	.00496	Group 52	0	Group 92	.00330
Group 13	.32890	Group 53	0	Group 93	.00496
Group 14	.00397	Group 54	.00496	Group 94	.00330
Group 15	.00372	Group 55	.42305	Group 95	.00372
Group 16	.00496	Group 56	.25891	Group 96	.60198
Group 17	.36498	Group 57	.00496	Group 97	.63333
Group 18	.36589	Group 58	.00496	Group 98	.00496
Group 19	.00372	Group 59	.00496	Group 99	.20193
Group 20	.34613	Group 60	.00496	Group 100	0
Group 21	.00425	Group 61	.00372	Group 101	.00330
Group 22	.00330	Group 62	.47213	Group 102	.00496
Group 23	.28713	Group 63	.00372	Group 103	.30165
Group 24	0	Group 64	.33498	Group 104	.16749
Group 25	.00496	Group 65	.58518	Group 105	.00496
Group 26	.00330	Group 66	.00496	Group 106	.00496
Group 27	.00330	Group 67	0	Group 107	.31728
Group 28	0	Group 68	.45093	Group 108	.15613
Group 29	.30124	Group 69	.21767	Group 109	.00496
Group 30	0	Group 70	.00330	Group 110	.7
Group 31	.00496	Group 71	.30165	Group 111	.00372
Group 32	.00397	Group 72	.00496	Group 112	.36099
Group 33	0	Group 73	.16873	Group 113	.4
Group 34	.00372	Group 74	.40198	Group 114	.30124
Group 35	.38049	Group 75	.5	Group 115	.00372
Group 36	.30124	Group 76	.00496	Group 116	.5
Group 37	.00413	Group 77	.00330	Group 117	.27249
Group 38	.00372	Group 78	.40198	Group 118	.00496
Group 39	.18497	Group 79	.00496	Group 119	.00413
Group 40	.00496	Group 80	.32885		

Note. Average Silhouette Width (ASW) method by Rousseeuw (1987). The values range from -1 (inconsistent subgroups), 0 (no homogeneous subgroups), and 1 (homogeneity) and represent how strong the faultlines are. The stronger the blue coloration, the stronger the faultline.