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Between Transition and Back to Normal: Empirical Insights into Post-Pandemic Digital Education at Primary Schools in Germany

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Abstract

The Covid-19 pandemic had a massive impact on school education around the world. Digital media thus became an integral part of school life, and the question arises as to how this development has affected digital education in primary schools and what the long-term effects of this change have been. Digital education encompasses the pedagogical use of digital media to foster digital competencies, as well as the use of technologies in teaching and learning processes. The paper discusses the impact of the Covid-19 pandemic on digital education in German primary schools and the current situation. It presents results from ten qualitative focus group interviews with 45 stakeholders in primary education, including school principals, teachers' association representatives, and school administrators. The interviews were analyzed using qualitative content analysis. Interviewees report only limited sustainable development of the technological infrastructure and the use of digital media in education driven by the pandemic. Overall, teachers were reported to be very willing to test and experiment with the pedagogical possibilities and potential of digital technologies, especially during the pandemic. They perceived structural conditions, such as technical infrastructure, bureaucratic processes and inconsistent data protection requirements, as significant barriers to the use of digital media. The findings thus highlight the importance of analyzing the interplay between teachers' personal factors and the structural conditions of digital education.

Keywords: Digital Education, Primary School, Post-Pandemic Studies, Media-Related School Development

Introduction

Digital technologies have become ubiquitous in our society, shaping the way we communicate and interact. As a result, they have a decisive influence on the social construction of reality (Hepp, 2020). Children are growing up with digital technologies in their everyday lives. As early as primary school, they are using digital media in many different contexts and situations (Smahel et al., 2020). Against this backdrop it is evident that children need to develop media-related skills in order to be able to orient themselves in today's and tomorrow's society. How schools can and should address this challenge is the subject of lively debate in both, academic circles and educational policy. In the European Commission's Digital Education Action Plan, for example, concrete strategies for promoting digital skills are described for different institutions and phases of life (European Commission [EU], 2020; Pedaste et al., 2023; Vourikari et al., 2022). These initiatives support the expansion of digital education across Europe, although the level of development currently varies from country to country (Fraillon, 2025). The term *digital education* refers to the pedagogical use of digital media and technologies in school contexts, including both the teaching of media-related competencies and the integration of digital technologies into everyday learning processes (Huang et al. 2025). This concept implies critical reflection and thus goes beyond the mere acquisition of technical skills. The realization of digital education depends crucially on how well digital media is integrated into schools and incorporated into everyday teaching.

The importance and use of digital media in the classroom were greatly affected by the Covid-19 pandemic between 2020 and 2022. During this period, schools were closed on a large scale, and in many cases, teaching was carried out remotely with an intensive reliance on digital media (Al Mazrooei et al., 2022; Bond, 2021; Yi, 2022). This mode of school-based instruction and acquisition of knowledge is referred to as distance schooling. Contrary to the notions of e-learning or homeschooling, distance schooling during this period was not distinguished by regular and meticulously planned pedagogical frameworks. Instead, it was characterized by a swift response to an unanticipated development. As in all school types, digital media became a necessary part of education in primary schools (Alsubaie, 2022). Inevitably, changes were made to established forms of media use in teaching and learning during the pandemic. Education policy also influenced this, providing financial and legal support for the further development of media-based learning environments. Against this background, it is reasonable to assume that longer-term structural changes in the use of digital media for learning in schools have taken place, impacting the conditions of digital education.

With regard to the German school system, which is the focal point of this article, these developments have been insufficiently researched to date. Especially when it comes to primary schools, the research base in this respect is limited, as a systematic literature review shows (Dertinger et al., 2023a). Against this backdrop, the paper presents the results of a study on the impact of the pandemic on digital media usage in German primary schools. It focuses on the influence of the pandemic on the post-pandemic integration of digital media in schools, as well as on its use by teachers. The guiding research questions are as follows:

- What changes do different actors perceive with regard to the conditions for integrating digital media in primary schools following the pandemic?
- What assumptions were made regarding the reasons behind these changes?

To investigate this, the study examines the views of stakeholders of teacher associations, school leaders and school administrators. Data were collected as part of the Project “DiBiGa - Future prospects for digital education at primary school age”, which ran from December 2021 to February 2024.[1]

The project comprised three phases. First, a systematic literature review was carried out (01-05/2022) (Dertinger et al., 2023a; Dertinger et al., 2023b). Secondly, focus group interviews were conducted with various stakeholders relevant for digital education at primary school age. Both the school context and the family context were analyzed (05/22-07/23). In a third step, the findings were refined and developed through a participatory research process (08-10/23).

In order to answer the research questions, the data obtained from the focus group interviews conducted during the second phase will be examined. The variety of stakeholders involved in the group discussions enables analysis of both school-specific structures at the meso level and cross-school structures at the macro level.

[1] The project was funded by the Federal Ministry of Education and Research, and was led by Prof. Dr Rudolf Kammerl and Dr Susanne Eggert (project number 16INS109A).

The following section outlines the current state of research on the integration of digital technologies and digital education in German primary schools, with a focus on the impact of the Covid-19 pandemic. We refer here to the results of the systematic literature review that we conducted. On this basis, the methodological implementation of the focus group interviews is described, the main findings are presented and discussed.

State of research: Digital education in German primary schools

The Covid-19 pandemic has temporarily brought about massive changes in the conditions of primary education. Two aspects of digital education are central in this context. Firstly, the use of digital technologies has become a basic requirement for everyday teaching in primary schools. Secondly, deficiencies in the prevailing technical infrastructure of primary schools have emerged as a salient concern within education policy discourse. During the pandemic, schools in Germany received additional funding from government agencies to improve their technical infrastructure (Fickermann & Edelstein, 2021). From this starting point, as a part of the DiBiGa-Project, a systematic review was conducted to explore how digital education for primary school children in Germany has been realized in the context of distance schooling (Dertinger et al., 2023a). Only the central findings will be outlined in summary here, in order to provide the appropriate framework for the focus group interviews.

The results indicate that the technical infrastructure in German schools underwent expansion during the pandemic (Robert Bosch Stiftung, 2020). However, at the end of the pandemic, teachers still tended to see a need for further improvement (Robert Bosch Stiftung, 2021). In addition, research suggests that teachers' willingness to use digital media in primary schools increased during the pandemic and that there was a growing awareness of the need for digital education for this age group (Robert Bosch Stiftung, 2021; R. Schneider et al., 2020). The studies analyzed show that during the pandemic, teachers used different technologies and programs to teach in primary schools, such as learning apps, educational videos and digital learning environments (Kirsch et al., 2021; R. Schneider et al., 2021). Nonetheless, such technologies were employed with less frequency in primary schools than in secondary schools. In general, innovative teaching approaches involving digital media were seldom used in primary schools during the pandemic (Eickelmann & Drossel, 2020; Porsch & Porsch, 2020). As a result, school assignments were typically distributed to primary school students via email, postal service or in person.

In summary, the conditions in terms of infrastructure, teachers' attitudes and their educational practice improved slightly during the pandemic. However, there were no profound changes in the pedagogical use of digital technologies in primary schools. Only limited data is available to explain why digital media has not been more extensively integrated into teaching in German primary schools since the pandemic. One reason therefore is that existing studies mainly focus on the secondary school sector. This is particularly evident in the fact that current large-scale, representative studies focusing on digital education have only been conducted in secondary schools (Fraillon, 2025; Lorenz et al., 2022; Schmid et al., 2017). Conclusions about digital education in primary schools can only be drawn from studies that focus on other areas, but consider issues related to the use of digital media in primary schools (e.g., McElvany et al., 2023) or that are smaller in scale (e.g., Knoth & Haider, 2023). This research suggests two potential and

interconnected rationales: (A) the educational practice of teachers (at the meso level) and (B) the existing technical infrastructure in German primary schools (at the macro level).

(A) In terms of educational practice, studies show heterogeneous attitudes towards media among (pre-service) primary school teachers in Germany (Bärnreuther et al., 2023; Knoth & Haider, 2023). Despite the widely spread positive attitudes towards media and openness to digital technologies, media-critical attitudes persist. There is also evidence that primary school teachers do not acquire the necessary competencies to use media in the classroom during their teacher training, but rather in informal contexts (Lorenz et al., 2023). Despite the partly positive attitudes towards media, teachers seem to make little use of digital media in primary education. For example, the results of the Progress in International Reading Literacy Study (PIRLS) 2021 show that only 16.7% of pupils in German primary schools use digital media to search for and read information for at least 30 minutes during the school day, which is significantly below the international average (Lorenz, Goldhammer, & Glondys, 2023). There is also evidence that primary school teachers in Germany use digital media primarily to support familiar and traditional forms of teaching and do not change the structure of teaching through the use of digital media (Hauck-Thum, 2021; Kulcke, 2023).

(B) Representative data on the provision of technical equipment in primary schools are available from international comparative studies on school performance. Since 2012, the results of the PIRLS and TIMSS (Trends in International Mathematics and Science Study) for German primary schools have consistently shown significantly lower values in an international comparison of pupils' access to digital devices on a one-to-one basis (Lorenz, Goldhammer, & Glondys, 2023; Mullis et al., 2017; Mullis et al., 2012; Mullis et al., 2020). The latest PIRLS data show that digital devices are occasionally available to pupils in most German primary schools, but that situational and individual use of digital media is rarely possible due to the overall low level of media equipment (Lorenz, Goldhammer, & Glondys, 2023). A representative German survey, conducted during the Covid-19 pandemic, also shows a relatively low availability of digital devices for students. Respondents in only 19% of German primary schools reported that every pupil had the opportunity to use a laptop or tablet owned by the school (Robert Bosch Stiftung, 2021). Other aspects of the technical infrastructure, such as an adequate internet connection in the school building, the possibility of video lessons or the equipment for teachers, were also rather low. Only one third to one half of primary schools reported that they were adequately equipped in these areas. Secondary schools in Germany scored higher on all these items (Robert Bosch Stiftung, 2021).

Overall, the available studies do not suggest a profound change in media usage in primary schools since the pandemic. Conditions at the meso and macro levels of the school system appear to be relevant factors in this respect. However, to clarify these developments and their determining factors more precisely, a more in-depth analysis of these relationships is needed. The results of the focus group interviews conducted as part of the DiBiGa-Project can provide such detailed insights into these conditions. In particular, by taking different stakeholder groups into account, these interviews make it possible to consider both the meso and macro levels, as well as possible connections between them.

Materials and Methods

As part of the DiBiGa-Project ten qualitative focus group interviews (Merton et al., 1956) were conducted with school principals, representatives of teachers' associations and school administrators between July 2022 and February 2023 (table 1). A total of 14 headteachers, 16 representatives of teachers' associations and 15 representatives of school administration (e. g. representatives of the public-school authorities, the institutions for teacher training, the Ministry of Education, etc.) took part. In consideration of the federal structure that characterizes the German education system the aim was to recruit stakeholders from as many federal states as possible. Thus, participants from 13 of the 16 federal states took part in the focus group interviews. The qualitative research logic enables minimum and maximum contrasts (not representativeness) to be presented. Between three and six people participated in each of the group interviews, which were conducted online and audio-recorded. The groups were homogeneous in terms of status (school principals, representatives of teachers' associations and school administrators) in order to encourage an exchange of potentially similar experiences and challenges. The interviews were conducted in German and the quotations in this article were translated by the authors.

The audio recordings were transcribed and analyzed using qualitative content analysis (Kuckartz, 2019) with MAXQDA 2022. A combination of deductive and inductive coding methods was used. By integrating theory-driven and data-driven strategies, an analytically grounded category system was created, systematically capturing the participants' perspectives in a comparable manner. Three heuristic categories were deductively developed to describe the conditions under which digital education took place (Bärnreuther et al., 2023; Lorenz et al., 2017): media-related school development, educational practice and individual and familial circumstances of the children. The code "media-related school development" included all statements about the existing conditions for digital education in the schools and how they have changed over time. This encompassed components of the technical infrastructure (e. g. internet connection, Wi-Fi, available digital devices), school concepts for organizing digital education as well as corporations with education policy stakeholders on the topic of digital education. The code "educational practice" included all statements about the organization of lessons and the interaction between teachers and pupils in the context of digital media. It also included teachers' media-related skills and attitudes. The code "individual and familial circumstances of the children" contained all statements about the individual preconditions of the pupils as a starting point for digital education.

Within these three main categories, subcategories were developed inductively. The main categories of media-related school development and educational practice each included a subcategory for pandemic-related opportunities and challenges, each of which described the experiences and opinions of the respondents on the pandemic-related changes in primary schools and their influence on digital education. To answer the research questions associated with this paper, the subcategories 'Pandemic-related opportunities and challenges' were used.

Table 1

Sample

Focus-Group	Stakeholder	Number of Persons	Federal States	Age Range	Date of Interview
SLGD01	Headteachers	Five	Bavaria, Rhineland-Palatinate	45-57	14 July 2022
SLGD02	Headteachers	Five	Bavaria, Berlin, Saxony	46-61	19 September 2022
SLGD03	Headteachers	Four	Bavaria, Baden-Wuerttemberg, Hamburg	49-67	02 February 2023
LKVGD01	Representatives of teachers' associations	Four	Bavaria, Brandenburg, Rhineland-Palatinate	37-61	11 November 2022
LKVGD02	Representatives of teachers' associations	Three	Rhineland-Palatinate, Schleswig-Holstein	30-56	17 November 2022
LKVGD03	Representatives of teachers' associations	Five	Bavaria, Baden-Wuerttemberg	36-63	13 February 2023
LKVGD04	Representatives of teachers' associations	Four	Bavaria, Baden-Wuerttemberg, Mecklenburg-Western Pomerania	36-55	16 February 2023
SAGD01	Representatives of school administration	Six	Bavaria, Baden-Wuerttemberg, Hamburg, Hesse, North Rhine-Westphalia	42-59	29 November 2022
SAGD02	Representatives of school administration	Five	Bavaria, Baden-Wuerttemberg, Rhineland-Palatinate, Berlin, Brandenburg	31-58	30 November 2022
SAGD03	Representatives of school administration	Four	Bavaria, Lower Saxony, Saarland	40-61	07 December 2022

The coding of interviews was carried out by four researchers. To ensure the analysis was reliable despite the involvement of different researchers, intercoder reliability was calculated for each subcode in accordance with the recommendations for qualitative content analysis (O'Connor & Joffe, 2020). Therefore, one of the interviews from each stakeholder group was selected and coded by two people so that intercoder reliability was calculated for three of the ten interviews.

Two researchers each coded in different tandems. The intercoder reliability was calculated with MAXQDA 2022. The reliability coefficients for the subcodes considered in this article ranged from κ = .89 to 1.00 (table 2). On the basis of the intercoder reliability results, the developed category system was discussed and revised by the entire research team. The entire data was coded using the finalized category system. The researchers remained in constant exchange with each other and discussed passages that could not be clearly assigned to the codes.

Table 2

Intercoderelabilities

Subcodes	School Principles (Interview SLGD03)	Teachers Associations (Interview LKVGD03)	School Administration (Interview SAGD02)
pandemic-related opportunities and challenges for educational practice	*κ = .97*	*κ = 1.00*	κ = .92
pandemic-related opportunities and challenges for media related school development	*κ = .93*	*κ = 1.00*	κ = .89

The study design and experimental protocols were reviewed and approved by the project sponsor, the German Federal Ministry of Education and Research. A data protection policy was developed for the project and approved by the University's Data Protection Supervisor. Data collection was based on the European General Data Protection Regulation (GDPR), as well as the Guidelines for Ensuring Good Scientific Practice of the German Research Foundation (German Research Foundation, 2022) and the Code of Ethics of the German Educational Research Association (German Educational Research Association [GERA]). Participation in the study was voluntary and based on written informed consent. All data were pseudonymized and stored in accordance with the European General Data Protection Regulation (GDPR).

Results

The stakeholders interviewed reported two phases of development. Firstly, there was a kind of push towards the integration and use of digital media in primary schools during the pandemic. Secondly, however, there was a regression to pre-pandemic pedagogical practices and a decreased use of digital media in the classroom in the post-pandemic period. This is exemplified in the following quote.

> What I'm observing is that, um, things are now being scaled back again. Now that in-person classes are taking place again, we're taking a step backwards in some areas. So, we had the

> learning platform, which worked well, we had the assignment module, which worked well, we provided the children with things via these platforms, um, but then at some point we quickly reverted back to the old ways. So, the question is, how sustainable are these things that happened during the pandemic, and how much of an impact will they have? (SAGD01, pos. 72)

The two subcategories “pandemic-related opportunities and challenges for educational practice” and “pandemic-related opportunities and challenges for media-related school development” help to understand why these two developments have occurred. Below, the results of the category of pandemic-related opportunities and challenges for educational practice are summarized (4.1) and then classified against the background of the corresponding subcategory of media-related school development (4.2).

Educational practice (meso level)

Although all interviewees found the pandemic and the associated distance schooling very challenging and stressful, they reported that it had created new opportunities for educational practice. In this way, it was also a time of experimentation, testing, and exploring the potential of digital technologies. One headteacher described it as an “enabling space” (“Ermöglichungsraum”):

> It was like an enabling space, um to deal with um I would say various technical devices and platforms, apps and so on. And on the one hand to gain initial experience together at the beginning. (SLGD03, pos. 27)

In addition, the pandemic offered the possibility to incorporate a variety of digital tools and programs, including applications such as Anton, Oncoo, Padlet and TaskCards. Furthermore, the possibilities and potential of video conferencing tools and learning management systems were explored and integrated. At the same time, it was important for the teachers and headteachers to engage personally with the children and their parents, and to use digital media alongside haptic and traditional learning materials. For example, worksheets were printed out and delivered personally to the pupils. In one school an "open window" was provided where pupils could pick up their learning materials.

> [...] but we also had something analogous like an open window [...] because we had windows at uh level, where you could stand and talk to the children and they handed in their things and you could also give direct feedback [...] man it turned out great. So, on this level, where you simply noticed that people were queuing up and didn't want to leave, how important that was. (LKVGD01, pos. 55)

The work during the pandemic was therefore a pedagogical opportunity for teachers and school administrators under very different and challenging conditions, where on-site and technological resources were explored and used. In the focus group interviews, there were also reported trends in primary schools towards a shift in the conventional roles of teachers and pupils during the pandemic. With the omnipresence of digital media, children were able to bring their experience and knowledge of using media into the classroom and, in some cases, support the teachers. In this context, they experimented with new ways of organizing lessons and making use of the

opportunities offered by digital technologies. The focus group interviews revealed that teachers' willingness to engage with digital media increased remarkably, with even the most critical teachers becoming more willing to try and explore.

However, the interviewees also reported that teachers' willingness declined noticeably after the pandemic when regular teaching resumed. Attitudes towards education that are sceptical of digital technologies have increased post-pandemic.

> Actually, I think it's such a shame when people say that they've had such an intense time and worked so hard on so many things. And for many people, I think the reaction was very strong: no, okay, now I don't have to do things digitally anymore, finally I can do things normally again, like always. And then you were (laughing) basically glad that it was finally gone and you could just do things the way you always did. (LKVGD04, pos. 49)

In light of the increased willingness to explore the possibilities of digital technologies during the pandemic the decline afterwards is counterintuitive and demands explanation. The collected data indicates that this change is related to the stress experienced during the pandemic. Besides the opportunities described, the pandemic caused great difficulties due to a lack of personnel and time resources, and a greatly increased workload for teachers.

Teachers reported experiencing high expectations from various sources, including education policy, parents, and general societal norms, which they often perceived as challenging to meet.

> Um (.) there's so, so, so much, um, personal initiative behind it [...] nobody was interested in whether we were equipped with teaching staff to do online teaching, that was simply assumed, just as it is assumed for a lot of things, that we have worked our way through these tools ourselves, what can I use now and how do I use it. I've never worked with Teams before, I suddenly have to share screens, maybe work with breakout rooms and so on and so forth. (LKVGD01, pos. 113)

This is indicative of a tension between the increasing willingness and personal initiative to explore the potential of digital media and a heavy workload that severely limited teachers' pedagogical options during this time. This tension refers to macro-level conditions as factors influencing the post-pandemic decline in media use in schools. These factors are described in more detail in the next section.

Media-related school development (macro level)

At the macro level, analysis of the code relating to media-related school development reveals three central issues that made the pedagogical use of digital technologies more challenging in the context of the pandemic. The topics are (differences in) the technical equipment of schools, problems with cooperation between administrative organizations, and bureaucratic hurdles. These topics will be presented in this section.

The interview data indicate that the *technical infrastructure* of primary schools has generally improved during the pandemic. However, the interviewees reported that this varied greatly from school to school. An important factor was whether the schools had reasonably good technical equipment before the pandemic and/or whether they were already actively involved in media-

related school development. Primary schools, which were already in a worse position prior to the pandemic, faced even greater problems during it. Even after the pandemic some of these schools did not have a reliable, fast and stable internet connection.

> [...] so the focus was initially on the infrastructure, which means that many cities started by providing elementary schools with Wi-Fi anyway. [...] Unfortunately, we still have schools that are not yet equipped with Wi-Fi and accordingly the infrastructure is not really in place yet. (SAGD01, pos. 28)

The possibility of using this technical equipment, which was sometimes rudimentary, for educational purposes was further complicated by *coordination processes* with and between administrative organizations. School stakeholders viewed communication processes and different responsibilities as time-consuming and unproductive. These coordination issues made integrating digital technologies into teaching increasingly difficult.

> The challenge is, uh, the technical side of things on the city's part. Uh, to give an example, um, our iPads were purchased in batches and were supported by different companies. So that means, assuming we now want to have this or that application on our devices, I have three contact persons, all of whom I email to ask them to install this app. And such processes naturally make things much more difficult than if everything were in one place. (SLGD03, pos. 79)

These cooperation issues were linked to bureaucratic processes that schools found tedious and challenging. Data protection played a significant role in this. All stakeholders involved in the focus groups reported major problems with the inconsistent and changing data protection requirements. For example, many applications (e.g., Zoom, Teams or Padlet) could only be used for a short period of time during the pandemic, so teachers had to keep learning how to use new ones. As the following quote illustrates, these issues persisted after the pandemic.

> [...] where data protection keeps throwing a spanner in the works. Um, I'd just like to see, yes, from the top down, I'll say, uh uh a/ yes, approvals or/ or uh uh uh previously negotiated things that we can then use. Because at the moment it's often the case that we start things and then have to stop again and that's very frustrating. (SAGD01, pos. 101)

All three topics represent challenges that were particularly stressful for stakeholders during the pandemic due to their reliance on distance learning, but which persisted after the pandemic, at the time of data collection. The persistence of these problematic conditions experienced by school stakeholders after the pandemic stands in sharp contrast to reports of the pandemic period as a phase of testing and experimentation in the educational use of digital media. It suggests that the stress experienced by teachers when dealing with digital media during the pandemic shaped their reduced willingness to use it afterwards.

Discussion

The Covid 19 pandemic has changed schools significantly, with the use of digital media becoming an important part of primary education. However, it is important to discuss how sustainable the short-term developments were and whether or not achievements have been able to take effect

over time. The presented study shows that, In German primary schools, the changes in the use of digital media in the classroom tend to decrease when face-to-face teaching resumes (see also Dertinger & Bärnreuther, 2024). The article explores the reasons for that development. As stated above, factors influencing the use of digital technologies in the classroom in German primary schools are located primarily in the dispositions and the practice of the teachers (meso level) or in the specific conditions of the schools (macro level). The interviewees describe a trend towards an increased willingness of teachers to use and explore digital technologies for teaching purposes. Such an openness of German primary school teachers to the use of digital media was also evident in other studies conducted after the Covid-19 pandemic (Knoth & Haider, 2023; Lorenz et al., 2023). This suggests an effect of the pandemic on teachers' media-related attitudes, beliefs, and practices. Overall, on the macro level the technical equipment and infrastructure of German primary schools improved during the pandemic, mainly due to government funding. However, from the perspective of primary school stakeholders, it was judged to be inadequate for teaching with digital media in a pedagogically appropriate way during the pandemic in many schools. In addition, structural and administrative conditions hampered the use of digital media for educational purposes. Conducted after the pandemic, the study takes into account the retrospective and current perspectives of stakeholders on the role of digital technologies in primary schools. It reveals the ongoing involvement of teachers and school leaders with meso-level conditions that influence their attitudes and pedagogical practices. The results of the study presented highlight the interactions and areas of tension between the meso and macro levels. These interactions are taken into account in existing models for media integration and school development at the national (Lorenz et al. 2022) or European level (Kampylis et al. 2015). However, it is challenging to make them accessible empirically in their mutual interdependence. Thus, the current state of research is characterized primarily by focused surveys of one of these areas (Vidal-Esteve & Martín-Gómez, 2023; OECD, 2023), or - predominantly quantitative - studies of both areas, with little intensive examination of their mutual interaction (Fraillon, 2025; Lorenz et al. 2023).

Overall, the findings show that the sustainable integration of digital education in primary schools can only succeed if pedagogical, structural, and administrative factors are considered together. Importantly, the participants' statements explicitly refer to developments after the return to face-to-face teaching. While certain digital routines were maintained in the short term, structural and organizational constraints gradually limited their continuation.
As a limitation of the study, it should be noted that the sample size is quite small. Furthermore, the interviews took place online and it cannot be ruled out that a better willingness to speak could have been evoked in a face-to-face situation. Yet, this way a nationwide data collection (participation of 13 of the 16 German federal states) could be realized. This is particularly important in Germany, where education policy is the responsibility of the federal states. Overall, the study expands the national and international state of research, which mainly relates to the secondary level and focuses on quantitative research (Bond, 2021).

Conclusion

The Digital Education Action Plan sets out the need for digital education to be systematically and sustainably integrated into the school curricula of all European Countries (EU, 2020). Therefore, adequate implementation of digital technologies is necessary to enable teachers to explore new

teaching methods. The pandemic made it necessary for teachers to experiment with different ways of using digital technologies. Although the teachers in the studied sample experienced positive aspects and new opportunities for teaching, administrative conditions during and after the pandemic often resulted in a return to familiar teaching structures with little or no innovative use of media. Such an interrelationship between the meso level of teaching and the structuring macro level does not provide the fertile ground necessary for adequate digital education to develop in German primary schools. This can inform empirical and political conclusions about the German school system.

From an *educational policy perspective*, a priority should be to promote interaction between different administrative authorities and schools in terms of communication, cooperation and fundamental aspects such as schools' technical infrastructure. The results emphasize the importance of structural conditions as a prerequisite for the effective implementation of digital education in primary schools. For this reason, it is essential to ensure that primary schools have access to essential technical equipment and an internet connection. Furthermore, they require appropriate internal and external pedagogical and technical support. The results also highlight the need to clarify the interrelationship and collaboration between the various entities within the German education system (e.g., the federal government, federal states, school administration, local authorities and educational institutions) that are responsible for digital education in primary schools. Additionally, enhancing data protection clarity and streamlining bureaucratic procedures are recommended. Finally, the results stress the importance of integrating digital education content more holistically and systematically into the various phases of teacher training.

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