MedienPädagogik
Zeitschrift für Theorie und Praxis der Medienbildung
www.medienpaed.com **ISSN 1424-3636**

Jahrbuch Medienpädagogik 20: Inklusive Medienbildung in einer mediatisierten Welt: Medienpädagogische Perspektiven auf ein interprofessionelles Forschungsfeld. Herausgegeben von Anna-Maria Kamin, Jens Holze, Melanie Wilde, Klaus Rummler, Valentin Dander, Nina Grünberger, Mandy Schiefner-Rohs

Risks of Digital Exclusion

An Empirical Analysis of Teacher Support during Active Media Work in Primary Schools

Traugott Böttinger[1], Anja Kürzinger[1] und Lea Schulz[2]

[1] Pädagogische Hochschule Schwäbisch Gmünd

[2] Universität Flensburg

Abstract

Teaching in primary schools means taking the heterogeneity of students' backgrounds, skills, and capacities into account and offering them a commensurately wide variety of learning opportunities. This is particularly the case when it comes to digital-based instruction, which often entails individualized learning and greater responsibility of learners for their own learning processes. To enable participation and reduce risks of exclusion – for students with disabilities and in the context of the digital divide – teachers' learning support is of great importance. Despite the potential of teacher support for learning with digital media, few studies have investigated this topic. This paper introduces a research study using videography to analyze the learning support given by preservice teachers during active media work. The findings indicate that teachers tend to provide mainly direct instruction, and significantly less diagnostic support aimed at fostering the learning process. The results do not confirm the idea that digital teaching formats provide technical rather than content support. Furthermore, they show that digital learning formats enable participation by all the students in the class. These results are discussed with a view to risks of exclusion and implications for teacher professionalization.

Böttinger, Traugott, Anja Kürzinger, und Lea Schulz. 2023. «Risks of Digital Exclusion. An Empirical Analysis of Teacher Support during Active Media Work in Primary Schools». *MedienPädagogik* 20 (Jahrbuch Medienpädagogik), 183–206. https://doi.org/10.21240/mpaed/jb20/2023.09.08.X.

Risiken der digitalen Ausgrenzung. Eine empirische Analyse der Unterstützung von Lehrpersonen bei der aktiven Medienarbeit in Grundschulen

Zusammenfassung

Unterricht in der Grundschule muss die verschiedenen Heterogenitätsdimensionen der Schüler:innen und damit eine grosse Bandbreite an Lernvoraussetzungen berücksichtigen. Dies gilt ebenso für digital vermittelten Unterricht, da der Einsatz digitaler Medien häufig mit einer grösseren Verantwortung für den eigenen Lernprozess verbunden ist. Um Teilhabemöglichkeiten für alle Lernenden zu eröffnen und Exklusionsrisiken, z. B. für Schüler:innen mit Behinderungen oder im Rahmen des Digital Divide, zu minimieren, kommt der Lernunterstützung durch die Lehrkräfte eine wichtige Rolle zu. Dennoch beschäftigen sich nur wenige Studien mit diesem Thema. Dieser Beitrag stellt eine Videografie-Studie vor, die die Lernunterstützung durch angehende Lehrkräfte während einer aktiven Medienarbeit in der Grundschule analysiert. Die Ergebnisse indizieren, dass die Lernenden vor allem direkt angeleitet werden, da Unterstützungen, die auf den Lernprozess abzielen (diagnostische Unterstützungen), deutlich seltener gegeben werden. Die Annahme, dass digitale Lehr-Lernformate vor allem durch technische und nicht inhaltlich-fachliche Unterstützungen geprägt sind, kann dagegen nicht bestätigt werden. Diese und weitere Ergebnisse der Studie werden vor dem Hintergrund möglicher Exklusionsrisiken diskutiert und Implikationen für die Lehrkräfteprofessionalisierung abgeleitet.

1. Digital basic education as a task for primary schools

In Germany, primary school is the first school children attend. It marks the beginning of their basic education. Given the diversity of children entering schools, inclusivity should perspectively become a key educational principle at the primary level. Schools across Germany's 16 federal states differ in many respects. Especially in their understanding of inclusive learning they do not always share the idea that inclusive learning means education and participation for all students, not merely those with special educational needs (Deutsche UNESCO Kommission 2021; Lange 2017). In spite of

these different approaches to inclusive learning, primary schools in Germany are seen as schools for all children, and as such do not carry out any selection (at least conceptually) between students (Miller 2022).

According to this idea, schools should be places where inequalities are overcome through heterogenous pedagogical practices. One of the challenges primary schools face is in providing fair and appropriate opportunities for education and learning by supporting individual skill sets, on the one hand, and by fostering participation and social interaction, on the other (Götz et al. 2022). This can only be achieved by taking important current developments in society into consideration. Digitalization is one of these developments.

To prepare children for life in the age of digitalization, primary schools must offer digital basic education (Irion et al. 2023). To ensure inclusivity, this digital basic education must encourage participation through digital media (Bosse 2020) and learning with, through, and about digital media (Schulz 2018). One way to respond to students' diverse needs is through the adaptive use of information and communication technology (ICT) in the inclusive classroom (Schulz 2018). In our understanding, ICT comprises all (digital) technologies for the design of teaching-learning processes in the sense of technology-enhanced teaching (Scheiter 2021, 1041f.). Digital media are part of complex teaching-learning arrangements within a specific teaching context. Our focus is not on the technological aspects of ICT, but on the orchestration of teaching (ibid.), an area in which the learning support provided by teachers plays an important role. Studies (e.g., Schaumburg 2021) show that students can easily be overstrained using digital media. Often the reason is a lack of individual support from teachers, individualized approaches to the use of digital media, and appropriate ways of learning with digital media.

2. Adaptive use of ICT in the inclusive classroom and risks of exclusion

The adaptive use of ICT in classrooms enables opportunities for participation and reduces educational disadvantages (Autorengruppe Bildungsberichterstattung 2020), as learning groups with diverse needs benefit from

differentiated and individualized digital teaching approaches. In addition, digital media can support inclusive classes, for example, by considering the visual, auditory, and haptic needs of learners (ibid.). When discussing inclusive teaching, this article supports a broad understanding of inclusion that focuses not only on students with disabilities or special educational needs, but on all learners with their individual needs, talents, and (social, cultural, and socio-economic) backgrounds (UNESCO-Kommission 2021, 2). In this context, active media work is important in supporting communication processes in the classroom (Schluchter 2019, 201). Meta-analyses have shown that digital media exert a particularly beneficial effect on learning when used with constructivist teaching methods that are aligned to students' needs (Schaumburg 2018).

Meanwhile, teachers often lack inclusive educational media (Fuchs, Niehaus, and Stoletzki 2014, 111f.), theoretically substantiated concepts for differentiation and individualization of learning with digital media in inclusive classes (Schaumburg 2018), and didactic approaches to reduce inequality while using digital media (Eickelmann and Gerick 2020, 159). Evidence of this has been reported in recent papers indicating a higher risk of exclusion when ICT is integrated in the classroom (e.g., Böttinger and Schulz 2021; O'Shaughnessy 2020). For instance, correlations have been observed between learners' computer- and information-related skills and their social backgrounds (e.g., Rudolph 2019) due to the digital divide (e.g., Fraillon et al. 2019). On a first level, access to digital technologies is related to parental levels of education: The higher the parents' level of education, the greater the chance that children will be familiar with digital technologies as educational and not just entertainment media. On a second level, the use of digital technologies relates to education in a similar way: The lower the parental level of education, the less time is spent on educational activities (e.g., reading news or doing research) and the lower the will of the parents to support their children's media use (DIVSI 2015). The impacts of the first and second levels become obvious on the third level: The lower the level of education, the lower the possibilities for using digital technologies for participation in a digitalized society, for instance, to build networks or gain computer- and information-related skills (Bonfadelli and Meyer 2021). These three levels define the ways students use digital technologies in

their everyday lives and in school. Against this background, the primacy of pedagogy (KMK 2021) is important: As a point of reference for media education beginning as early as the first years of school (e.g., Irion 2020, 64), the use of digital technologies should be reflected in pedagogical and didactic practices. In addition, teachers cannot assume that the learners in a class have similar levels of knowledge and skills regarding digital media. Planning lessons that use digital media means thinking about how to provide individual learning support.

3. Learning support

Empirical classroom research points to an important role of constructive learning support in the classroom. This kind of support is a feature of instructional deep structures, which are associated with greater learning gains than visual structures (e.g., social forms) (Hattie 2009; Lipowsky 2020). Similarly, individual learning support is said to positively influence cognitive and motivational competences (Kobarg and Seidel 2007; summarizing: van de Pol, Volman, and Beishuizen 2010), whereby the type and quality of the support is relevant (Pauli and Reusser 2000; Pohlmann-Rother, Kürzinger, and Lipowsky 2018). Encouraging students' thinking and understanding (Krammer 2009) and diagnosing the learning process (Hardy et al. 2011) are considered much more supportive than direct forms of assistance like providing solutions. There have been only a few studies on individual learning support in German-speaking countries. Those available show a rather low percentage of activating and diagnostic learning support in analogue teaching settings without digital media (Lotz 2016; Schnebel and Wagner 2016; Pohlmann-Rother et al. 2018). To be able to determine the efficiency of learning support, it is also import to align support to students' individual learning requirements and to the level of difficulty of their tasks (Pohlmann-Rother et al. 2018). As described in Chapter 2, individualized learning environments require the ability to engage in self-regulated learning, which can disadvantage students with learning difficulties or learners from families with limited access to different types of capital (Bourdieu 1996) and resources. They often lack metacognitive strategies as a basis for autonomous learning (Bremm, Racherbäumer, and

van Ackeren 2017). In this context, didactic approaches that enable reflection on inequality, such as the highly effective concept of scaffolding (van de Pol et al. 2010), can reduce disadvantages by reducing closely monitored support structures to enable students to use independent learning processes (Bremm et al. 2017; Lipowsky 2020). Regarding the potential of digitally supported learning environments, Döbeli Honegger, Hielscher, and Hartmann (2018) also find that weaker learners benefit from more structured learning environments with clear guidelines. These results show that risks of exclusion in a cooperative learning environment could possibly be reduced by good teacher support. To date, however, studies on teachers' support behavior during teaching with ICT are largely lacking. Overall, there are only sparse findings on the quality use of digital media used in teaching, with video-based analyses being particularly rare (Quast et al. 2021).

4. Objectives and methodology

4.1 Objectives

Against this backdrop and in light of the current state of research, we want to contribute to analyzing the conditions under which teachers and students can participate in contemporary educational media practices and understanding the kinds of inequities that accompany these practices. The question we want to answer with our research study is: What kind of teacher support can be observed during active media work in primary schools, and how does the teacher support help students to participate in the lessons? To answer this question, we interpret data from our study "KoILDiklu"[1] in terms of teacher support and possible risks of exclusion for students.

Because this study relied on a broad understanding of inclusion, specific disabilities were not captured. Instead, the focus was on an adaptive learning environment. For this reason, the students were not divided into categories.

1 Initial findings of this study can be found in Kürzinger, Böttinger, and Schulz (in print).

Based on our objective of using exemplary teaching videos to examine support behaviors of prospective teachers, initial implications can be derived from the study results for teacher professionalization. Detailed knowledge of the support behavior of prospective teachers in digital settings would make it possible to specify initial media-related qualification needs and derivative conditions for teaching with ICT.

This study focused on prospective teachers for several reasons. Digital inclusive learning has so far been taught in the first phase of teacher training. This is made clear by existing research desiderata (see above) and by the still underdeveloped use of digital media in schools in Germany (see, e.g., Schmid et al. 2017). For example, only 15% of teachers use digital media to provide support (Eickelmann et al. 2019) or to conduct formative assessments (Autorengruppe Bildungsberichterstattung 2020). The prospective teachers in the study were able to engage intensively with the design of digitally inclusive learning environments for an entire semester as part of a university seminar. It can therefore be assumed that prospective teachers with appropriate training have a competence advantage in this area.

However, due to the specific project requirements (e.g., small number of videos, see also Chapter 6), it is only possible to derive initial impulses for teaching with digital media from the results of this study.

4.2 Video Sample

The six videos analyzed in the Kolldiklu project consist of lessons with digital media on the subject "Christmas around the world" in science classes in three fourth grade learning groups taught by preservice teachers.

Such video recordings are an appropriate method for examining detailed microprocesses in the classroom and for assessing teaching quality (Praetorius 2014). Their added value is based on the authenticity and integrity of the data material as well as on their repeatability and re-analyzability (Pauli and Reusser 2006, 787).

In the videotaped classrooms, the students were first instructed to gather information about Christmas celebrations in different countries (Australia, Denmark, and Mexico), to create a storyboard, and finally to record green screen videos of Christmas celebrations in those countries. On

the one hand, this kind of digitally supported teaching setting was special because the implementation had more of a project character than if it were integrated into teaching units lasting several weeks. On the other hand, students were accustomed to the use of digital media because they were used regularly in class.

Attention was paid to minimizing deficits in the use of digital media (e.g., operating skills) through prior teacher training. The focus of evaluation was not on explaining risks of exclusion due to technology-related deficits on the part of the teachers, but on analyzing teachers' support behavior in the classroom.

The teaching concepts were developed by the preservice teachers as a part of the seminar "Diclusion" at the European University of Flensburg in winter semester of 2021/2022. When preparing their lessons, the preservice teachers were asked to consider potential risks of exclusion by taking the universal design for diclusive learning (Böttinger and Schulz 2021) into account during the planning stage. This concept for teacher design of a digitally inclusive teaching and learning environment uses the broad understanding of inclusion described above and is an adaptation of the evidence-based Universal Design for Learning framework (CAST 2018), which focuses on the learning needs of students. In addition, the preservice teachers were expected to provide self-directed learning, for example, while creating the storyboard for the film themselves. This was also designed to prevent 1:1 supervision and thus to enable collaborative work between students. Beside these content-related targets, the course of storyboarding and media production as the two phases of active media work was up to the preservice teachers.

Access to the field was facilitated by a productive collaboration with a longstanding partner, a school that has maintained a four-year partnership with the University of Flensburg. The selection of this specific school was based on the students' previous experience with iPad usage and the favorable spatial conditions it provided for conducting the study. Consent forms were obtained from the Ministry, the parents, and the school administration for the recording to take place. For ethical reasons, the videos were stored exclusively on university devices without a cloud connection, and then anonymized on a specially secured hard drive.

4.3 *Methodology and Procedure*

To analyze the participation in contemporary educational media practices during students' active media work, we developed a high and medium inference rating system (Kürzinger, Böttinger, and Schulz 2023, in print) on the basis of videotaped classroom research (e.g., Pauli 2012). The instrument consists of 14 criteria and depends on an inductive-deductive method to observe teachers' learning support during active media work that might help students to participate in lessons.

Following Krammer (2009), learning support is defined as essentially any type of teacher-student interaction during students' active media work that aims to support a student or groups of students. This includes, for example, hints, solutions, or diagnosis of the learning process.

In a first step, all supportive interactions between teachers and students were identified during the storyboarding and media production (Pohlmann-Rother and Kürzinger 2019). Each instance of learning support was then characterized in terms of its type (nine criteria) and its subject (four criteria). Based on this detailed medium inference analysis, the study examined to what extent the preservice teachers' support helped students to participate during their active media work. Furthermore, the students' participation level was assessed based on a high inference rating in which the complete active media work was examined. Students' participation levels can be considered from different perspectives (Lipowsky, Pauli, and Rakoczy 2008, 67), for example, as an indicator of the cooperation of the class and effective classroom management (ibid; Kounin 2006). It is thereby assumed that equal participation in the lessons is accompanied by a more active use of learning opportunities and more effective classroom management (ibid, 68). If students are equally involved in the lesson, their potential attention and engagement with the subject matter might be high. In contrast, there could possibly be risks of exclusion for individual students who are not integrated or inattentive. Based on this consideration, the present study also examines students' degrees of participation during their active media work as an indicator of exclusion risks.

The detailed instrument for assessing the support behavior and participation levels is presented below using tables. In Table 1, nine different types of learning support are shown.

Types	Short Description	Examples
Task taken over (own development)	No support, but task taken over by the teacher	"I'll quickly add the background image for you myself."
Solution (Krammer 2009; Lotz 2016; Pohlmann-Rother and Kürzinger 2019)	Supplying entire solution: Instead of encouraging reflecting on the task, information on fulfilling the task is given by the teacher	"At the green screen, stand two steps to the left."
Solution and explanation (Siemon, Scholkmann, and Paulsen 2018)	Giving a solution including an explanation by the teacher	"At the green screen, stand two steps further to the left so that you can be seen in the video."
Hint (Krammer 2009; Lotz 2016; Pohlmann-Rother, and Kürzinger 2019)	Suggestion for self-contained problem solving/completing the task without giving solutions	"Where could you stand?"
Hint and explanation (Siemon et al. 2018)	Suggestion for self-contained problem solving/completing the task including an explanation	"Where could you stand so that you can be seen in the video?"
Diagnosis (Krammer 2009; Lotz 2016; Pohlmann-Rother, and Kürzinger 2019)	Obtaining information on work and learning progress by asking purposeful questions by the teacher	"What step is next?"
Encouragement (own development)	Motivation and encouragement to continue the learning process (no content-related support)	"Well done."
Admonition (own development)	Admonition to cooperation and attention	"If you don't take your role in the video seriously, we'll have to switch roles."
No learning support (own development)	Need for support is ignored or not recognized by the teacher	-

Tab. 1: Types of learning support (medium inference rating system) during active media work (Kürzinger, Böttinger, and Schulz 2023, in print).

Table 2 shows the four subject criteria of the learning support.

Subject	Short Description	Examples
Organizational issues (own development)	Learning support for framework conditions and organization of the students' active media work	"Please hang up the green screen; it's now your turn."
Technical issues (own development)	Learning support for purely technical aspects of the students' active media work (e.g., using the video function of the iPad)	"Do you know where to press? How to choose wallpaper?"
Content-related issues (own development)	Learning support for content-related issues of the students' active media work	"How does Santa Claus get down the chimney? Which of the background images suits our scene?"
Emotional-social issues (own development)	Learning support for emotional-social issues of collaborative work (e.g., conflict prevention or solution or praise, regulation of social behavior)	"Great, you can do it! Please step aside."

Tab. 2: Subject of learning support (medium inference rating system; Kürzinger, Böttinger, and Schulz 2023, in print).

The analysis of the students' participation level based on a high-inference tool is summarized in Table 3. While the medium inference rating system of the preservice teachers' supporting behavior focuses on qualitative distinction between different types and subjects of learning support, the participation level is rated by a four-point scale describing different dimensions of an ideal performance with indicators. Thus, the judgement is made by the number of students involved, the frequency or proportion of time taken by a student's participation, and the intensity of the participation level (Rakoczy and Pauli 2006; Pfister, Moser Opitz, and Pauli 2015, 1084). Regarding positive and negative indicators,

> "a 4 signifies full compliance with the ideal performance, a 3 signifies a rather good compliance, a 2 means a little compliance, and a 1 means no compliance with the ideal performance" (Pfister et al. 2015, 1084).

Short Description	Indicators	Four-point rating system
Students' participation level (source: Hess, 2019 following Helmke & Renkl, 1992): To assess students' participation levels, it is observed how many students are on-task (processing the task, raising their hands, answering questions) or off-task (daydreaming, doing nothing, diverting) and how long.	Positive indicators: • Each group member has a task and participates in processing • The students ask independently for new assignments or get new tasks • The students work on assignments over a long period of time • The students ask comprehension questions • The students raise their hands • The students seem to be focused on the subject matter of the lesson Negative indicators: • Individual group members don't have a task and don't participate in task processing • The students seem to be uninterested and unmotivated • The students don't participate and are daydreaming • Only a few students are raising their hands	A "4" signifies students working intensively throughout the entire period and actively participating in class discussions. A "3" signifies most students' working intensively over the entire period and actively participating in class discussions. A "3" is also given if the students do not participate in some situations and do not seem to be on task. A "2" signifies only a few students working intensively throughout the entire period and actively participating in class discussions. A few students are participating in the work phase, the rest of the group seems uninterested and unmotivated, hardly asks for tasks, and shows no interest. A "1" signifies many students not working intensively for a long time. They seem uninterested or unmotivated, daydream frequently, don't ask for tasks, and rarely participate.

Tab. 3: High inference rating of students' participation level.

To evaluate the learning support and the participation level, two assistants (preservice teachers at the Schwäbisch Gmünd University of Education) were trained in a one-day training session during which the various coding rules were discussed intensively and practiced on a 20-minute excerpt from one of the videos. While the videos for the medium inference

rating were split between the two assistants, each video for the high inference rating of the participation level was rated by both preservice teachers. For the evaluation of the high inference rating, the relative generalizability coefficient *grelativ* = 1.0 (*N* = 6) is above the pre-defined minimum characteristic of grelativ ≥ 0.70 and shows a very high observer agreement.

The quality of the medium inference rating was tested by randomly selected double codings of 10% of the video material. Overall, the observer agreement of the medium inference rating can be described as good, with 87.5 to 93.3% for percentage of agreement and k = .82 to .92 for Cohen's kappa (predefined minimum parameters: percentage agreement ≥ 85%; Cohen's kappa k ≥ 0.70; see Lotz et al. 2013).

5. Results

Based on the descriptive analysis, the preservice teachers' supporting behavior can be described as very active (Kürzinger, Böttinger, and Schulz 2023, in print): During the six videotaped lessons (*mean* = 58.49 minutes; *SD* = 19.31 minutes), almost five learning supports (*mean* = 4.61; *SD* = 1.53; *min/max*: 2.29 - 7.44) per minute were given on average. Within the three learning groups, which were each taught by three preservice teachers, the average support per minute provided by every individual preservice teacher was 1.53. In absolute numbers, the nine teachers supported the 15 primary school students for almost six hours (5:50:55) in 1.542 cases. However, there are differences regarding the learning groups and the two phases of active media work. Comparing storyboarding (*mean* = 55.55 minutes; *SD* = 12.08 minutes) and media production (*mean* = 61.42 minutes; *SD* = 27,59 minutes), the students were supported more often in the slightly longer media production on average (*mean* = 5.29 learning support per minute; *SD* = 1.91 vs. *mean* = 3.94 learning support per minute during storyboarding; *SD* = 0.88). The absolute figures for learning support in the phases and learning groups are shown in Figure 1.

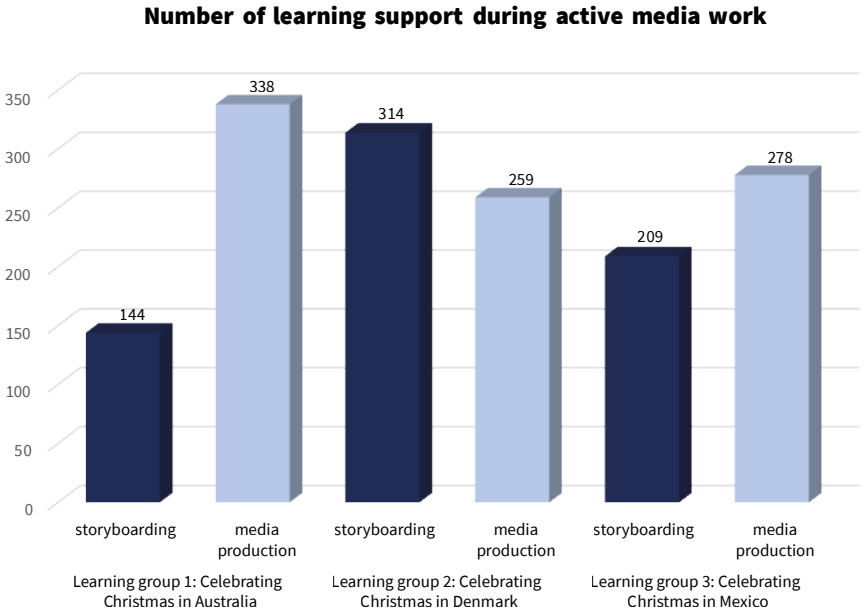

Fig. 1: Frequency of learning support by learning group and working phase.

Differences in learning support can also be identified in terms of types and content-related issues. As shown in Table 4, the preservice teachers most often supported students by providing solutions (40.14%), followed by encouragement (18.41%) and hints (16.80%). There were almost no situations in which the students did not receive any help because teachers ignored or failed to recognize the need. Furthermore, students were admonished little (1.23%), and the preservice teachers took over very few tasks (5.32%) during active media work. Evaluative learning support (diagnosis) that is considered to be conductive to learning (Pohlmann-Rother et al., 2018), however, was rarely given (7.52%).

In the following, a situation is described as one of the rare examples in which a task was taken over by preservice teachers:

> «Four students are standing in front of the green screen to record a scene. The cameraman (another student) starts recording, but at the end of the scene, the teacher standing next to the cameraman taps the iPad to end the recording. The scene should then be viewed together with the students. Again, the teacher takes over the task of the cameraman and wants to play back the recording, but she can't

find the playback function ("No, that doesn't work. Where is that again?"). The four children are waiting in front of the camera, the cameraman is not involved in the process, and his attempted support (pointing to the iPad: "There?") is ignored by the teacher. As a result, all the children within this scene have no active task. In addition, no solution is found, and viewing the task is postponed until later.»

	absolute frequency	percentage
solution	619	40.14%
encouragement	284	18.41%
hint	259	16.80%
diagnosis	116	7.52%
solution and explanation	98	6.36%
task taken over	82	5.32%
hint and explanation	61	3.96%
admonition	19	1.23%
no learning support	4	0.26%
Total	*1542*	*100%*

Tab. 4: Distribution of learning support types.

Regarding the subject, more than every second learning support refers to content-related issues (56.23%; Table 5). Organizational and technical aspects are only addressed in around 15% of the learning support.

	absolute frequency	percentage
content-related issues	867	56.23%
organizational issues	235	15.24%
technical issues	233	15.11%
emotional-social issues	207	13.42%
total	*1542*	*100%*

Tab. 5: Distribution of learning support subjects.

Looking at the distribution of the most common types and subjects of the learning support during storyboarding and media production (fig. 2), differences are again noticeable. Only slightly more solutions ($N = 188$) than hints ($N = 146$) and encouragements ($N = 139$) were given during the storyboarding phase. During film production, on the other hand, solutions clearly dominate all other types of support.

Distribution of the learning support during active media work

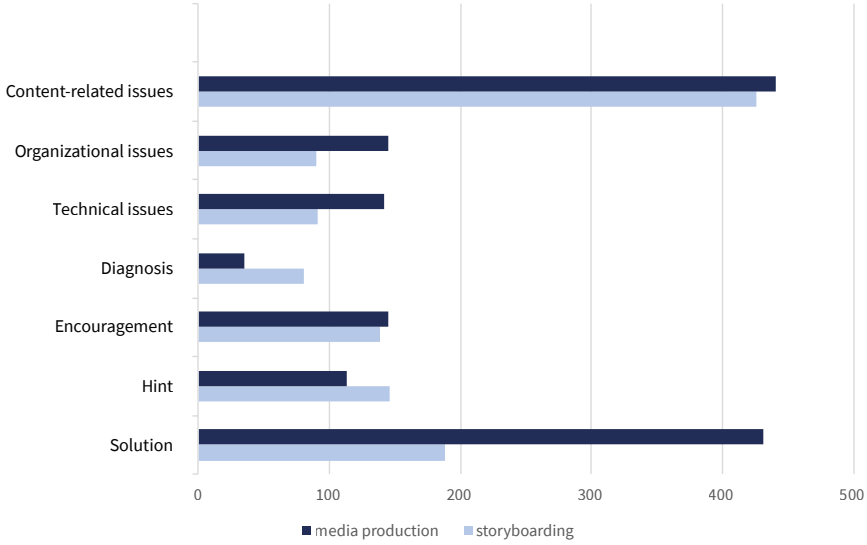

Fig. 2: Distribution of types and subjects of the learning support.

Similar to the preservice teachers' intensive support behavior, the students' participation levels are above average, with a mean of 3.42 (SD = 0.53, range:1-4; min = 2.5; max = 4.0). Overall, the students seem to be similarly involved in the lesson and their potential attention and engagement with the subject appears to be high. Periods of time when students are distracted and unmotivated tend to be rare or short. An example of a situation in which the participation level of the students is rather low for a short period of time is the following scene:

> «During a recording, three children are standing in front of the green screen and one student is standing in front of the iPad as a cameraman. Two students have no task during this scene. At first,

they are standing or sitting at the edge of the scene and watching the recording. After a while, they start to disturb others (through sounds, conversations, movement) and are admonished: ‹Kids, the others sat quietly while you played the scene.›».

6. Discussion

When a teacher takes away a task without any explanation, this can represent a risk of exclusion, as students do not have the opportunity to carry out an activity or task independently or think about possible solutions. At the same time, in some learning situations, it is necessary for a task to be taken away to achieve the learning goal or to not jeopardize the course of the lesson. Overall, only a few learning tasks were completely taken away from the students in this study. The reason for taking away the task could be, on the one hand, the inexperience of the preservice teachers in dealing with digital media, and on the other hand, the tight time frame. The involvement of the students in problem-solving processes (e.g., in the search for the playback function of the app in the example above) should, however, play an important didactic role. Otherwise, the teacher's actions when taking the task away should at least be accompanied by a verbalized explanation. One approach that could be further investigated would be to analyze the extent to which taking away a task and the use of ICT in the classroom are connected. During the production phase, the teachers gave more solutions than during the storyboard phase. One could ask whether this entails a certain risk of exclusion, as students are given a solution without the possibility of having their own learning experiences, for example, through trial and error. This is important, as the digital divide (Chapter 2) shows that teachers cannot assume that the learners in a class have similar levels of knowledge of digital media and skills in their use. Therefore, some students risk being disadvantaged—not only by not being able to participate, but also by not being able to acquire skills by themselves. In such cases, it might be more expedient for teachers to give hints that encourage learners to think on their own (and for teachers to support them in doing so). Interestingly, the study's results show that in total there were significantly more solutions than hints. At the same time, a solution may be reasonable:

Depending on the context and the didactic intention, it can function as a didactical reduction, abstracting complexity to facilitate and direct learning or to sustain the lesson's planning and flow. It should be noted, however, that the time constraints for finishing the project may also be a reason for the frequent solutions.

In an open learning environment, especially students with learning difficulties need step-by-step learning support associated with a higher level of structure and transparency (Bohl 2009; Stebler, Reusser, and Pauli 2016), for example, as feedback regarding the current stage of learning ("diagnostic"). The active media work carried out in this study can be assigned to this kind of open learning environment. But the results show that such teacher support was given very infrequently (about 7%), resulting in a risk of exclusion by the lack of an attendant evaluation of the learning process. It can be assumed that in our study, the short professional experience of the teachers and the limited knowledge of the students' current state of learning make a difference. Pohlmann-Rother and colleagues (2018) emphasize the importance of such learning support and find a considerably higher occurrence (about 13%) in their study with more experienced teachers (Pohlmann-Rother et al. 2018, 328).

In only very few cases were students' needs for support overlooked. When problems arose, there was a wide range of support – from the teachers, but also from other students. This shows that in the videotaped lesson sequences, a variety of support as a characteristic of good inclusive teaching (Heimlich and Bjarsch 2020, 282) could be found almost throughout. The results do not confirm the assumption that an increased use of digital media leads to support needs (e.g., in the technical area) being increasingly disregarded. Rather, support in terms of content was clearly in the foreground. Here, too, the assumption can be rejected that digital media lead to an increased involvement with technical and/or organizational aspects of teaching. Due to the large number of content-related supports, it can instead be assumed that a large amount of real learning time was available – a feature that is listed as a characteristic of high teaching quality in the context of efficient classroom management (Kunter and Voss 2011; Scheiter 2021). At the same time, it should be noted in the present study that the

high supervision ratio and work in small groups ensured high-quality support better than would be the case in a larger group. Therefore, the results cannot be easily transferred to other contexts.

7. Conclusion

In summary, the study seems to suggest that efficient, detailed lesson preparation and learning supports may reduce the risk of exclusion during active media work. To confirm the assumptions under more realistic classroom conditions, supportive behavior in educational media practices should be analyzed among experienced teachers with a lower supervision ratio. Furthermore, surveys should be conducted with different classes and selections. Due to the existing cooperation with the university, the implementation was limited to a previously determined primary school. In addition, students' individual learning requirements and family backgrounds are key factors that should be considered when examining learning support. For example, there may be a relationship between learning requirements and the nature or frequency of learning support during active media work. In particular, special needs of students were not studied in detail in this study. Future studies could focus more on specific needs and support possibilities in the context of creative media work. Observation of individual students and their reactions to teachers' actions and the available instructional support could also provide more precise results.

Despite the limitations, the study offers insights for the training of teachers, especially with regard to the importance of diagnostic learning supports for a heterogeneity-sensitive design of a lesson with digital media. To foster these kinds of competencies, preservice teachers should have space in the form of open workshops or skills labs at universities to try out and test digital media and reflect on their use.

From a methodological perspective, this study illustrates how digital teaching-learning settings can be analyzed using video-based high and medium inference instruments. Further research could develop instruments by considering more adaptive learning support.

References

Autorengruppe Bildungsberichterstattung. 2020. *Bildung in Deutschland 2020 – Ein indikatorengestützter Bericht mit einer Analyse zu Bildung in einer digitalisierten Welt*. https://www.bildungsbericht.de/de/bildungsberichte-seit-2006/bildungsbericht-2020/bildung-in-deutschland-2020.

Bohl, Thorsten. 2009. «Weiterentwicklung des offenen Unterrichts – Mikroprozesse des Lernens berücksichtigen und Gesamtkonzeption optimieren». In *Pädagogik* 9 (4): 6-10.

Bonfadelli, Heinz, and Werner Meier. 2021. «Dominante Strukturen und Akteure der Digitalisierung: von Digital Divide auf Mikro-Ebene zu Digital Inequality auf Makro-Ebene». In *Digitaler Strukturwandel in der Öffentlichkeit – Historische Verortung, Modelle und Konsequenzen*, edited by Mark Eisenegger, Marlis Prinzing, Patrik Ettinger, and Roger Blum, 421-446. Wiesbaden: Springer VS. https://doi.org/10.1007/978-3-658-32133-8_23.

Bosse, Ingo. 2020. «Schulische Bildung durch Teilhabe in, an und durch Medien inklusiv gestalten». In *#schuleDIGITAL. Friedrich Jahresheft*, 94-95.

Böttinger, Traugott, and Lea Schulz. 2021. «Diklusive Lernhilfen. Digital-inklusiver Unterricht im Rahmen des Universal-Design for Learnings». *Zeitschrift für Heilpädagogik* 72, 436–450.

Bourdieu, Pierre. 1996. *Die feinen Unterschiede.* 8. Auflage. Frankfurt am Main: Suhrkamp.

Bremm, Nina, Kathrin Racherbäumer, and Isabell van Ackeren. 2017. «Bildungsgerechtigkeit als Ausgangspunkt und Ziel ungleichheitsreflexiver Schulentwicklung in sozial deprivierten Kontexten». In *Inklusion: Profile für die Schul- und Unterrichtsentwicklung in Deutschland, Österreich und der Schweiz. Theoretische Grundlagen – Empirische Befunde – Praxisbeispiele*, edited by Birgit Lütje-Klose, Susanne Miller, Susanne Schwab, and Bettina Streese, 57-67, Münster: Waxmann.

CAST – Center for Applied Special Technology. 2018. *Universal Design for Learning Guidelines*, Version 2.2. https://udlguidelines.cast.org.

Deutsche UNESCO-Kommission. 2021. *Für eine chancengerechte Gestaltung der digitalen Transformation in der Bildung. Resolution der 81. Mitgliederversammlung.* https://www.internationaler-bund.de/fileadmin/user_upload/storage_ib_redaktion/resolution_unesco_digitalisierung-bildung.pdf.

DIVSI – Deutsches Institut für Vertrauen und Sicherheit im Internet. 2015. *DIVSI U9-Studie. Kinder in der digitalen Welt*. https://www.divsi.de/publikationen/studien/divsi-u9-studie-kinder-der-digitalen-welt/index.html.

Döbeli Honegger, Beat, Michael Hielscher, and Werner Hartmann. 2018: *Lehrmittel in einer digitalen Welt. Expertenbericht im Auftrag der Interkantonalen Lehrmittelzentrale (ilz).* https://edudoc.ch/record/133603?ln=de.

Eickelmann, Birgit, and Julia Gerick. 2020. «Lernen mit digitalen Medien. Zielsetzungen in Zeiten von Corona und unter besonderer Berücksichtigung von sozialen Ungleichheiten». In *DDS – Die Deutsche Schule* 16. Beiheft «Langsam vermisse ich die Schule...». Schule während und nach der Corona Pandemie, 153-162.

Fraillon, Julian, John Ainley, Wolfram Schulz, Tim Friedman, and Daniel Duckworth. 2019. *Preparing for life in a digital world. IEA International Computer and Information Literacy Study 2018. International Report*. Amsterdam: IEA.

Fuchs, Eckhardt, Inga Niehaus, and Almut Stoleztki. 2014. *Das Schulbuch in der Forschung – Analysen und Empfehlungen für die Bildungspraxis*. Göttingen: V&R unipress.

Götz, Margarete, Joachim Kahlert, Maria Fölling-Albers, et al. 2022. «Didaktik des Sachunterrichts als bildungswissenschaftliche Disziplin». In *Handbuch Didaktik des Sachunterrichts*, edited by Joachim Kahlert, Maria Fölling-Albers, Margarete Götz et al., 16-29. 3. Auflage. Stuttgart: Klinkhardt.

Hardy, Ilonca, Silke Hertel, Mareike Kunter, Eckhard Klieme, Jasmin Warwas, Gerhard Büttner, and Anim Lühken. 2011. «Adaptive Lerngelegenheiten in der Grundschule: Merkmale, methodisch-didaktische Schwerpunktsetzungen und erforderliche Lehrerkompetenzen». In *Zeitschrift für Pädagogik* 57 (6): 819–833.

Hattie, John. 2009. *Visible learning. A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Heimlich, Ulrich, and Susanne Bjarsch. 2020. «Inklusiver Unterricht». In *Studienbuch Inklusion*, edited by Ulrich Heimlich, and Ewald Kiel, 248-294. Bad Heilbrunn: Klinkhardt.

Hess, Miriam. 2019. «Hoch inferentes Rating: Qualität von Leseübungsphasen». In *Technischer Bericht zu den PERLE-Videostudien – Band 2: Beobachtungssysteme zur Beschreibung und Qualität von Grundschulunterricht*, edited by Miriam Hess, Ann-Katrin Denn, and Frank Lipowsky, 271–334. Frankfurt am Main: Gesellschaft zur Förderung Pädagogischer Forschung (GFPF).

Irion, Thomas. 2020. «Digitale Grundbildung in der Grundschule. Grundlegende Bildung in der digital geprägten und gestaltbaren, mediatisierten Welt». In *Digitale Bildung im Grundschulalter. Grundsatzfragen zum Primat des Pädagogischen*, edited by Mareike Thumel, Rudolf Kammerl, and Thomas Irion, 49–81. München: Kopaed.

Irion, Thomas, Markus Peschel, and Daniela Schmeinck. 2023. «Grundschule und Digitalität. Grundlagen, Herausforderungen, Praxisbeispiele». In *Grundschule und* Digitalität, edited by Thomas Irion, Markus Peschel, and Daniela Schmeinck, 18-42. Frankfurt a.M.: Grundschulverband.

KMK – Kultusministerkonferenz. 2021. *Lehren und Lernen in der digitalen Welt – Ergänzung zur Strategie der Kultusministerkonferenz Bildung in der digitalen Welt.* https://www.kmk.org/de/dokumentation-statistik/beschluesse-und-veroeffentlichungen/bildung-in-der-digitalen-welt.html.

Kobarg, Mareike, and Tina Seidel. 2007. «Prozessorientierte Lernbegleitung – Videoanalysen im Physikunterricht der Sekundarstufe I». In *Unterrichtswissenschaft* 35 (2): 148–168.

Koller, Hans-Christoph. 2014. «Heterogenität – Zur Konjunktur eines pädagogischen Konzepts». In *Heterogenität. Zur Konjunktur eines pädagogischen Konzepts*, edited by Hans-Christoph Koller, Rita Casale, and Norbert Ricken, 9–18. Paderborn: Schöningh.

Kounin, Jacob. 2006. *Techniken der Klassenführung*. Münster: Waxmann.

Krammer, Kathrin. 2009: *Individuelle Lernunterstützung in Schülerarbeitsphasen. Eine videobasierte Analyse des Unterstützungsverhaltens von Lehrpersonen im Mathematikunterricht*. Münster: Waxmann.

Kürzinger, Anja, Traugott Böttinger, and Lea Schulz. 2023, in print. «Kooperatives Lernen mit digitalen Medien im inklusiven Grundschulunterricht – Befunde eines videografischen Forschungsprojekts». In Videografische Forschung zu inklusivem Unterricht: erziehungswissenschaftliche und fachdidaktische Perspektiven, edited by G. Wilm, R. Koßmann, S. Böse, M. Fabel-Lamla and C. Meyer-Jain. Bad Heilbrunn: Klinkhardt.

Kunter, Mareike, and Voss, Thamat. 2011. «Das Modell der Unterrichtsqualität in COACTIV: Eine multikriteriale Analyse». In *Professionelle Kompetenzen von Lehrkräften – Ergebnisse des Forschungsprogramms COACTIV,* edited by Mareike Kunter, Jürgen Baumert, Werner Blum, Uta Klusmann, Stefan Krauss, and Michael Neubrand, 85-113. Münster: Waxmann.

Lange, V. 2017. *Inklusive Bildung in Deutschland*. Berlin: Friedrich-Ebert-Stiftung.

Lipowsky, Frank. 2020. «Unterricht». In *Pädagogische Psychologie*, edited by Elke Wild, and Jens Möller, 69-118. 3. Auflage. Berlin: Springer. https://doi.org/10.1007/978-3-662-61403-7_4.

Lipowsky, Frank, Christine Pauli, and Katrin Rakoczky. 2008. «Schülerbeteiligung und Unterrichtsqualität». In *Lehrerexpertise - Analyse und Bedeutung unterrichtlichen Handelns*, edited by Michaela Gläser-Zikuda, and Jürgen Seifried, 67-90. Münster: Waxmann.

Lotz, Miriam. 2016. *Kognitive Aktivierung im Leseunterricht der Grundschule. Eine Videostudie zur Gestaltung und Qualität von Leseübungen im ersten Schuljahr.* Wiesbaden: Springer VS. https://doi.org/10.1007/978-3-658-10436-8.

Miller, Susanne. 2022. «Profession und Disziplin: Spezifika und Entwicklungsperspektiven der Grundschulpädagogik». In *Professionalisierung von Grundschullehrkräften*, ed. Ingelore Mammes, and Carolin Rotter, 17-35. Bad Heilbrunn: Klinkhardt.

Pauli, Christine. 2012. «Kodierende Beobachtung». In *Beobachtung in der Schule – Beobachten lernen,* edited by Heike de Boer, and Sabine Reh, 45-63. Wiesbaden: Springer VS. https://doi.org/10.1007/978-3-531-18938-3_3.

Pauli Christine, and Kurt Reusser. 2000. «Zur Rolle der Lehrperson beim kooperativen Lernen». In *Schweizerische Zeitschrift für Bildungswissenschaften* 22 (3): 421–442.

Pauli Christine, and Kurt Reusser. 2006. «Von international vergleichenden Video Surveys zur videobasierten Unterrichtsforschung und -entwicklung». In *Zeitschrift für Pädagogik* 52 (6): 774–798.

Pfister, Mirjam, Elisabeth Moser Opitz, and Christine Pauli. 2015. «Scaffolding for Mathematics Teaching in Inclusive Primary Classrooms: A Video Study». *ZDM – Mathematics Education* 47 (7): 1079-92. https://doi.org/10.1007/s11858-015-0713-4

Pohlmann-Rother, Sanna, and Anja Kürzinger. 2019. «Die videogestützte Evaluation im Projekt dileg-SL. Leitfragen, Ergebnisse und Perspektiven für die Grundschullehrerbildung». In *Digitale Medien in der Grundschullehrerbildung. Erfahrungen aus dem Projekt dileg-SL*, edited by Thomas Junge, and Horst Niesyto, 263-276. München: kopaed.

Pohlmann-Rother, Sanna, Anja Kürzinger, and Frank Lipowsky. 2018. «Individuelle Lernunterstützung im schriftsprachlichen Anfangsunterricht: Formen, Verteilungsmuster und Wirksamkeit». In *Zeitschrift für Grundschulforschung*, 11, 315-332.

Pol, Janneke, Monique van de Volman, and Jos Beishuizen. 2010. «Scaffolding in Teacher-Student Interaction: A Decade of Research». In *Educational Psychology Review* 22 (3): 271-296.

Praetorius, Anna-Katharina. 2014. *Messung von Unterrichtsqualität durch Ratings*. Münster: Waxmann.

Rakoczy, Katrin, and Christine Pauli. 2006. «Hoch inferentes Rating: Beurteilung der Qualität unterrichtlicher Prozesse». In *Videoanalysen*, edited by Isabelle Hugener, Christine Pauli, and Kurt Reusser, 206–233. Frankfurt am Main: DIPF.

Rudolph, Steffen. 2019. *Digitale Medien, Partizipation und Ungleichheit. Eine Studie zum sozialen Gebrauch des Internets*. Wiesbaden. Springer VS. https://doi.org/10.1007/978-3-658-26943-2.

Schaumburg, Heike. 2018. «Empirische Befunde zur Wirksamkeit unterschiedlicher Konzepte des digital unterstützten Lernens». In *Digitalisierung in der schulischen Bildung*, edited by Nele McElvany, Franziska Schwabe, Wilfried Bos, and Heinz Günther Holtappels, 27–40. Münster, and New York: Waxmann.

Schaumburg, Heike. 2021. «Personalisiertes Lernen Mit Digitalen Medien Als Herausforderung für Die Schulentwicklung: Ein Systematischer Forschungsüberblick». *MedienPädagogik: Zeitschrift für Theorie Und Praxis Der Medienbildung* 41 (Inklusiv-mediale Bildung): 134-66. https://doi.org/10.21240/mpaed/41/2021.02.24.X.

Scheiter, Katharina. 2021. «Lernen und Lehren mit digitalen Medien: Eine Standortbestimmung». *Zeitschrift für Erziehungswissenschaft* 24 (5): 1039-1060.

Schluchter, Jan-Rene. 2019. «Methoden inklusiver Medienbildung». In *Handbuch Inklusion und Medienbildung*, edited by Ingo Bosse, Jan-Rene Schluchter, and Isabell Zorn, 198-206. Weinheim: Beltz Juventa.

Schmid, U., L. Goertz, and J. Behrens. 2017. *Monitor Digitale Bildung. Die Schulen im digitalen Zeitalter.* Gütersloh: Bertelsmann Stiftung.

Schnebel, Stefanie, and Sandra Wagner. 2016. «Kognitiv anregende Lernunterstützung in einem naturwissenschaftlichen Lernsetting». In *Zeitschrift für Grundschulforschung* 9 (1): 107–120.

Schulz, Lea. 2018. «Digitale Medien im Bereich Inklusion». In *Inklusion in Schule und Unterricht*, edited by Birgit Lütje-Klose, Thomas Riecke-Baulecke, and Rolf Werning, 344-367. Seelze: Kallmeyer.

Siemon, Jens, Antonia Scholkmann, and Tekla Paulsen. 2018. «Beschreibung von Formen lehrerseitigen Unterstützungsverhaltens im offenen Unterricht». *Zeitschrift für Bildungsforschung* 8: 19–41.

Stebler, Rita, Kurt Reusser, and Christine Pauli. 2016. «Wie Lehrpersonen Lernen unterstützen können». In *Profil: das Magazin für Lehren und Lernen* 2 (16): 6-9.

Quast, Jennifer, Charlott Rubach, and Rebecca Lazarides. 2021. «Lehrkräfteeinschätzungen zu Unterrichtsqualität mit digitalen Medien: Zusammenhänge zur wahrgenommenen technischen Schulausstattung, Medienunterstützung, digitalen Kompetenzselbsteinschätzung und Wertüberzeugungen». *Zeitschrift für Bildungsforschung* 11: 309-341.