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Classroom disruptions in digital teaching during the pandemic – an interview study

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Introduction: The pandemic increased the speed at which education had to evolve into the digital age. While digital tools create possibilities, new forms of classroom disruptions appear. Classroom disruptions as essential part of classroom management may take away students' precious learning time and the associated stress could put teachers' health at risk.

Methods: We conducted a semi-structured, guideline-based interview study with teachers from Germany and asked them about experienced disruptions in digital teaching (RQ1 and RQ2), their prevention and intervention strategies (RQ3) as well as their opinions on potentials and risks of the digital evolution in teaching (RQ4).

Findings: Findings show that digital teaching is affected by already known and by new types of disruptions. Teachers use their existing experiences to adapt to these new challenges. Simultaneously they reflect on the changes in teaching due to the increased digital involvement and identify potentials for improved teaching in the future.

Discussion: Based on the research literature and our interview findings a 2D graph of classroom disruptions is developed to systematize disruptions in context of digitalization.

KEYWORDS

classroom disruptions, classroom disturbances, classroom management, digitization, teacher education, interview, systematization

1 Introduction

Classroom disruptions steal precious time from learning. In the Teaching and Learning International Survey (TALIS) teachers reported that over 30% of their actual teaching time was spent dealing with disruptions (OECD, 2014). The YouGov surveys show that students are losing up to an hour of learning time each day due to disruptions in classrooms (Ofsted, 2014, p. 4). While students may be losing learning and development opportunities (Marquez et al., 2016), teachers' health is at risk when facing disruptions (Brouwers and Tomic, 2000; Ingersoll, 2001; Greene et al., 2002; Kokkinos, 2007; Gonzalez et al., 2015; Rajendran et al., 2020; Wettstein et al., 2021). As an additional challenge arising from the SARS-CoV-2 pandemic, education across the world has been rapidly forced into digitization (Cho et al., 2020; Daniel, 2020). Changes that occurred during the pandemic have shaped the way how teachers and students participate in teaching (Gross and McCann, 2022; Gülmez and Ordu, 2022; Lemov, 2022). New strategies for teachers, as part of their classroom management, were developed (Gross and McCann, 2022).

However, current research about disruptions deals only, if at all, with classroom management in general (Sepúlveda-Vallejos et al., 2023; Thiel et al., 2023; Zoder-Martell et al., 2023). There is only a marginal focus on the topic of dealing with classroom disruptions in the digital context, which is particularly important for pre-service and newly in-service teachers, since lockdowns, forced online learning, and frequent changes in requirements have made it hard, if not impossible, for these young professionals to refine their abilities in dealing with difficult situations (Marcum-Dietrich et al., 2021). Practicing teachers would also benefit from knowledge on this topic, since the relevant tools and tips are often updated, but teachers may not be aware of these changes (Moltudal et al., 2019).

2 Theoretical framework

The considerations of this study are based on various definitions and systematizations for classroom disruptions, teachers' behavior, and classroom management in general. Furthermore, current research shows that digitization and the pandemic have generated several challenges for educators worldwide (Sing Yun, 2023). To create an overarching framework and implement the current state of digitization in education into this, we first look at existing research on these topics.

2.1 Definitions and current state of research

Various terms, such as classroom disruptions, classroom disturbances, disorders, or disruptive/disturbing behavior, are used synonymously (Meinokat and Wagner, 2022). Exemplary definitions have described disruptions and disruptive behaviors as "behavior a reasonable person would view as being likely to substantially or repeatedly interfere with conduct of a class" (Stockton University, 2001, p. 1), "general issues hindering students' and teachers' classroom work" (Belt and Belt, 2017, p. 55), "any behavior that interferes with teaching and learning" (Franken, 2020, p. 445) or "behavior that seriously interferes with the teaching process, and/or seriously upsets the normal running of the classroom" (Infantino and Little, 2005, p. 493). What all these definitions have in common is the notion that a disruptive effect makes the actual teaching and learning process (temporarily) impossible. Drawing from a systematic literature review to transfer this quintessence to classroom disruptions in digital settings, digital teaching will be understood as "the generic term for online learning, digitally enhanced face-to-face learning, and blended learning, assuming that digital tools are used as technology to enable or support the respective form of teaching" (Meinokat and Wagner, 2022, p. 4671).

Aside from the above definitions, earlier research has tried to systemize, categorize and theorize classroom disruptions in various forms. For a better understanding, concepts taken from the literature to display classroom disruptions in a systematically way will referred to as systematization here. These systematizations can be fundamentally divided into two forms: systematizations that aim at being able to weigh classroom disruptions against one another, and those that distinguish between different types of disruptions (**Figure 1**).

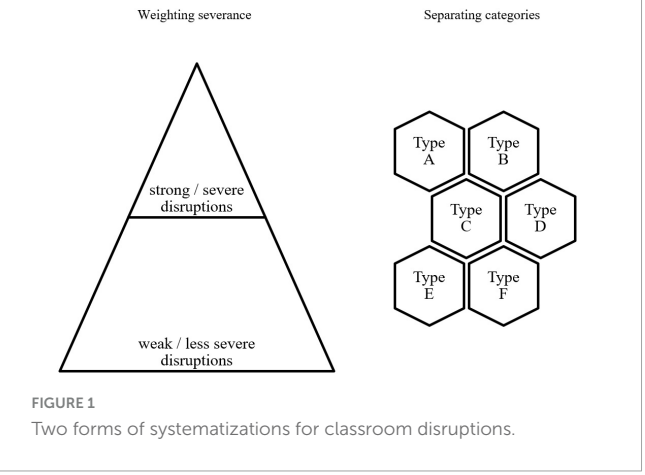

FIGURE 1
Two forms of systematizations for classroom disruptions.

Prime examples for systematizations that are separating disruptions into different types are Biller (1979), Lohmann (2011), and Winkel (2011). Biller (1979) separates classroom disruptions into four categories. They are named: (1) minor faults which include for example forgotten homework, (2) (in)direct disruptions which affect the classroom climate and the teacher-student-relationship, (3) unrecoverable disruptions which include disruptions that cannot be solved by the teacher alone (rather with the help of other professionals like psychologists), and (4) unavoidable disruptions which include all disruptions that simply cannot be avoided. Lohmann (2011) distinguishes into four categories as well: (1) verbal disruptions are disruptions by students through interjections, (2) lack of willingness to learn is shown by students lacking interest in the current subject, (3) motoric restlessness can be seen throughout physical movement of the students in times were such behavior is not expected, and (4) aggressive behavior refers to actions that try to harm others physically or emotionally. Winkel (2011) creates seven different categories: (1) disciplinary disruptions such as failure to follow the class rules, (2) provocation and aggression, which include aggressive behavior toward others, (3) permanent acoustic and visual disruptions, as well as restlessness and concentration seen by interjections or motoric movement, (4) disruptions from outside the class such as loudspeaker announcements, (5) refusal to learn and passivity which include non-attendance, (6) lack of motivation, which is reflected in the care with which the students complete their assigned tasks, and (7) neurotic disorders which include behavior that goes beyond a single classroom disruption situation.

While the above mentioned systematizations are generally based on non-digital settings, Li and Titsworth (2015) are the only ones so far that developed a scale, the Student Online Misbehavior Scale (SOMs), to connect disruptions to an online setting. In this scale the authors compose four categories of disruptions: (1) seeking unallowed assistance which includes cheating, (2) internet slacking seen by students using the internet for non-educational purposes, (3) aggressiveness which include physical and psychological actions in the classroom as well as in the virtual room, and (4) lack of communication such as failure to give answers or not being available. An overview of these categories is shown in **Table 1**.

Examples of systematizations that relate classroom disruptions to one another can be found in Cogswell et al.'s (2020) research on

TABLE 1 Categories for separating systematizations.

Non-digital setting			Digital setting
Biller, 1979	Lohmann, 2011	Winkel, 2011	Li and Titsworth, 2015
• Minor faults	• Verbal disruptions	• Disciplinary disruptions	• Seeking unallowed assistance
• (In)direct disruptions	• Lack of willingness to learn	• Provocation and aggression	• Internet slacking
• Unrecoverable disruptions	• Motoric restlessness	• Permanent acoustic and visual disruptions, as well as restlessness and concentration	• Aggressiveness
• Unavoidable disruptions	• Aggressive behavior	• Disruptions from outside the class	• Lack of communication
		• Refusal to learn and passivity	
		• Missing motivation	
		• Neurotic disorders	

TABLE 2 Severity weighting systematizations.

	Non-digital setting		
Severity	Cogswell et al., 2020	Rattay et al., 2018	Scherzinger and Wettstein, 2019
	• High-level classroom disruption	• Conduct disorders	• Aggressive
		• Behavioral problems	
		• Impossibility	
		• Interruption	
	• Low-level classroom disruption	• Impairment	• Nonaggressive

low-level classroom disruptions (LLCD) or Rattay et al. (2018), who distinguished between five escalation levels, as well as Scherzinger and Wettstein's (2019) systematization by aggressiveness. The authors created scales to distinguish how severe a classroom disruption is perceived. Cogswell et al. (2020) named their scale easy to understand: from low-level (perceived as less disruptive) to high-level (perceived as highly disrupted) classroom disruptions. Scherzinger and Wettstein (2019) named the dimensions of their scale in a different way. They separate from non-aggressive, and therefore non-directional, to aggressive, directional, and behavior. Rattay et al. (2018) give more stages of their scale, starting at the lowest and least disrupting dimension with impairments (e.g., students being distracted), going over interruptions (the flow of the lesson is disrupted), impossibilities (e.g., problems from outside the class are transferred into the class and make the learning process impossible), behavioral problems (e.g., a student is disruption repeatedly) to conduct disorders (e.g., developmental and adjustment disorders). While the first four stages are declared as situational behavior, conduct disorders are named over-situational and therefore go beyond classroom disruptions that consist of single situations and can be solved immediately. **Table 2** gives an overview.

2.2 Relation to classroom management

In a wider context, managing classroom disruptions is a part of classroom management (Durak and Saritepeci, 2017). According to Mulvahill (2018) "simply put, classroom management refers to the wide variety of skills and techniques that teachers use to ensure that their classroom run smoothly, without disruptive behavior from students" (Mulvahill, 2018, p. 1). Although researchers in educational science are aware that not only students can be disruptive in a classroom (Kearney et al., 2002; Scherzinger and Wettstein, 2019), and different perspectives inside a classroom create different views on classroom disruptions (Montuoro and Lewis, 2015; Wettstein et al., 2016; Eckstein, 2019), studies in this area have often been teacher centered (Meinokat and Wagner, 2022). This research about Classroom Management is focusing on general strategies to achieve the goal of having a smooth classroom environment (Zoder-Martell et al., 2023). Hereby, dealing with classroom disruptions is implied but not explicitly focused in latest research (Durak and Saritepeci, 2017; Zoder-Martell et al., 2023), often leaving the question open how to deal with it.

As one of their two priorities, the European Commission is urging for the enhancement of digital skills and competences (European Union, 2020). Teachers, as the initiators of good classroom management (Mulvahill, 2018), are focused here. The importance of their role in the process of managing the classroom and digitalizing the education process is obvious (Wohlfart and Wagner, 2023), leaving questions open for current research which competences, skills, and roles teachers need (Sepúlveda-Vallejos et al., 2023). Especially skills and strategies for teachers to deal with classroom disruptions are hereby only vaguely implied in general strategies and recommendations for classroom management (Durak and Saritepeci, 2017).

2.3 The influence of digitization and research questions

Although digitization, accelerated by the pandemic, has already found its way into most schools, science about the topic of digital teaching has still some conceptual ambiguity (Storch and

Juarez-Paz, 2019; Noor et al., 2020). While research on classroom management in general and its connection to digitization in particular is growing (Demir and Çatak, 2023), such limited developments show how slowly we have "entered the digital age" (Cho et al., 2020, p. 9). As classroom management consists of multiple aspects and areas (McLeod et al., 2003; Balli, 2011; Mulvahill, 2018), and dealing with disruptions is just one part of the process (Durak and Saritepeci, 2017), research that connects a focused view on classroom disruptions to digitization is underrepresented compared to work on classroom management in general (Meinokat and Wagner, 2022). Existing systematizations of disruptions, with the exception of that of Li and Titsworth (2015), are not based on a digital setting (Biller, 1979; Lohmann, 2011; Winkel, 2011; Rattay et al., 2018; Scherzinger and Wettstein, 2019; Cogswell et al., 2020) and existing research on digitization in education is missing the importance of dealing with classroom disruptions so far (Sing Yun, 2023). Furthermore, the special situation of the pandemic has resulted in a research gap that this explorative study tries to close. To generate useful information for practicing and future teachers regarding classroom disruptions in digital settings, the following research questions structure the present study:

(1) What forms of classroom disruptions occur in digital teaching?
(2) What are the underlying causes of classroom disruptions in digital teaching?
(3) How do teachers deal preventively with and intervene in classroom disruptions in digital teaching?
(4) What potential do teachers see when transferring elements of digital teaching from online teaching during the pandemic to face-to-face teaching?

3 Method

The explorative character of this study led to the adoption of a qualitative approach (Denzin and Lincoln, 2018). Data were derived from semi-structured guideline-based interviews, which were performed with 13 teachers from the state of Baden-Wuerttemberg, Germany, via Microsoft Teams in the period from May 18 to 28, 2021. The interviews lasted between 34 and 56 min (in total: 9 h and 31 min). Each interview was recorded, anonymized, and transcribed according to the transcription rules by Claussen et al. (2020). The interviews were conducted and transcribed in German, and quotations from the interviewees were later translated into English by the authors.

3.1 Participants

A purposeful sampling strategy based on the work of Patton (2015) was employed. As we wanted to generate various insights in teaching scenarios amongst different student ages, we invited teachers from the federal state of Baden-Wuerttemberg who taught classes of the secondary levels I and II (where students are between 10 and 18 years old). In addition, the teachers were required to have had different professional experiences from each other and to have taught different combinations of subjects. We considered whether the teachers had different workloads associated with extracurricular activities at their school, such as departmental management or collaboration on the media development plan commission, as well as different familial responsibilities. All teachers have taught before and during the pandemic. From all invited teachers, five female and eight male teachers, all teaching at gymnasium (highest form of secondary school in Germany) with an age range of 27–59 years, with various subject areas of expertise and different years of experience (1–27), took part in the interviews. The teaching load varied from 5 to 25 (highest possible) hours a week. Nine out of the 13 teachers performed additional functions in the school.

3.2 Interview guide

A semi-structured, guideline-based interview format was chosen to maintain the spontaneous character of an interview while keeping the conversation structured and comparable (Misoch, 2015; Bortz and Döring, 2016). The structure of the guidelines was modeled on the four-step procedure proposed by Misoch (2015). After starting with a brief section containing an overall introduction, background information, and data protection issues, the interview started with a general icebreaker question to set a friendly and trustworthy conversation climate. After that, the main part of the interview contained five questions, each accompanied by supporting questions, and all on the topic of teaching during the pandemic, as well as classroom disruptions. An overview of the questions, potential additional questions and relations to research questions is shown in **Table 3**. The interviews ended with the gathering of demographic information.

3.3 Analysis

The transcripts of the interviews were processed using the qualitative content analysis (QCA) approach adopted by Mayring (2014). Therefore, the transcripts were read multiple times by the authors, and segments were coded using the software MAXQDA Plus 2020. The codes were generated mostly deductively from existing research. First, the interviews were coded according to the four research questions of this study. Further coding iterations grouped segments according to their similarities and their differences, generating sub-codes. The procedure was repeated until no further sub-categories could be identified, and every segment was at least part of one code. In total, 208 coded text segments were used in this study.

4 Findings

The findings are shown separately for each research question.

4.1 Reported forms of disruptions

The 13 teachers mentioned a total of 58 situations that were coded as classroom disruptions. These disturbances were

TABLE 3 Interview questions.

Interview question (sub-questions)	Related research question
What classroom disruptions have you experienced in your digital teaching? (What happened/What was the setting like?) (Who was involved?) (What do you think: Why did the disruption occur?) (How did you react to the disruption?) (How did the students react to the disruption?) (How would you deal with this situation today?) (How do you think this situation can be avoided?)	RQ1: What forms of classroom disruptions occur in digital teaching? RQ2: What are the underlying causes of classroom disruptions in digital teaching? RQ3: How do teachers deal preventively with and intervene in classroom disruptions in digital teaching?
In your opinion, what new, digital experiences/tools can and will be retained after the pandemic? (What do these new possibilities bring with them in terms of (new) disruption potential?) (Do you think that the transfer of new opportunities into the post-pandemic phase can provoke disruption? If yes: Which? If no: Why not?)	RQ4: What potential do teachers see when transferring elements of digital teaching from online teaching during the pandemic to face-to-face teaching?

TABLE 4 Categories for classroom disruptions in digital teaching.

Code	Number of coded segments
Conversations and messages not related to the subject	11
Technical difficulties	11
Occupation with non-school content	9
Problems in operations	8
Missing communication	6
Exploit given administrative digital rights	5
Rule breaking	3
Extracurricular distractions	2
Psychological attacks	2
Overenthusiasm	1
Total	58

categorized into different codes representing different forms of classroom disruptions in digital teaching based on similarities and differences in a specific situation (Table 4).

The most mentioned form was conversations/messages not related to the subject (n = 11). In such cases, students would be talking off-topic, using the chat function and "sometimes just somehow writ[ing] several words in and let[ting] the chat go through" (M06), or using the shared note's function, which "seventh graders just wrote some shit into" (M07).

Teachers reported disruptions due to technical difficulties (n = 11). For instance, one teacher was inclined to ask, "can the Wi-Fi in the school handle it? Will the online connection break off? How good is the acoustic connection?" (M02). All these questions showed possible technical problems disturbing the class.

Difficulties with the technology can arose in other forms. For example, when there are problems with handling the PC, where "if you said, 'open the folder,' they took out their paper notepads and opened them instead of somehow clicking on any file directory" (W01) or certain specifications in software, like Zoom, where "you can just give yourself a name to join the conference with. If you ask the students to take their own name, 90% do it, maybe 5% don't want to, and the other 5% can't do it" (M08). These disruptions sometimes led to increased waiting times for students, which created more room for disruptions:

> *If, for example, I want to show them briefly how the app works, and three students are not ready yet, and everyone else has to wait for these three students, then of course there is a phase in which some have nothing to do but the other three maybe just sit in front of the computer and wait because the update graphic is showing. (W01)*

These sorts of disruptions are summarized as problems in operations (n = 8).

Once the digital tool was running (again), it could lead to another stated form of disruption: occupation with non-school content (n = 9). In particular, the permanent and easy access to the internet caused problems because "you can't control it very well when every student has a device or when the two of them have a device; are they really doing what they are supposed to do, or are they watching videos on YouTube?" (W05).

Another mentioned form of disruption was students not giving answers when asked questions or missing communication (n = 6). Teachers declared that to be normal, as indicated when one teacher said that this

> *is actually the classic case where you ask a question, or you want to involve a student or that you [. . .] want to involve the class and want to start a [. . .] conversation or discussion and you are sitting in front of 24 black tiles with initials on them and no one answers. (M05)*

Student actions in digital settings were not always aimed at improving the class. Some students exploited their given administrative digital rights (n = 5) when "they tried to call some girl from the parallel class and invite her to the meeting" (W03) or "they [. . .] just raised the [digital] hands of other students and said 'I think he will answer,' even though he did not want to" (W03).

Most of the students and teachers experienced these forms of disruption when they were in home schooling. During home schooling, extracurricular distractions led to disruptive situations (n = 2). For instance, in one case, such disruptions were

TABLE 5 Categories for causes of disruptions.

Code	Number of coded segments
Disruptions by infrastructure	15
Disruptions by organizational or administrative problems	8
Disruptions by lack of motivation and dissatisfaction	7
Disruptions by technical operating errors or inexperience	5
Disruptions by environmental influences	2
Total	37

described as encompassing situations where "the cat runs through the webcam" (M06).

Teachers also reported disruptions that occurred in digital environments, but which could also be found in a general, non-digital setting as well. Students broke previously established rules (n = 3), for example: "as soon as I leave the classroom, they think they can get up and walk around" (M01). The interviewees also reported direct psychological attacks on other students (n = 2) or disturbing overenthusiasm (n = 1).

4.2 Causes of disruptions

While classroom disruptions are determined by the point of view and determination of the reporting person, the causes for this are reported partly assumptions that can be categorized according to similarity. Five different reasons for classroom disruptions were suggested by the teachers (Table 5).

The most frequently mentioned causes of disruptions were related to infrastructure (n = 15). Teachers explained that the situation with the given technology sometimes "was problematic [. . .], because depending on what kind of attachment they wanted to add, our school e-mail system did not allow us to send 20 megabytes" (W01). More generally, one teacher indicated that "the technical equipment is simply not yet stable" (M01).

Even if the technical infrastructure was capable of the task, technical operating errors, or inexperience (n = 5) were also reasons for disruptions: "Somehow, people turn on the camera and distract everyone because they are now fetching their cocoa, eating their muesli, or forgetting to turn off their microphone" (M02).

In some cases (n = 8), the teachers attributed the cause of the disruption to organizational or administrative problems. This affected not only their own organization, but it also concerned the administrative requirements they were expected to meet. M04 described such a case when talking about a hybrid setting, he was teaching in: "I have to deal with half a class in the classroom at the same time, then, of course, I am no longer there at the computer [to] answer questions that arise [here]."

Another source of distraction were environmental influences (n = 2). I was reported that "one of the schoolgirls forgot to turn off her microphone and then made fried potatoes in the background" (W05).

Since the reason for this specific period of online learning was the pandemic, teachers also saw the lack of motivation and dissatisfaction (n = 7) of the students as an underlying cause:

TABLE 6 Categories for intervention strategies.

Code	Number of coded segments
Verbal interventions	14
Disable functions/delete posts	9
Improvised solutions	3
Break in class	3
Exclusion	3
Total	32

TABLE 7 Categories for prevention strategies.

Code	Number of coded segments
New abilities in digital teaching and the administrative assignment of rights	10
Rule setting	8
Create motivational and interesting classes	8
Involving parents	2
Adjusting expectations	1
Total	29

> *There were also a lot of people who were very dissatisfied with this situation, so that many also found this change—with now sometimes being there [in school], sometimes being at home—so stupid, and somehow you can't really make progress [. . .]. Your friends [are] in the other group; they are now at home, and you are at school yourself, and of course it would be nice if you could at least see your friends at school, and it would just be one of them. Yes, none of the problems were in the subject being taught, nor was it something with me, just this inner dissatisfaction that they had, that, somehow, they had to get out. (W04)*

4.3 Prevention and intervention strategies in digital teaching

In total, 32 intervention strategies and 29 prevention strategies were coded in the transcripts. Tables 6 and 7 show overviews of the generated categories for these types of strategies as they are explained later.

4.3.1 Intervention strategies

As seen in Table 6, the major component of the intervention strategies used by the teachers was verbal (n = 14). Examples of this sort of strategy were the following: "then I say, 'leave it, or there will be trouble"' (W01), and "you say that [the students should stop] once and then it has mostly been cleared up" (M08). These strategies were mentioned multiple times for online settings as well as for others.

If a verbal intervention was not appropriate, disabling functions or deleting posts without a comment (n = 9) was a quick solution (M04). Here, the teachers took advantage of digital

features in the learning environment. Sometimes the teachers had to find improvised solutions (n = 3), even in cooperation with the students (W02).

Two more radical intervention strategies chosen were a total break in class (n = 3), where "the entire lesson was [. . .] paused" (W04), or an exclusion of the disruptive student (n = 3): "if something happens, then you kick them out of the conference, say they can no longer participate today, and then they are simply blocked from the conference and are gone" (M08).

Generally, the teachers reported mostly about their strategies in an online setting, but some of the mentioned strategies can be used in other settings as well. They were not asked to specify what setting they were in when using the strategies.

4.3.2 Prevention strategies

To prevent disruptions, many teachers used their new abilities in digital teaching and the administrative assignment of rights (n = 10). For instance, according to one teacher, "there is an authorization function [. . .], which I have now switched on" (M07). With this function the teacher was able to control entry to their online classroom as well as what features students can use in the online environment.

They set rules (n = 8) to make it clear what students "are allowed to do and what not" (M06), a strategy that was reported in all three forms of online, hybrid, and face-to-face teaching.

The teachers also tried to create motivational and interesting classes (n = 8) because "the more you get them involved and they do their own work, or the more you let them exchange ideas via group rooms, the lower the risk of them losing interest or wanting to be distracted" (M06).

Sometimes, especially in home schooling settings, it was necessary to involve the parents (n = 2): "we also tried to make it clear through the parents that you don't need a cell phone during class, and that they [the parents] are allowed to go into the room here and there" (M03).

One teacher declared the rise of their own frustration level as a strategy to prevent seeing some situations as disturbing. Generally spoken, the teacher was able to change the way what he defines as a classroom disruption for himself. Disruptions that would have been bothering in the past were now seen as no disruption for the interviewee. This adjustment in expectation (n = 1) prevents disruptions from being impactful.

Most of the prevention strategies were applicable to online lessons. This could also be explained by the fact that the teachers taught online for the most part during the period covered by the interviews. Otherwise, almost one-third of the strategies were usable in other settings.

4.4 Potentials for transfer from online to face-to-face teaching

Teachers often referred to times before the pandemic or tried to compare the circumstances of the pandemic to a non-pandemic situation. The interviewers asked the teachers if they predicted any disruptive potential during the transition from online teaching during the pandemic to face-to-face teaching.

TABLE 8 Categories for disruption potentials in the transition.

Code	Number of coded segments
Getting used to/new habits	5
New technical equipment	4
New opportunities	3
Need for new rules and infrastructure	2
Learning deficits	1
Total	15

4.4.1 Disruption potential in the transition

An overview of categories for disruption potentials in the transition can be found in Table 8. The change in teaching created new habits, and teachers saw disruptive potential in the adaption to these new behaviors (n = 5): "it is certainly possible that students will have to get used to it again." (M07).

The teachers recognized that the forced change in teaching brought forth new possibilities. This generic formulation also opened a wide field of possible problems. Thus, some teachers (n = 3) asked themselves critical questions: "what will happen to teachers who are sick in the future? Are you still expected to post learning material online? Is it expected that students who are sick will be provided with learning material at home [. . .]?" (M04). Teachers saw the impact of pandemic teaching first-hand, and one of the interviewees expected problems due to the learning backlog generated during this phase of teaching. This problem was considered subject-related:

> *Students who were now pulled through under pandemic conditions would probably not have made the transfer [to the next grade] under normal circumstances. This certainly creates potential for conflict between the students, between teachers and students, and certainly between [teachers and] the parents. (W04)*

The most obvious change through digital teaching, the usage of new digital tools, was considered to have disruptive potential as well (n = 4). Teachers predicted that

> *other problems will certainly arise now as well. We now have some students who would like to continue working with the iPad [. . .]. They bought it for home schooling, and now they are familiar with it, so they would like to continue using it. (M03)*

This usage of new digital tools came along with the implementation of new rules, and the lack of such rules was another potential for disruption mentioned by teachers (n = 2).

The pandemic creates a learning deficit what is seen to be a potential cause for disruptions (n = 2).

4.4.2 Potential from the more frequent use or overuse of digital tools

Table 9 shows that teachers saw a variety of potential advantages. For example, file sharing online (n = 8), like "put[ting] the solutions on Moodle [. . . so] I get feedback from the students"

TABLE 9 Categories for potentials from the more frequent use or overuse of digital tools.

Code	Number of coded segments
File sharing	8
Multimedia usage/differentiated access	6
Better/easier communication	6
Easer use	5
Easier administration	3
No need for presence	2
Data backup	2
Total	32

(W04), was thought to benefit the organization, and teachers reported that they "no longer [needed to] copy things, but instead could say, 'you have it as a PDF"' (M02).

In general, the teachers saw that the work with digital tools became easier and more efficient (n = 5). According to one teacher, "It [the use of online learning platforms] is now so well established that it works" (M04). This also applies to the administration and the overall organization, which became easier to handle and benefited from the use of digital tools (n = 3). Teachers felt more confident in trying new things, like, for example "booking the computer room online" (W05).

The new ways to convey knowledge made it easier for the teachers to enact different approaches (n = 6), and as one teacher stated, "in the future, [. . .] when it comes to homework, [. . .] I will use such learning videos more often" (M06).

The interviewees reported that the reduced need to be personally present and mediate in person (n = 2) was a good opportunity to reduce stress. This also applied in the case of the "many meetings, sessions, parents' evenings, and so on" (M04) that the teachers were normally expected to attend.

Better and/or permanent communication (n = 6) was reported as potentially effective in avoiding possible disruptions. Teachers thought "that students are now daring to seek direct contact with the teacher" (M02).

Two interviewees reported on the benefits of data backup (n = 2), which would potentially come in handy to avoid disruptions in the future preparation of classes.

4.4.3 Potential for less frequent use or underuse of digital tools

In five cases, teachers reported that they would not use (parts of) the newly implemented digital tools because they saw either disruption problems or declared that non-digital solutions were more likely to lead to higher educational outcomes. Some teachers "believe [. . .] that the children will need more of the conventional approach again" (W02):

> *I believe that by the time the pandemic is so far over that everyone can go to schools, one thing or another has already changed. For instance, I think communication will definitely be different in the long term. But I think some things like MS Teams or BigBlueButton will no longer have the status they have now for a long time. (W01)*

Teachers already see changes in their classes, regardless of whether they evaluate them as positive or negative. Such an assessment is the responsibility of each individual teacher.

5 Discussion

The findings provide numerous opportunities for further discussion. In particular, the necessary adaptions to the theoretical framework, the dependency of actions on certain settings, and the impact of the pandemic will be discussed in detail as well as the limitations of this study.

5.1 Necessary adaptions to the previous framework

The findings show that existing systematizations of classroom disruptions by different authors, need adjustment. Referring to the systematizations of Rattay et al. (2018) and Cogswell et al. (2020), both systematizations can be merged. From impairment to conduct disorder, the categories also represent an increasing escalation, which is comparable to the development of low-level to high-level classroom disruptions. Across these levels, Scherzinger and Wettstein (2019) have differentiated between directional, aggressive and rather undirectional, nonaggressive disruptions. In considering these systematizations in relation to one another, a 2D graph can be created where the x-axis is scaling according to Scherzinger and Wettstein (2019) and the y-axis is scaling according to Cogswell et al. (2020) and Rattay et al. (2018) (**Figure 2**).

To implement the 2D graph of classroom disruptions, specific examples must be chosen and inserted into the graph. It is important to state, that this is representing a single point of view, for example, the point of view from a teacher, who perceived disruptions during lesson and is now trying to classify them to systematically decide how to deal with them in the future. Categories of disruptions, such as those proposed by Biller (1979), Li and Titsworth (2015), Lohmann (2011), and Winkel (2011), can be used for implementing with caution since the disruptions they contain can vary in their position on both axes. For example, a disruption like a talking student who distracts a classmate with a question could be a directional or an undirectional disruption (Scherzinger and Wettstein, 2019), depending on the intention of the initiating student. It also can be a very low-level disruption, if it is not affecting the class heavily or a rather high-level disruption (Cogswell et al., 2020), when it happens more often and disrupts more than just the two students involved.

The SOMs by Li and Titsworth (2015) is the only systematization to provide categories that relate to disruptions in digital settings. The teachers were interviewed about their experiences in this particular setting and our approach is based on this conceptualization. Thanks to its name, category aggressiveness (AG) can easily be placed within the graph. Aggressive behavior, such as being "aggressive toward the teacher"

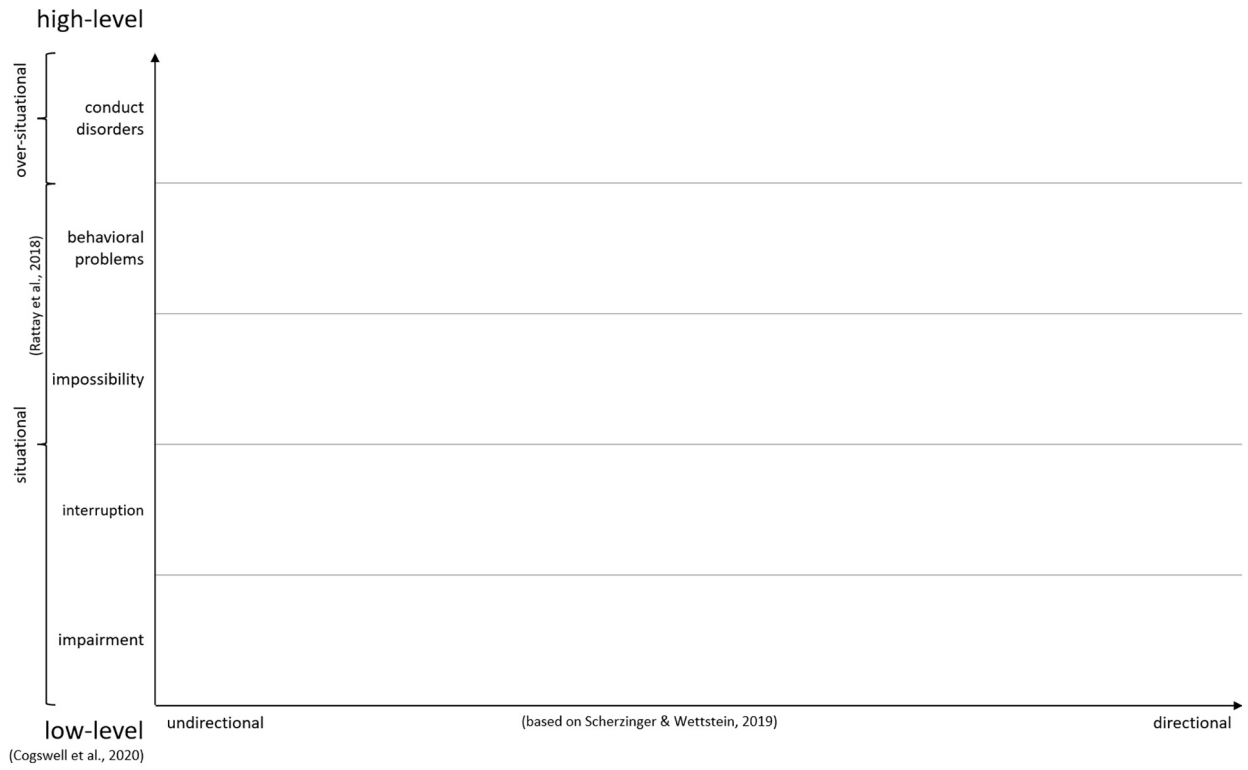

FIGURE 2
2D graph of classroom disruptions.

(Li and Titsworth, 2015, p. 46), can imply the impossibility of continuing to teach and indicates general behavioral problems. This shows very directional behavior. Therefore, AG can be included as high-level and directional in the 2D graph of classroom disruptions. A lack of communication (LoC) makes it impossible to generate a productive teaching-learning environment. However, the degree of directionality is unclear here. It seems more plausible that missed communication is at least intentional on one side. Slacking on the internet (IS), for example, by or because of procrastinating (Li and Titsworth, 2015, p. 46), is not reported as aggressive or directional. If anything, this activity only interrupts the class for a short moment. This is generally reported as a problem for one student at the time, unlike seeking unallowed assistance (SUA), where at least two students have to be involved. Therefore, this category must be classified a bit higher depending on its escalation level. Furthermore, this behavior is based on a directional decision from the student and therefore can be placed accordingly on the graph. An example of placing those four categories into the graph is shown in **Figure 3**.

Depending on the situation and ones' personal thinking about the severity of the disruptions, the placement of categories may vary. None of the mentioned categories reached the level of conduct disorders. According to Rattay et al. (2018), this is to be expected since conduct disorders are on a level that is beyond daily classroom disruptions. As mentioned, when deciding which systematization suits the best for choosing categories for disruptions to put them into the graph, some of the disruptions reported by the teachers do not fit into the existing categories, such as the exploitation of given administrative rights, the violation of established rules, operating errors, technical errors, and non-topic-related use of the chat/note's functions. To implement these disruptions, three more categories were generated and added to the already-mentioned categories by Li and Titsworth (2015). These include technical errors (TE), operating errors (OE), and illicit social behavior (ISB). TEs occur, for example, when students cannot connect to an online meeting, as mentioned by M08. Such issues make teaching impossible, but they are not clearly indicative of directional behavior on the part of the student. OE, as exemplified by M02s' description of student's forgot to turn off their microphone, can be both very directional and undirectional. In this case, forgetting the microphone setting is undirectional and interrupts the class for a moment. Finally, ISB is based on a more directional behavior of a student, and its impact at least interrupts teaching, if not worse. For example, W03 mentioned that some students invited another student from a parallel class to their meeting when they had the chance to do so. This intentional behavior interrupted the session and forced the teacher to pay attention to this situation. In **Figure 4** these new categories are added into the graph as shown earlier.

Again, based on the specific disruption chosen for each category, placement on the graph may vary, according to the person choosing. Putting examples on this graph provides two advantages for teachers. On the one hand, teachers can see the number of disruptions and their escalation levels and therefore predict the impact disruptions have on their teaching. On the other hand, if disruptions are (un-)directional, this gives indications of the causes of the disruptions for the teacher.

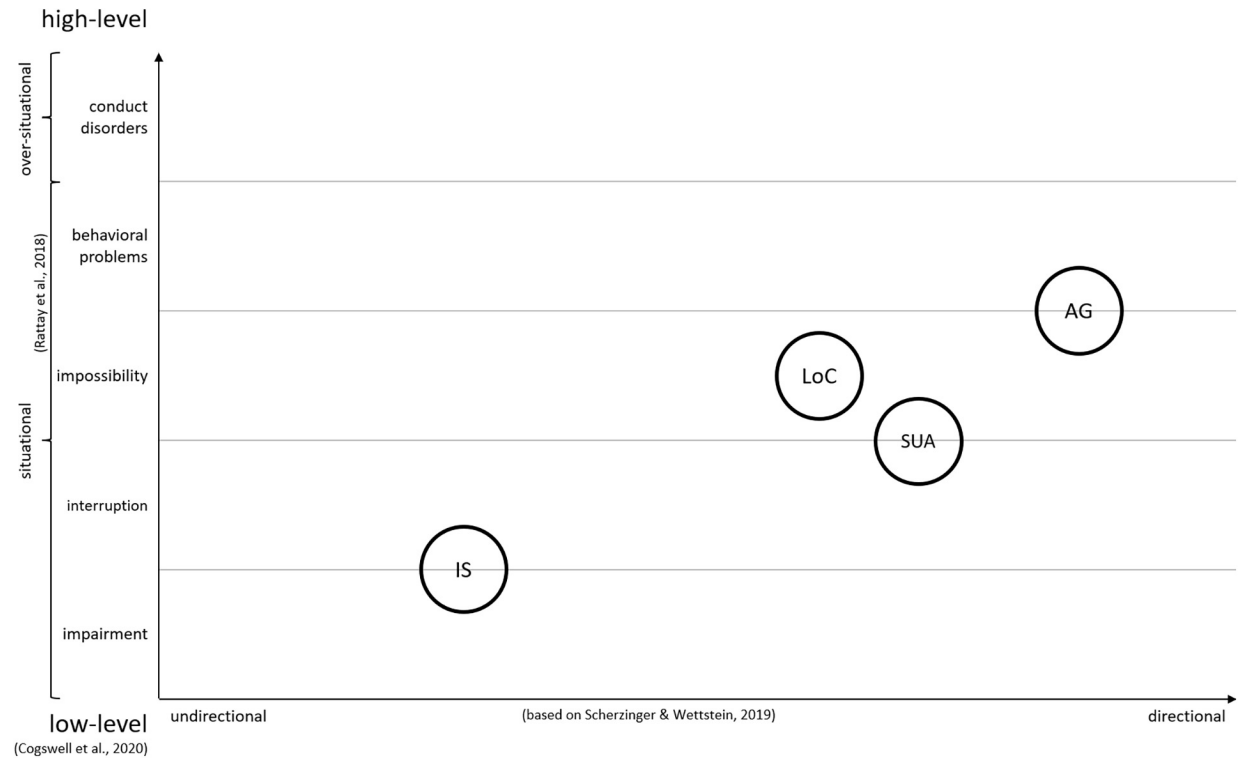

FIGURE 3
2D graph of classroom disruptions with categories from Li and Titsworth (2015).

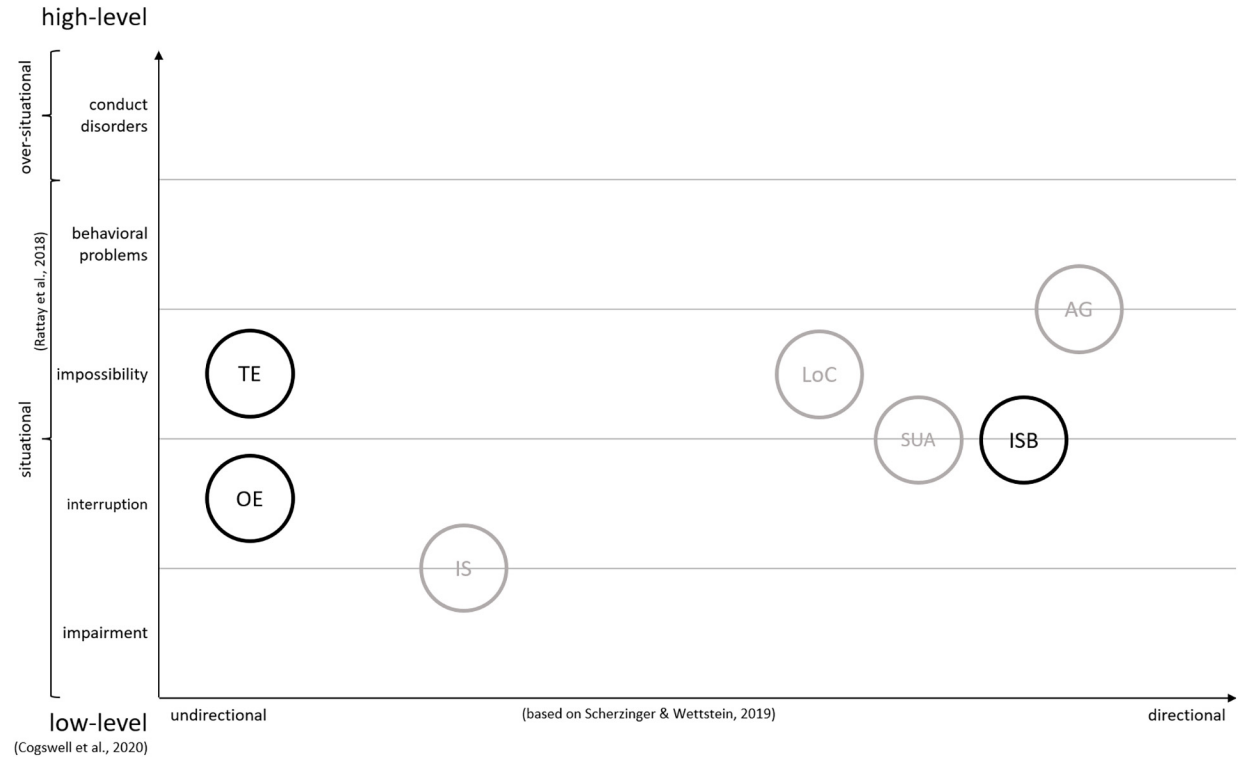

FIGURE 4
2D graph of classroom disruptions extended by categories found in this study.

5.2 Necessity to change teachers' strategies

The reported disruptions in digitally enhanced face-to-face settings show that already existing disruptions were still present, while new sorts also appeared. As demanded by the European Commission, teachers must enhance their digital skills and competences (European Union, 2020) and according to the findings of this study, teachers are already adapting their existing strategies to new developments. This goes along with the findings of Zoder-Martell et al. (2023), where classroom management systems in form of different strategies are used to keep students on track of class. Attentive and academically engaged students (Zoder-Martell et al., 2023) are less likely to disrupt the classroom (Li and Titsworth, 2015; Durak and Saritepeci, 2017; Rattay et al., 2018) and more likely to achieve academic success (Marquez et al., 2016). Furthermore, these adaptations help teachers to effectively deal with classroom disruptions and therefore decrease the amount of stress they are experiencing (Wettstein et al., 2021; Sepúlveda-Vallejos et al., 2023).

Both the prevention and intervention strategies chosen by the teachers are highly dependent on the setting in which they are located, as suggested by Lohmann (2011). It can be assumed that certain properties of the respective setting, such as the spatial dimension or physicality, determine which strategies teachers prefer more than others. A majority of the enacted strategies can be found in the categories of verbal interventions (i.e., an intervention strategy). Verbal communication (and therefore a verbal intervention, if needed) is the main form of interaction in the online setting. This can easily be explained by the missing physicality due to distance learning. In a face-to-face setting, verbal interventions are used by teachers as well. However, due to other possible interventions because of the physical setting, other strategies are used more frequently than they may be in the online setting. Before the pandemic, the teachers were not used to this form of teaching. They were forced into this new setting (Cho et al., 2020; Daniel, 2020) and, according to the teachers interviewed, found that the strategies they had used before on a regular basis were no longer unadapted applicable. At the same time, the teachers reported that new opportunities emerged that were not likely to be discovered without the forced change in settings due to the pandemic. Examples are new ways to interact with students and new ways to convey knowledge. We believe that one important aim of our research here is to advise teachers that new possibilities have to be examined, alternative solutions have to be developed, and (future) teachers have to be instructed on these new possibilities. According to Lemov (2022), students (amongst others) have changed during the pandemic. The rise of smartphone and social media (Lemov, 2022) is one example of what teachers have to adapt to. This is supported by the different views on classroom and schools returning to the school after the pandemic (Gülmez and Ordu, 2022). According to the challenges that digitization brings to the educational systems worldwide (Sing Yun, 2023), the findings of this interview study show that teachers are at least subconsciously aware of this need to adapt and are already (and inevitably) adapting.

In hybrid settings, one form of the digital settings (Meinokat and Wagner, 2022), the teachers reported organizational problems arising more often than in the other settings. Having one-half of the class being present in the classroom and the other half connected to the class over the internet tasked the teacher with having to manage two separate places at the same time. In other words, the teachers had to expand their spatial perception into the digital room, a skill that no teacher had learned before. This shows, that the teachers interviewed support one of the four main themes for digitization challenges as stated by Sing Yun (2023, p. 15): "Digital Competence and Pedagogy Challenges." It is also supporting evidence for the demand of the European Commission (European Union, 2020), although still lacking a sufficient solution to the teachers problems. While this challenge was already demanding for the teachers, they also often had to deal with technical and organizational difficulties as well. It is easy to imagine that the strategies teachers had used so far to keep the classroom operations running smoothly were now partly unusable. To generate more space for teachers to focus on both the students and the teaching subject, teachers need to be prepared and supported during this challenge. A total of 10% of the reported disruptions were in such a form that teachers saw the urgent need for the school administration and political authorities to create realistic expectations and a solid infrastructure again supporting a main theme of Sing Yun (2023, p. 15) "Challenges to Sustainable Development of a Digitalized Learning."

5.3 Constantly changing demands

With the findings of this study, we were able to improve the state of research developing a graph to systemize and prioritize classroom disruptions. Furthermore, the mentioned adaption of strategies show, that we are already in a changing environment when it comes to daily educational practices (Lemov, 2022). When asked about the process of this transformation, teachers respond mostly optimistic in terms of usefulness of digital settings as well as their perceived change in roles. During the interviews, teachers acknowledge their change to a more moderating position inside the classroom rather than an instructive one. As seen in the overview from Wohlfart and Wagner (2023), this change is perceived in many countries. This leaves the question open how international teacher education is addressing this adaption. The teachers in the interviews already see benefits in using digital tools such as video technology for their instruction. Research shows that this is also happening in teacher education at universities (Thiel et al., 2023) as well as used by educators for their already practicing teacher colleagues (Biermann et al., 2023). Further research is advisable so that future teachers can develop the skills and competencies needed (European Union, 2020).

While the teachers report positive effects of newly found communication between teachers, students, and parents, it has to be critically asked what such changes lead to in terms of psychological health for teachers (Rajendran et al., 2020). Being available most of the day and combining this with the already high commitment to their profession, teachers should pay close attention to their work-life balance and be aware of the risks of burnout (Kokkinos, 2007). This is not only necessary for the fact that more teachers are required worldwide (Bümen, 2010), it is also a problem for students and their academic achievement (Klusmann et al., 2016). When teachers are aware of this problem,

the digitization can be used to address certain challenges (Sing Yun, 2023). The interviewees mention an easier organization through digital tools as well as the possibility to attend meetings from a distance as examples. In terms of optimization and sustainability research has to investigate what will last.

5.4 Pandemic's influence and future directions

As we see from the discussion so far, the pandemic acted as a catalyst for changes in education. Wohlfart et al. (2021) stated that the pandemic has had a great impact on teachers' attitudes toward digital education. This is underlined by the findings shown in section "4.3 Prevention and intervention strategies in digital teaching." Although the pandemic is still affecting the world partly at this point, more and more societies and education systems have paved their way back to some sort of normality or as Gross and McCann (2022, p. 10) state: "returning [back] to more than normal." The predictions made by the teachers are now being tested daily.

While Wohlfart et al. (2021) made more general statements about teachers' acceptance of technology, the findings and discussion of this study show, for the first time, the direct effects that can be examined in real school scenarios at the moment, according to the teachers asked. Digital teaching, in the form of online, hybrid, and enhanced face-to-face learning, and the disruptions coming with it, will probably become more standardized in future education. Our findings go along with contemporaneous research findings, supporting the challenges for digitization in education (Sing Yun, 2023) as well as experienced and expected changes in (social) behavior (Lemov, 2022). Teachers views on classrooms after returning to school after the influence of the pandemic in other parts of the world (Gülmez and Ordu, 2022) go hand in hand with the statements of our interviewed teachers, showing that educational systems worldwide suffered similar problems and can profit from more international research. Teachers already benefit from the experiences they have had and the skills they have developed while adapting to digital settings and will certainly profit the other way around. Our findings allow us to assume that these experiences, skills, and tools will endure over the pandemic, and digital teaching will lose its status as a new, special, or alternative mode of instruction. Therefore, it is not desirable to generate new models or systematizations of classroom disruptions, especially in digital settings. Merging adaptions into existing research (Biller, 1979; Stockton University, 2001; Scherzinger and Wettstein, 2019) and expanding existing systematizations (Li and Titsworth, 2015) allows future researchers and teachers to generate a better overview of their teaching and better prepare for classroom disruptions and their challenges (Lemov, 2022; Sing Yun, 2023). Rather than assigning research on this topic in digital settings a separate status, it supports the prediction that digital teaching will enhance existing teaching and create new possibilities for better learning outcomes in the future. This, of course, creates additional complexity and new challenges. However, with this integration, teachers will be able to face these challenges through their accumulated experiences and benefit from their newly gathered knowledge to further enhance their teaching. Particular attention should be paid to the future development of hybrid/blended settings, especially from the point of view of internal differentiation.

5.5 Limitation

Educational lessons consist of at least three components: a teacher, students, and a subject. This study took a closer look at only one of these components: the teachers. A study that will account for all three perspectives at the same time might become too expansive and miss the in-depth perspective that is often required. Therefore, the authors decided to look at one perspective at a time, knowing that this limits the insights gathered about the overall topic of classroom disruptions in digital teaching.

The sample size was also limited. The information gathered from 13 qualitative interviews provides ample opportunities to obtain insightful information about teachers' perceptions regarding classroom disruptions but cannot generate a complete overview over common practices for all teachers. Due to the exceptional situation of the pandemic, the willingness of the teachers to participate in interviews, and the practicability of conducting those interviews, this limitation is accepted, knowing well that larger samples would have generated more data, and using a different methodical approach could also provide further insights.

As mentioned in the discussion, the use of the 2D graph is highly depending on the person using it. It gives a framework for a single individual to systemize experienced disruptions. This generates the possibility to collaboratively work on strategies for classroom disruptions. Nevertheless, the graph could receive further improvements to generate a standardized tool. This might be difficult since different perspectives always will have uncertainties about comparability and the view on disruptive situations is highly subjective. In addition, the students' point of view would generate even more complexity, which still is needed for an attempt of a mutual understanding of teacher and students.

6 Conclusion

While students lose precious time for learning due to classroom disruptions (Marquez et al., 2016), such situations are also one of the biggest health issues for teachers of all experience levels (Wettstein et al., 2021). To gain insight into classroom disruptions from a teacher's point of view, qualitative guided interviews were held with 13 teachers from secondary schools in Baden-Wuerttemberg, Germany. These teachers were asked to describe disruptive situations (RQ1) and their possible causes (RQ2). Prevention strategies to avoid a disruption before its occurrence and intervention strategies to deal with them when they are occurring were also discussed (RQ3). Finally, teachers reported their thoughts about the possible problems that could arise from the transition from pandemic-caused online teaching to digitally supported face-to-face teaching (RQ4).

The findings show that existing systematizations of classroom disruptions need adjustment to integrate digital teaching. Thus, we generated a 2D graph for classroom disruptions to account for specific situations according to their impact on the teacher/lesson

and the intention the students had. Based on the SOMs developed by Li and Titsworth (2015), we were able to generate a systematization that included categories of digital teaching for the first time.

The strategies used by the teachers depended on the setting in which the teaching was carried out. These and other insights from the findings, as well as international research, show that research does not have to view digital teaching as a special form, but instead as an integral part of all teaching in the future.

Considering the limitations of this study, future research should focus on other perspectives on classroom disruptions and concentrate on specific areas of digital teaching.

Data availability statement

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

Ethics statement

Ethical approval was not required for the studies involving humans because no ethical approval is needed for an interview study about this research topic. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

PM: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. IW: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Validation, Writing – review & editing.

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Conflict of interest

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

Publisher's note

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