# Vorschlag 1:

Eyes on the Classroom – How Teacher Expertise Shapes Gaze Behavior and Classroom Management

# Vorschlag 2:

Who Masters Classroom Disruptions - Expertise Differences in Classroom Management and Gaze Behavior in a Laboratory Setting

# Abstract

*Keywords:* classroom management, professional vision, eye-tracking, expertise differences, managing classroom disruptions

# Introduction

Classroom disruptions, such as students chatting with neighbors or nervously clicking their pens, significantly hinder learning processes by consuming instructional time (Keller, 2014). Managing these disruptions effectively is essential to successful classroom management (Helmke, 2022). Teachers’ professional vision is central to effective classroom management – the capacity to selectively notice, interpret, and respond to critical classroom events based on their knowledge (Goodwin, 1994; Sherin & van Es, 2009). Professional vision thus connects (strategic) knowledge with action, enabling teachers to anticipate and address potential disruptions – a skill known as “monitoring” (Gold et al., 2016).

Expert teachers differ from novices particularly in their refined ability to filter relevant cues within complex classroom interactions (Barth, 2017; Berliner, 2001). Novices often struggle precisely because their professional vision is less developed (Berliner, 2004; Emmer & Gerwels, 2006). Process-based research methods, such as eye-tracking, offer deeper insights into teachers’ cognitive processing and visual attention during teaching (Dessus et al., 2016; van den Bogert, 2016). Studies demonstrate that expert teachers exhibit more efficient gaze patterns (Gegenfurtner et al., 2020; Wolff et al., 2016). Understanding how visual attention relates to effective classroom management thus holds significant potential for improving teacher education by enhancing professional vision and associated response strategies (Grub, 2023).

This study examines differences in gaze behavior, self-reported classroom management, and strategic knowledge between experienced and inexperienced teachers in a controlled micro-teaching unit involving classroom disruptions. Using eye-tracking technology and self-report measures, it explores how expertise influences visual attention, disruption noticing, and management strategies toward classroom disruptions.

**Classroom Disruptions**

The ability to anticipate and respond effectively is particularly vital when addressing one of the most persistent challenges in educational settings: classroom disruptions, which can impair instructional time, weaken student engagement, and hinder academic achievement (Chow et al., 2024; Kraft & Monti-Nussbaum, 2021; Marder et al., 2023).

Disruptions, as described by Lohmann & Meyer (2003), are events that interfere with the essential conditions necessary for effective instruction and student participation. These behaviors can generally be categorized into four primary types, based on their nature and impact on classroom dynamics (Lohmann & Meyer, 2003). *Verbal disruptions* include spoken interruptions such as chatting, whispering, or heckling, which can disturb lesson flow and diminish focus. *Physical disruptions* refer to motor restlessness or unnecessary physical activity, like drumming on desks, snipping fingers, or clicking pens, which distract both teachers and students. Indicators of a *lack of eagerness to learn* manifest through disengagement behaviors, such as drawing, resting one’s head on the desk, or using a phone, actions that reduce participation and hinder comprehension. Finally, *aggressive behavior* encompasses hostile actions or emotional outbursts, including yelling, defiance, or physical confrontations, all of which threaten the classroom’s safety.[[1]](#footnote-2)

A crucial concept in understanding these disruptions is salience, which refers to how noticeable a behavior is within the classroom context (Kilbury et al., 2024) and thus directly influences teachers’ noticing as a critical aspect of effective disruption management. Highly salient behaviors, such as loud outbursts, naturally draw immediate attention, whereas subtle, non-salient behaviors can be equally detrimental over time if left unaddressed.

The complexity of managing disruptive behavior is further intensified by its subjective interpretation, influenced by both the behavior and the perceptions of teachers and students (Eckstein et al., 2016). This dual perspective requires educators to develop an acute awareness of both conspicuous and subtle indicators of disruption.

## Classroom Disruption Management

Effective classroom management is a core competence for teachers to contribute to reducing the frequency of disruptions, as lessons that are stimulating, individualized, and cognitively engaging are associated with fewer interruptions (Wettstein et al., 2010). Thus, classroom management encompasses creating a positive learning environment, promoting student engagement, and establishing clear rules and routines (Evertson & Weinstein, 2011). It also supports the development of a constructive classroom atmosphere and enhances student learning outcomes (Djigic & Stojiljkovic, 2011; Mitchell & Bradshaw, 2013).

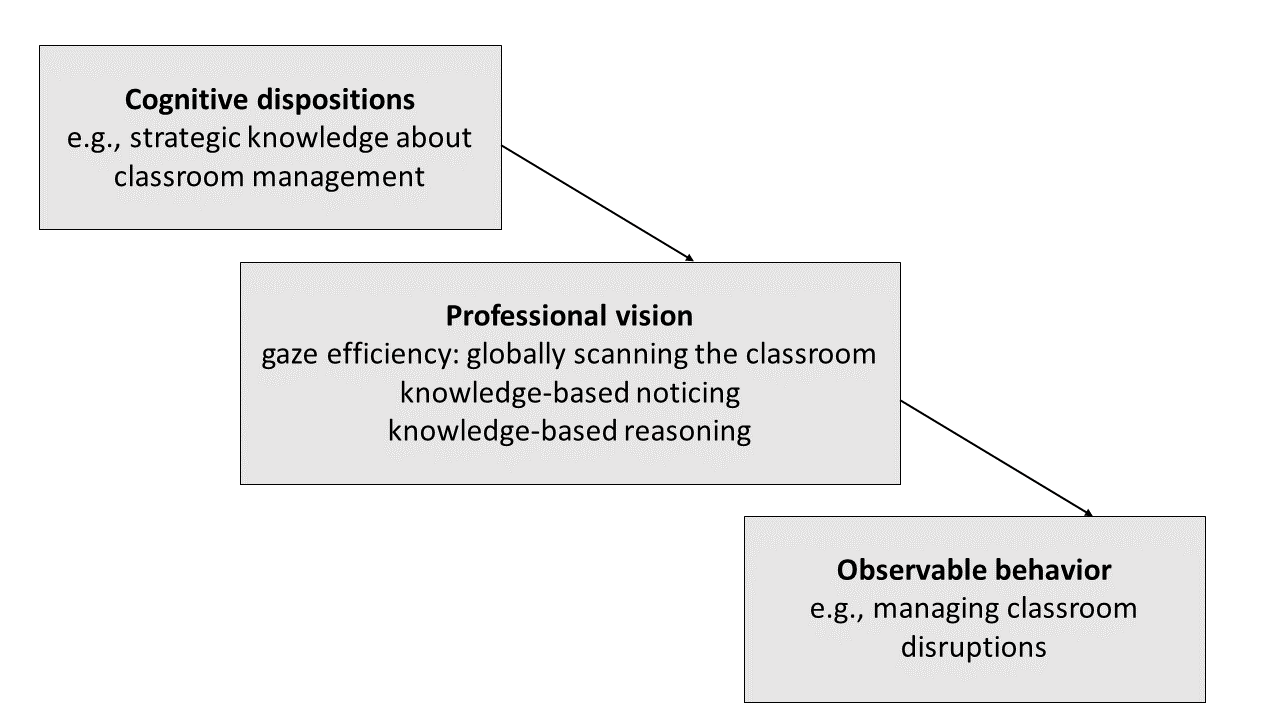
The management of classroom disruptions is one essential aspect of effective classroom management, making it important for teachers to develop appropriate strategies in disruptive situations (Helmke, 2022). Achieving effective management of disruptions requires teachers to handle the simultaneity and complexity of classroom interactions (Doyle, 1980) by developing skills like *withitness* and *overlapping* (Kounin, 2006). Withitness refers to a teacher’s awareness of classroom dynamics, while overlapping involves managing multiple tasks without disrupting instructional flow. Gold and Holodynski (2015) group these under *monitoring*, which includes proactive strategies, such as maintaining perceptible presence (Kiel et al., 2013), and reactive strategies tailored to the context and severity of disruptions (Kounin, 2006).[[2]](#footnote-3) Reactive strategies should be timely, subtle, and escalate gradually (Borich, 2015; Keller, 2014; Lohmann, 2014; Nolting, 2017). A low-profile approach, such as responding early with minimal interruption, has proven effective in managing minor disruptions without diverting attention from the learning process (Rinne, 1982; Borich, 2015; Helmke, 2021). Subtle verbal or nonverbal cues help preserve instructional flow and classroom climate, especially when addressing seemingly harmless behaviors like daydreaming or mobile phone use (Grewe, 2002; Helmke, 2021).

## Competence Development in Classroom Disruption Management

Effectively addressing classroom disruptions requires teachers to continuously monitor their environment for behaviors that may interfere with the learning process. Figure 1 presents a simplified model that illustrates how cognitive dispositions interact with perception processes – conceptualized as *professional vision* – and lead to observable teaching behavior. This model is adapted from the competence-to-performance transformation framework proposed by Blömeke et al. (2015) and further developed by Grub (2023).

**Figure 1**

*Model of Professional Competence Development in Classroom Disruption Management (Adapted From Blömeke et al. (2015) and Grub (2023), Modified by The Authors)*



As shown in Figure 1, at the foundation of professional teaching practice lie *cognitive dispositions*, such as well-structured and integrated knowledge of classroom management strategies (Barth, 2017; Kunter et al., 2011; Voss et al., 2014; Zierer, 2015). This strategic knowledge enables teachers to make informed, context-sensitive decisions in complex teaching situations (Borko, 2004; Fenstermacher, 1994; Goldman, 2007). It is considered a core component of instructional competence (Barth, 2017; D’Agostino & VanWinkle, 2007; Kunter et al., 2011; Voss et al., 2014), evolving through practical problem-solving experiences where declarative knowledge transforms into procedural knowledge (Blömeke et al., 2022; Gold & Holodynski, 2015; Rauner, 2005).

*Professional vision* serves as a crucial mediating skill between teachers’ dispositions and their classroom behavior. Originally introduced by Goodwin (1994) and adapted to teacher education by Sherin (2007), professional vision encompasses the ability to selectively perceive classroom events and interpret them based on pedagogical knowledge (Van Es & Sherin, 2002). In the initial stage of professional vision, gaze efficiency refers to the teacher’s ability to visually scan the classroom in a balanced and purposeful way. Eye-tracking studies show that expert teachers distribute their gaze more evenly across students, indicating greater situational awareness and attentional control. Cortina et al. (2015) demonstrated that mentors, compared to novices, had significantly lower GINI indices, reflecting a more uniform gaze distribution and frequent shifts of attention between students. Huang (2018) and McIntyre (2016) confirmed that experts focus more on learners and less on irrelevant stimuli, while novices are more easily distracted and tend to fixate longer on fewer, often non-instructional, areas. Dessus et al. (2016) further noted that novices exhibited less stable attention due to increased cognitive load. Complementing these findings, Gegenfurtner et al. (2020) introduced the Gaze Relational Index (GRI) as a measure of visual expertise. Experts showed more exploratory, top-down gaze patterns with shorter fixations and higher counts, suggesting a more efficient search behavior aligned with task relevance. Thus, gaze efficiency reflects an important facet of professional vision that enables teachers to perceive relevant classroom events early and broadly, supporting proactive classroom management.

*Knowledge-based noticing* refers to teachers’ ability to selectively attend to and interpret pedagogically meaningful events in the classroom (van Es & Sherin, 2002; König et al., 2022). Rather than merely observing, noticing involves making sense of what is seen, guided by prior knowledge and teaching experience (Sherin et al., 2011). Biermann et al. (2023) demonstrated that teachers who consciously noticed disruptions showed increased fixation patterns and deeper engagement, although expertise differences were subtle. Furthermore, research shows that expert teachers recognize pivotal classroom moments more precisely and interpret them more deeply than novices (Gibson & Ross, 2016). Their noticing includes hypothesizing about students’ thinking and adjusting instruction accordingly – an ability essential for adaptive classroom management. Notably, such noticing is not simply a result of teaching experience, but must be explicitly developed through targeted professional training (Gibson & Ross, 2016). Thus, noticing functions as a central link between perception and informed teaching action.

After noticing, teachers engage in *knowledge-based reasoning* that describes how teachers interpret what they notice and use their knowledge to decide how to act. Van Es and Sherin (2002) define it as a key step in professional vision. Expert teachers reason more deeply about student thinking and adjust instruction accordingly (Gibson & Ross, 2016).

Together, these three processes – gaze efficiency, knowledge-based noticing, and knowledge-based reasoning – constitute a situated, knowledge-driven perceptual cycle that enables teachers to detect, interpret, and respond to classroom disruptions effectively. They bridge the gap between (strategic) knowledge and visible classroom action and are therefore pivotal for the development and demonstration of professional teaching competence.

The third component of the model, *observable behavior*, refers to the visible application of classroom management strategies. Research has shown that novice teachers differ significantly from experienced teachers in their classroom management, particularly in handling disruptions (Leinhardt & Greeno, 1986; Berliner, 1987; Bromme, 1992). While experienced teachers can rely on established routines and cognitive schemas that help them manage disruptions efficiently (Thiel et al., 2012; Berliner, 2004), novice teachers often struggle with complex student behavior and tend to lose sight of overall classroom dynamics (Barth, 2017; Thiel et al., 2012). Experts use their monitoring skills to detect disruptions early and intervene effectively (Emmer & Gerwels, 2006), whereas novices frequently overlook such signals or react too late. Novices also tend to rely on less effective reprimands, interrupting the lesson flow (Westerman, 1991; Thiel et al., 2012), and focus on quick fixes (Swanson, O’Connor & Cooney, 1990). Experienced teachers, by contrast, avoid escalating interactions and may employ techniques such as ostentatious ignoring – using paraverbal and nonverbal cues to signal that inappropriate behavior has been noticed but will not be addressed directly (Thiel et al., 2012).

In summary, the model illustrates that managing classroom disruptions effectively relies not solely on theoretical knowledge but significantly on the ability to perceive and interpret classroom dynamics in real-time. Integrating these components provides a comprehensive framework for describing and systematically enhancing teacher competence in classroom management.

## Expertise Differences in Classroom Management

Research on expertise shows clear differences between novice and expert teachers in classroom management (Lachner et al., 2016; Van Den Bogert et al., 2014; Wolff et al., 2017, 2021). While novices often perceive classroom management as enforcing discipline and reacting to disruptions, experts apply (strategic) knowledge to establish behavioral norms early, ensuring a proactive approach (Helmke, 2022). These differences stem from the organization of their knowledge, experience, and cognitive processing mechanisms, which significantly influence their ability to maintain a productive learning environment (Berliner, 2001; Shulman, 1987).

Experts possess highly structured and interconnected knowledge, allowing them to recognize patterns, anticipate challenges, and adapt their strategies efficiently (Baumert & Kunter, 2013; Livingston & Borko, 1989). Their long-term working memory facilitates faster knowledge retrieval, enabling them to process information rapidly and make precise decisions (Ericsson & Kintsch, 1995; Kirchhof, 2007). This advanced cognitive organization allows experts to integrate pedagogical knowledge with situational demands dynamically, leading to more flexible and effective classroom management (Goldman, 2007). In contrast, novices lack these structured knowledge networks, leading to fragmented perceptions and less effective responses to classroom events (Ophardt & Thiel, 2013; Shulman, 1987). As a result, they are more likely to rely on reactive strategies and rule enforcement, which may not always align with the needs of their students (Carter et al., 1988; Wolff et al., 2017).

This distinction is particularly evident in classroom management strategies. While novices often implement strict disciplinary rules, expert teachers use their context-sensitive knowledge to enhance instructional effectiveness (Berliner, 1987; Palmer et al., 2005). Their expertise develops through a combination of domain-specific knowledge and practical experience (Tynjälä et al., 1997), allowing them to be more adaptive and responsive to the complexities of teaching. Research suggests that expert teachers can interpret classroom events more holistically, recognizing patterns of student behavior that indicate potential disengagement (Wolff et al., 2015). By contrast, novice teachers may focus more on maintaining order, sometimes at the expense of student engagement and learning outcomes (König & Kramer, 2016; Berliner, 2001).

Expertise in classroom management is closely tied to professionalism, characterized by advanced problem-solving skills that enable teachers to manage diverse classroom situations while maintaining high instructional quality (Berliner, 2001). Research also highlights that experts use their refined classroom management scripts to anticipate potential disruptions and implement proactive responses that foster a structured yet flexible learning environment (Wolff et al., 2021).

Another key difference between novices and experts lies in their cognitive processing mechanisms (see Figure 1). Experts rely on top-down processing, guided by motivation, experience, and structured knowledge, which allows them to focus selectively on relevant visual elements (Hershler & Hochstein, 2009). They are also better at filtering out distractions, enabling them to prioritize meaningful interactions that support student learning (Ericsson & Kintsch, 1995). Novices, on the other hand, engage in bottom-up processing, where their perception is driven by physical stimulus features, making them more likely to focus on visually salient but potentially irrelevant aspects (Hershler & Hochstein, 2009). This contrast highlights how expert perception is shaped by knowledge, whereas novice perception is dominated by immediate visual stimuli, often leading to misinterpretations of classroom events (Livingston & Borko, 1989).

## Assessing Teachers’ Professional Vision with Eye-Tracking

To measure the competency differences between experts and novices in the described professional, cognitive perception and processing mechanisms in classroom management situations, the process-based method of eye-tracking is used as an important tool for examining continuous processes (Holmqvist et al., 2011). The eye-tracking method is suitable because, on the one hand, most information is processed through the eyes, and on the other hand, the eyes play a crucial role in the process of visual perception (Jarodzka et al., 2017).

Additionally, according to the Eye-Mind Hypothesis, it is assumed that visual stimuli from the environment are immediately processed cognitively, meaning that people generally think about what they are looking at (Just & Carpenter, 1976). Therefore, eye movements are used as behavioral indicators of cognitive processes, as fixation data reflect attention and shifts in attention (Grub et al., 2020). By recording eye movements using eye-tracking technology, conclusions can be drawn about fundamental cognitive processes such as selection and attention patterns, also referred to as noticing and perception processes, which typically occur unconsciously and are therefore difficult to verbalize (Grub et al., 2020; Seidel & Stürmer, 2014; van den Bogert et al., 2014; Wolff et al., 2016).

Specifically, the eye-tracking glasses record fixations, moments when the eyes appear to remain still for a certain period to focus on an object or person (Holmqvist et al., 2011). These fixations correspond with the person’s attention to the fixated area and can be characterized by their number and duration (Gegenfurtner et al., 2018). The fixation number is a metric reflecting the frequency of visual attention shifts, with higher fixation numbers indicating a more dynamic scanning behavior across the classroom environment (Grub et al., 2020). The average duration fixation is a metric that provides a measure of cognitive processing, with longer durations suggesting more time spent processing visual information (Negi & Mitra, 2020). The relationship between these two parameters serves as a key indicator of effective scanning behavior, as both the number and duration of fixations reflect how visual information is processed. In research, this relationship has been conceptualized as the Gaze Relational Index (GRI), which quantifies the ratio between average fixation duration (in milliseconds) and the total number of fixations (Gegenfurtner et al., 2020; Lowe & Boucheix, 2016). The GRI provides a standardized measure of gaze efficiency, where lower values indicate shorter fixation durations combined with higher fixation frequencies, typically associated with more dynamic, efficient, and adaptive scanning behavior (Gegenfurtner et al., 2020).

## Research on Teachers’ Professional Vision Using Eye-Tracking

Since 2013, research on teachers’ professional vision in the classroom using mobile eye-tracking has evolved, showing that experts show more efficient gaze behaviors than novices (for an overview, see Grub et al., 2020; Keskin et al., 2024). Cortina et al. (2015), for example, investigated attention distribution among 12 mentor-mentee teacher pairs, finding that mentors distributed their gaze more evenly across students, while mentees focused on fewer individuals. This suggests that expert teachers maintain broader classroom awareness, though the study’s small sample size limits its validity. In another study, McIntyre (2016) compared 40 teachers from England and Hong Kong, finding that experts focused more on students, while novices were more distracted by teaching materials and non-relevant stimuli. Huang (2018) analyzed mobile eye-tracking data from 25 expert-novice teacher pairs, finding that experts distributed their gaze more broadly across the classroom, while novices focused on fewer objects. Experts also exhibited shorter, task-relevant fixations, reducing distractions and improving situational awareness.

Despite growing research on professional vision, studies on the GRI remain limited, highlighting a need for further exploration for gaining a deeper understanding of visual expertise (Gabel et al., 2023; Gegenfurtner et al., 2020; Grub et al., 2022; Kosel et al., 2023).

Additionally, many previous studies have been constrained by small sample sizes (e.g., Pouta et al., 2021) or methodological limitations. Some studies suffer from low external validity due to their reliance on stationary eye-tracking (e.g., Stahnke & Blömeke, 2021), while others face challenges with internal validity and experimental control in real classroom settings (e.g., McIntyre et al., 2020).

## Present Study

This study addresses previous methodological limitations by employing mobile eye-tracking in micro-teaching units within a highly standardized learning environment, using a comparatively large sample. This approach balances authenticity and experimental control by capturing real teaching-learning interactions while enhancing standardization through scripted behavioral instructions.

Therefore, the study examines differences in gaze behavior, self-reported classroom management, and strategic knowledge between experienced and inexperienced teachers. Data were collected in the laboratory-based study *Professional Vision of Novice and Expert Teachers* (ProVisioNET), where both in-service (experienced) and pre-service (inexperienced) teachers participated in a controlled micro-teaching unit involving classroom disruptions. Eye-tracking technology, self-report measures, and strategic knowledge assessments were used to explore how expertise influences visual attention, disruption noticing, and management strategies.

Participants individually attended a laboratory session, where they conducted a brief micro-teaching unit lasting approximately 15 minutes. The “class” consisted of three trained actors who portrayed students and simulated typical classroom disruptions. During the micro-teaching unit, teachers’ gaze patterns were recorded using eye-tracking technology. Additionally, self-reports on classroom management and strategic knowledge were assessed through a questionnaire, an interview, and a test.

The study addressed five primary aims:

One aim was to examine how teachers distribute their visual attention during classroom interactions in a lab-based micro-teaching unit. We expected students to be the primary focus of teachers’ attention. This exploration was descriptive.

Another aim was to investigate differences in gaze behavior related to noticing abilities between experienced and inexperienced teachers. We hypothesized that, compared to inexperienced teachers, experienced teachers would demonstrate more efficient gaze patterns throughout the micro-teaching unit (**Hypothesis 1a**), focus their attention more frequently on students (**Hypothesis 1b**), and notice disruptions more quickly (**Hypothesis 1c**).

Additionally, we examined whether the type of disruption (i.e., verbal disruptions, physical disruptions, and indicators of lack of eagerness to learn) influenced the speed at which teachers noticed disruptions. We hypothesized that verbal and physical disruptions would be more salient and, therefore, noticed more quickly than indicators of a lack of eagerness to learn (**Hypothesis 2a**). Furthermore, we explored whether teaching expertise had an impact on the disruption noticing speed.

Another aim was to determine whether differences in teaching expertise were reflected in classroom management measures, including self-reports on classroom management (e.g., self-evaluated classroom management, disruptiveness, and confidence ratings) as well as strategic knowledge of classroom management. We expected experienced teachers to outperform inexperienced teachers (**Hypothesis 3a**).

Finally, we examined the relationship between gaze behavior and classroom management measures, expecting these variables to be correlated.

# Method

## Participants

We recruited a total of 84 teachers from Germany (42 pre-service teachers and 42 in-service teachers) through personal contacts, email lists, and flyers. Pre-service teachers were required to be actively enrolled in a teacher education program and to have completed their first internship, while in-service teachers needed to both have fully completed their teacher training (including the preparatory training year, the “Referendariat”)and to be currently working in the teaching profession. Data from two in-service teachers were excluded due to low-quality eye-tracking data, resulting in a final sample of 82 teachers, comprising 42 pre-service teachers and 40 in-service teachers.

The pre-service teachers (*n*= 29 women, *n*= 13 men) had a mean age of 22.80 years (*SD* = 1.90; range: 19–27). On average, they were in their 7th semester (*M* = 6.70, *SD* = 2.60; range: 3–11) and had an average of 9.60 hours (*SD* = 7.20; range: 1–36) of teaching experience through internships completed during their studies.

The in-service teachers (*n*= 24 women, *n*= 16 men) had a mean age of 39.10 years (*SD* = 10.60; range: 26–60) and an average of 11.60 years (*SD* = 11.30; range: 1–38) of teaching experience.

The study adhered to the ethical guidelines put forth by the University of Leipzig and received approval from the University’s Institutional Review Board. Participants were fully informed about the study’s objectives before testing. Their participation was voluntary, not incentivized, and commenced only after written consent.

## Setting and Procedure

Participants individually attended the lab for approximately two hours, following a standardized procedure for which a seminar room was transformed into a classroom. Upon arrival, they were welcomed by the experimenter, introduced to the procedure, and asked to sign the data protection agreement. Participants were then fitted with a binocular Tobii Pro Glasses 2 eye-tracker, adjusted for comfort and vision. After performing an initial calibration of the glasses (for details of the eye-tracker and the calibration, see Appendix A), the experimenter activated and synchronized the recording devices (eye-tracking glasses, four cameras, and an audio recorder) using an auditory signal. This setup phase included a brief introductory game to acclimate participants to the eye-tracking equipment and the three students, which took approximately 10-15 minutes.

After the initial setup, a second calibration was done in a separate room. As soon as the teacher re-entered the classroom, the micro-teaching unit started. Participants were asked to prepare a 15-minute micro-teaching unit on a topic and grade level of their choice. The only requirement was that the unit had to be an introductory micro-teaching unit, and had to consist of supervised individual work and/or frontal teaching. During the unit, three trained actors (playing students) performed scripted classroom disruptions. The students followed prompts that appeared every 1.5 minutes on a screen only visible to them (e.g., chatting with a neighbor, heckling, looking at the phone; see Table A1 in the supplementary material for an overview and categorization of all disruptions; and Figure B1 and B2 in the supplementary material for a depiction of the laboratory setting of the micro-teaching unit). The order of the disruptions and the performing students were fully balanced using Latin Squares. The whole micro-teaching unit was recorded using eye-tracking glasses to capture teachers’ gaze patterns. The micro-teaching unit lasted about 15-20 minutes.

After the teaching session, participants underwent a third calibration. Following this, all recording devices were stopped, and participants filled out a brief computer-based questionnaire (~10-15 minutes) assessing sociodemographic data and a self-evaluation of their classroom management during the micro-teaching unit. A ten-minute break followed, concluding the first part of data collection.

In the study’s second part, participants engaged in a Stimulated Recall Interview (SRI). They watched a video of their own teaching session, recorded through the eye-tracking glasses, while the experimenter paused the video at each classroom disruption. Participants answered five open-ended questions and three rating questions for each disruption, including self-reported *disruptiveness* and *confidence ratings* (see Measures). The SRI lasted approximately 45-60 minutes. Finally, participants completed a Situational Judgment Test (SJT) online, assessing their *strategic knowledge of classroom management*. The questionnaire took approximately 15 minutes to complete, marking the end of the study.

## Measures

***Gaze Behavior Measures***

Gaze behavior was analyzed using predefined Areas of Interest (AOI) to examine how participants distributed their visual attention during the micro-teaching unit[[3]](#footnote-4). Two types of AOIs were defined to structure the data meaningfully: global AOI and event-based AOI. Global AOI were used to assess gaze behavior over the entire video duration and included the following: the *students*, representing gaze points focused on the group of three students; *teacher material*, capturing gaze points directed toward instructional materials such as the board, screen, or other teaching aids; *student desks*, representing gaze points on elements related to students’ desks, including name tags and student materials; and *classroom/others*, which encompassed gaze points directed toward other areas of the classroom that were not associated with the students or teacher. In contrast, the event-based AOI was coded only during specific classroom events, i.e., disruptions caused by students. The AOI labeled *disruptive student* captured gaze behavior directed toward one of the three students who performed a classroom disruption.

#### Average Fixation Duration on AOI.

The average fixation duration was calculated by dividing the total fixation duration (in milliseconds) by the total number of fixations. Fixation data for these calculations were aggregated across all AOI and summarized for both experienced and inexperienced teachers.

#### Fixation Number per Minute on AOI *Students*.

The fixation number per minute was calculated by summing all fixations within the AOI *students* and dividing by the session duration in minutes. This yielded an individual fixation rate per participant, which was then summarized for experienced and inexperienced teachers.

#### Gaze Relational Index.

The Gaze Relational Index (GRI) was calculated as a composite metric to evaluate the efficiency of participants’ scanning behavior during the micro-teaching unit. The GRI was derived by dividing the average fixation duration (in milliseconds) by the fixation number per minute.

#### Time to First Fixation on AOI *Disruptive Student*.

The time to first fixation (TTFF) measured the time (in seconds) for participants to fixate on the AOI *disruptive student* after a disruption onset. Values were extracted by identifying the first fixation timestamp relative to the disruption onset, excluding invalid cases (TTFF = 0[[4]](#footnote-5) or >30s[[5]](#footnote-6)). Raw values were converted from milliseconds to seconds and log-transformed for normalization. To assess overall responsiveness to classroom disruptions, log-transformed TTFF values were averaged across all disruptions per participant and then summarized for experienced and inexperienced teachers.

### Self-Evaluated Classroom Management

After the micro-teaching unit, teachers answered a questionnaire using five items from a validated questionnaire (Helmke et al., 2013) and eleven self-developed items derived from the research literature (Kiel et al., 2013; Kounin, 2006; Marzano, 2007) to assess their self-evaluated classroom management. The questionnaire was a 4-point Likert scale (1 = strongly disagree; 4 = strongly agree).

### Disruptiveness and Confidence Ratings

The disruptiveness and confidence ratings were assessed during the SRI on an 11-point rating scale, ranging from 0 (not at all disrupting/confident) to 10 (extremely disrupting/confident). Ratings were averaged across the nine classroom disruptions for each participant to capture a general sense of how disruptive the classroom disruptions were during the micro-teaching unit and how confident participants felt in handling them.

### Strategic Knowledge of Classroom Management

Teachers’ strategic knowledge of classroom management was assessed using a Situational Judgment Test (SJT; Gold & Holodynski, 2015) via an online questionnaire on SoSci Survey. Participants graded five to six action alternatives for twelve teaching scenarios in which classroom disruptions were discussed on a six-point Likert scale (grade 1 = “very good” to grade 6 = “unsatisfactory”). As the SJT was originally designed for primary schools, adjustments were made to enable the use of the SJT for all types of schools in the *ProVisioNET* study. Due to their general applicability, all twelve scenarios and answer options were adopted and only the names of the class levels were removed from the questions - except for scenario 6, where this information was essential.

## Data analysis

The data were analyzed using R (RStudio Team, 2020, Version 2024.12.0) and IBM SPSS Statistics (Version 29). Graphics were created using ggplot2 (Wickham, 2016).

To examine teachers’ visual attention distribution (Aim 1), fixation durations[[6]](#footnote-7) for different AOI (e.g., students, disruptive student, teacher material) were analyzed descriptively. Mean proportions were compared between experienced and inexperienced teachers using independent-sample *t*-tests, with effect sizes reported as Cohen’s *d* (Cohen, 1988).

To assess differences in gaze behavior related to noticing abilities (Aim 2), we calculated the GRI during the micro-teaching unit, fixation number per minuteon AOI *students*, and TTFF on AOI *disruptive student*. Group differences were tested with t-tests, and effect sizes were reported.

To investigate how disruption type affects noticing speed (Aim 3), a 2 × 3 repeated-measures ANOVA was conducted, with expertise (experienced vs. inexperienced teachers) as a between-subject factor and disruption type (verbal, physical, lack of eagerness) as a within-subject factor. Bonferroni-adjusted post-hoc comparisons were performed for significant effects.

To examine classroom management differences (Aim 4), independent-sample *t*-tests compared self-evaluated classroom management, disruptiveness and confidence ratings, and strategic knowledge.

Finally, to explore the relationship between gaze behavior and classroom management (Aim 5), Pearson correlations were computed between gaze efficiency metrics (GRI, fixation number per minuteon AOI *students*, TTFF on AOI *disruptive student*) and classroom management measures. Statistical significance was assessed using *p*-values, with effect sizes reported.

# Results

## Gaze Distribution for Areas of Interest

The descriptive results for experienced and inexperienced teachers to investigate teachers’ gaze distribution are displayed in Figure 1.

**Figure 1**

*Average Fixation Duration Percentages by Area of Interest (AOI) and Teacher Experience Group for the Entire Micro-Teaching Unit*

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*Note.* The bar chart displays the percentage of fixation durations for five AOI (students, teacher material, student desk, classroom/others, and disruptive student) during the micro-teaching unit. Data are presented separately for experienced and inexperienced teachers, with error bars indicating 95% confidence intervals.

As suggested, both groups exhibited the highest percentages of fixation durations in the AOI *students*, while no statistically significant differences were observed between experienced and inexperienced teachers for any AOI (see Appendix C, Table C2 for *t*-test results and effect sizes).

## Gaze Behavior

Means, standard deviations, and range of experienced and inexperienced teachers’ gaze behavior measures are shown in Table 1.

**Table 1**

*Means, Standard Deviations, And Range of Experienced and Inexperienced Teachers’ Gaze Behavior Measures*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Gaze Behavior Measures | Experienced | | | | Inexperienced | | | |
| *M* | *SD* | Min | Max | *M* | *SD* | Min | Max |
| GRI for micro-teaching unit | 5.32 | 2.21 | 2.22 | 11.72 | 6.08 | 2.15 | 2.14 | 10.80 |
| Fixation Numbers in AOI *Students* | 98.53 | 19.21 | 49.07 | 135.81 | 91.21 | 14.52 | 68.99 | 123.37 |
| TTFF (log) in AOI *Disruptive Student* | 0.28 | 0.69 | –1.81 | 1.51 | 0.30 | 0.65 | –1.06 | 2.21 |
| *Note*. GRI = Gaze Relational Index, AOI = Area of Interest, TTFF = Time to First Fixation (log-transformed). Values represent the mean (*M*), standard deviation (*SD*), and range (minimum and maximum values) for each measure. Fixation numbers in AOI *Students* refer to the total number of fixations directed at students per minute. TTFF values represent the log-transformed time (in seconds) until teachers first fixated on a disruptive student. | | | | | | | | |

First, experienced teachers exhibited more frequent but shorter fixations, leading descriptively to a lower GRI than inexperienced teachers across the entire micro-teaching session (**Hypothesis 1a**). However, this difference was not statistically significant, *t*(80) = –1.57, *p* = .12.

Second, experienced teachers directed their gaze toward AOI *students* more often than inexperienced teachers (**Hypothesis 1b**), and this difference was statistically significant, *t*(80) = 1.96, *p* = .05, *d* = 0.43 (small effect).

Third, experienced teachers detected disruptions descriptively slightly faster, as reflected in their shorter noticing speed for the AOI *disruptive student*[[7]](#footnote-8) (**Hypothesis 1c**), but with no statistically significant difference, *t*(80) = –0.14, *p* = .89.

## Effect of Disruption Type and Expertise on Disruption Noticing Speed

For **Hypothesis 2a**, a significant main effect of disruption type was found, *F*(1.94, 141.49) = 68.05, *p* < .05, *η²* = .34, indicating that the type of disruption influenced how quickly teachers noticed it. Consistent with our hypothesis, post-hoc comparisons revealed that verbal disruptions were detected significantly faster than both physical disruptions, *t*(73) = 6.33, *p* < .05, *d* = 0.62 (medium effect), and lack of eagerness disruptions, *t*(73) = 11.09, *p* < .05, *d* = 1.23 (large effect). Furthermore, physical disruptions were noticed faster than lack of eagerness disruptions, *t*(73) = -5.72, *p* < .05, *d* = 0.62 (medium effect). The main effect of expertise, *F*(1, 73) = 0.03, *p* = .86, and the interaction between expertise and disruption type, *F*(1.94, 141.49) = 1.28, *p* = .28, were not significant, suggesting that expertise did not influence noticing speed, nor did it interact with disruption type.

## Expertise Differences in Classroom Management Measures

Table 2 presents descriptive statistics and internal consistency reliabilities for all classroom management measures.

**Table 2**

*Means, Standard Deviations, Range and Internal Consistency Reliability (McDonalds’ Omega, ω) of Experienced and Inexperienced Teachers’ Classroom Management Measures*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Classroom Management Measures | Experienced | | | | Inexperienced | | | | ω |
| *M* | *SD* | Min | Max | *M* | *SD* | Min | Max |
| Self-evaluated Classroom Management | 3.25 | 0.31 | 2.38 | 3.88 | 3.06 | 0.30 | 2.56 | 3.62 | .82 |
| Disruptiveness Rating | 4.81 | 2.90 | 0 | 10 | 5.55 | 2.81 | 0 | 10 | .84 |
| Confidence Rating | 8.44 | 1.68 | 2 | 10 | 7.18 | 2.04 | 0 | 10 | .88 |
| Strategic Knowledge | 0.75 | 0.08 | 0.54 | 0.88 | 0.72 | 0.13 | 0.10 | 0.91 | .89 |
| *Note*. Values represent the mean (*M*), standard deviation (*SD*), and range (minimum and maximum values), along with McDonald’s Omega (ω) coefficient, which indicates the internal consistency reliability for each measure. *Self-evaluated classroom management* refers to participants’ assessment of their classroom management competencies. The *disruptiveness rating* indicates the extent to which participants judged the disruptions as disruptive, while the c*onfidence rating* measures their confidence in managing them. S*trategic knowledge* measures teachers’ knowledge of classroom management strategies. | | | | | | | | | |

Independent-sample *t*-tests examined whether teaching expertise influenced classroom management measures (**Hypothesis 3a**). As expected, experienced teachers evaluated their classroom management competencies significantly higher than inexperienced teachers, *t*(80) = 2.78, *p* < .05, *d* = 0.62 (medium effect). They also reported disruptions as less disruptive, *t*(80) = –2.57, *p* < .05, *d* = –0.57 (medium effect), and greater confidence in managing them, *t*(80) = 5.63, *p* < .05, *d* = 1.24 (large effect). However, strategic knowledge of classroom management did not differ significantly between groups, *t*(80) = 1.00, *p* = .32, suggesting expertise was not associated with higher scores on the situational judgment test (SJT).

## Correlation Between Gaze Behavior Measures and Classroom Management Measures

Table 3 presents Pearson correlation coefficients between gaze behavior measures and classroom management measures, separately for experienced (below the diagonal) and inexperienced teachers (above the diagonal).[[8]](#footnote-9)

**Table 3**

*Correlations Between the Gaze Efficiency Measure and Classroom Management Measures for Experienced (Below Diagonal) and Inexperienced (Above Diagonal) Teachers*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (1) GRI | – | –.44\* | .11 | –.01 | .16 | .15 | –.14 |
| (2) Fixation Number Per Minute on AOI *Students* | –.53\* | – | –.39\* | .39\* | –.49\* | –.22 | .14 |
| (3) TTFF (log) on AOI *Disruptive Student* | .05 | –.29 | – | –.20 | .32\* | –.01 | .01 |
| (4) Disruptiveness Rating | .03 | –.20 | .02 | – | –.02 | .01 | –.15 |
| (5) Confidence Rating | 0 | .06 | –.06 | –.51\* | – | .48\* | –.19 |
| (6) Self-evaluated Classroom Management | .11 | 0 | –.18 | –.11 | .33\* | – | –.21 |
| (7) Strategic Knowledge | –.36\* | .16 | –.34\* | –.19 | –.03 | .12 | – |
| *Note.* The table presents Pearson correlation coefficients between gaze behavior measures (GRI = Gaze Relational Index, fixation number per minute on AOI s*tudents,* and TTFF (= log-transformed time to first fixation on AOI d*isruptive student*), and classroom management measures (self-evaluated classroom management, disruptiveness and confidence ratings, and strategic knowledge) for inexperienced teachers (above diagonal) and experienced teachers (below diagonal).  Statistically significant correlations (*p* < .05) are marked with an asterisk (\*).  GRI = Gaze-Relational Index; TTFF = Time to First Fixation on AOI d*isruptive student* (log-transformed). | | | | | | | |

For experienced teachers, lower GRI values (indicating more efficient gaze behavior) were significantly associated with higher fixation frequency on students and greater strategic knowledge. Additionally, more frequent fixations on students correlated with higher confidence in handling disruptions. Longer TTFF on disruptive students was linked to lower strategic knowledge.

For inexperienced teachers, greater fixation numbers on students were negatively correlated with self-evaluated classroom management and confidence ratings. Additionally, higher confidence in handling disruptions was positively associated with self-evaluated classroom management.

# Discussion

## Key Findings

Our study investigated …

Overall, our findings indicate that …

Our findings are consistent with prior research that illustrates the …

## Limitations and future directions

While the laboratory setting of the study allowed for a controlled implementation of stressors and high internal validity, it was not an authentic classroom environment, raising questions about its external validity. Most importantly, the teacher and their students did not have a shared history, and only a very thin basis for establishing a positive teacher-student relationship, which is a core characteristic of effective classroom management (Beaty-O’Ferrall et al., 2010; Rüedi, 2014).

In addition, the micro-teaching unit was only about 15 minutes long, and thus much shorter than a regular school lesson, providing less opportunities for experienced teachers to build up an engaging lesson.

Finally, the onset of disruptive student behavior was scripted, following an experimental time schedule, which was not affected by the behavior of the teacher. Thus, the setting may have masked effects of teaching experience by providing too little opportunities of experienced teachers to demonstrate their true classroom management skills.

In subsequent studies, it would therefore be insightful to …

## Conclusion

This study investigated …

In summary, our study contributes to the understanding …

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# Appendix

# Appendix A

**Eye-tracking apparatus and calibration**

Teachers wore a binocular Tobii Pro Glasses 2 eye-tracker during the micro-teaching unit to record eye-tracking data. The system consisted of a wearable head unit and a recording unit. The head unit was a measuring device with different sensors. A high-definition scene camera captured a full HD video of the teacher’s field of vision. An integrated microphone recorded surrounding sounds. Infrared light illuminators supported the eye-tracking sensors which recorded the eye orientation to capture the teacher’s gaze point. The videos were recorded with a sampling rate of 50 Hz in a video resolution of 1920 x 1080 at 25 frames per second. The scene camera had a field of view of 90 degrees in 16:9 format (82 degrees horizontal and 52 degrees vertical) and a frame dimension of 179 x 159 x 57 mm (width x depth x height). The recording unit is a compact computer that manages the head unit. It captures and saves eye-tracking data, audio, and scene camera footage on a removable SD memory card.

The evaluation of the calibration process followed the guidelines outlined in the Manual of Tobii AB (2024) and Onkhar et al. (2024) for assessing calibration quality. Participants’ gaze was calibrated using a bullseye card that the participant held at arm’s length. A successful calibration was achieved when the participant’s gaze marker sufficiently overlapped with the bullseye for a specified time, based on criteria internally determined by the manufacturer’s software (Tobii AB, 2024). All participants achieved successful calibration, and no participants were excluded due to calibration failure. The robustness of the calibration was further verified through a secondary nine-point calibration. During this step, participants were asked to read numbers from one to nine aloud and direct their gaze at specific fields corresponding to each number. The initial calibration was performed before and the verification calibration before and after each micro-teaching unit.

**Table A1**

*Classification of Nine Typical Classroom Disruptions According to Lohmann & Meyer (2003) Performed in The Micro-Teaching Unit by Actors*

|  |  |  |
| --- | --- | --- |
| Verbal disruptions | Physical disruptions | Lack of eagerness to learn |
| Heckling | Clicking pen | Looking at phone |
| Chatting | Snipping hands | Drawing |
| Whispering | Drumming hands | Head on table |

*Note.* Disruptions were classified based on the typology provided by Lohmann & Meyer (2003)*.* Categories include verbal, physical, and disengagement-related behaviors performed during the micro-teaching unit. The order of the performing actors and the disruptions was fully balanced using Latin squares.

# Appendix B

# Laboratory Setting of The Study

**Figure B1**

*Laboratory Setting of The Micro-Teaching Unit. Ein Bild, das Mobiliar, Stuhl, Kleidung, Schuhwerk enthält.

Automatisch generierte Beschreibung*

*Note*. The setting included three actors as the class (left) and a teacher (participant, right).

**Figure B2**

*Laboratory Setting of The Interview.*

Ein Bild, das Mobiliar, Zeichnung, Entwurf, Tisch enthält.

Automatisch generierte Beschreibung

*Note*. The experimenter and participant watched the previously taught micro-teaching unit on video.

# Appendix C

**Additional Results for Gaze Behavior Across AOI**

**Figure C1**

*Average Fixation Number Percentages by Area of Interest (AOI) and Teacher Experience Group for the Entire Micro-Teaching Unit with 95% Confidence Intervals*



*Note.* The bar chart illustrates the average fixation number percentage directed at five AOIs (Students, Teacher Material, Classroom/Others, Student Desk, and Disruptive Student) during the micro-teaching unit. Results are presented separately for experienced and inexperienced teachers, with error bars indicating 95% confidence intervals.

**Table C2**

t*-Test Results and Effect Sizes for Fixation Number Percentages (FNP) and Fixation Duration Percentages (FDP) Across AOIs Between Experienced and Inexperienced Teachers*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Measures | AOI | *t-*value | df | *p*-value | *M* Difference | Cohen's *d* | 95% CI |
| FNP a | Students | 0.01 | 80 | 0.99 | 0.03 | 0.00 | [–4.63, 4.69] |
| FNP | Disruptive Student | –1.32 | 80 | 0.19 | –0.27 | –0.29 | [–0.67, 0.14] |
| FNP | Teacher Material | 0.89 | 80 | 0.37 | 2.32 | 0.20 | [–2.84, 7.48] |
| FNP | Student Desk | –1.17 | 80 | 0.25 | –1.72 | –0.26 | [–4.65, 1.21] |
| FNP | Classroom/Others | –0.43 | 80 | 0.67 | –0.63 | –0.10 | [–3.53, 2.27] |
| FDP b | Students | –0.43 | 80 | 0.67 | –1.26 | –0.10 | [–7.1, 4.58] |
| FDP | Disruptive Student | –1.90 | 80 | 0.06 | –0.48 | –0.42 | [–0.98, 0.02] |
| FDP | Teacher Material | 1.55 | 80 | 0.13 | 4.45 | 0.34 | [–1.28, 10.18] |
| FDP | Student Desk | –1.67 | 80 | 0.1 | –2.89 | –0.37 | [–6.35, 0.56] |
| FDP | Classroom/Others | –0.28 | 80 | 0.78 | –0.30 | –0.06 | [–2.43, 1.84] |
| *Note*. This figure displays the results of *t*-tests and effect sizes (Cohen’s *d*) for fixation number percentages (FNP) and fixation duration percentages (FDP) across Areas of Interest (AOIs) between experienced and inexperienced teachers. AOIs included Students, Disruptive Student, Teacher Material, Student Desk, and Classroom/Others. Positive mean differences (*M* Difference) indicate higher percentages for experienced teachers. Confidence intervals (95%) for the mean differences are presented in brackets.  *p*-value < .05 is considered statistically significant.  a FNP = Fixation Number Percentages  b FDP = Fixation Duration Percentages | | | | | | | |

**Appendix D**

**Correlation Between Gaze Behavior Measures and Classroom Management Measures**

**Table D1**

*Correlations Between the Gaze Behavior Measures and Classroom Management Measures Across All Participants*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | (2) | (3) | (4) | (5) | (6) | (7) |
| (1) GRI | –.50\* | .08 | .06 | –.02 | .07 | –.23\* |
| (2) Fixation Number Per Minute on AOI *Students* | – | –.34\* | 0 | –.13 | –.06 | .16 |
| (3) TTFF (log) on AOI *Disruptive Student* | –.34\* | – | –.07 | .12 | –.01 | –.12 |
| (4) Disruptiveness Rating | 0 | –.07 | – | –.36\* | –.13 | –.03 |
| (5) Confidence Rating | –.13 | .12 | –.36\* | – | .49\* | –.06 |
| (6) Self-Evaluated Classroom Management | –.06 | –.10 | –.13 | .49\* | – | –.05 |
| (7) Strategic Knowledge | .16 | –.12 | –.03 | –.06 | –.05 | – |
| *Note.* The table presents Pearson correlation coefficients between gaze behavior measures (GRI = Gaze Relational Index, fixation number per minute on AOI *students*, and TTFF = log-transformed time to first fixation on AOI *disruptive student*) and classroom management measures (self-evaluated classroom management, disruptiveness and confidence ratings, and strategic knowledge) across all participants. Lower GRI values indicate more efficient gaze behavior. Statistically significant correlations (*p* < .05) are marked with an asterisk (\*). | | | | | | |

1. The present study intentionally excludes aggressive behaviors due to ethical considerations, as simulating or provoking such disruptions would compromise participant safety and well-being. [↑](#footnote-ref-2)
2. While proactive strategies are paramount in preventing classroom disruptions (Kounin 2006), this study primarily focuses on reactive strategies due to its design. [↑](#footnote-ref-3)
3. To code and analyze the gaze behavior, we used the software Tobii Pro Lab Analyzer (Version 1.241.54542). A fixation filter was applied, with a threshold set at 30°/sec to identify fixations, as this default fixation filter is recommended for mobile eye-tracking data in the Tobii Lab Analyzer Software (Tobii AB, 2024). [↑](#footnote-ref-4)
4. As our focus was on gaze behavior directed toward the disruptive student, instances where the gaze was already fixated on the disruptive student, when the event started, were excluded from the analysis. [↑](#footnote-ref-5)
5. Fixation times beyond 30 seconds were excluded, as they exceeded the duration of the scripted disruptions. [↑](#footnote-ref-6)
6. The percentage of fixation duration was used as the primary measure, as it offered a more intuitive visualization of attention distribution over time (see Appendix C, Figure C1 for the percentage for fixation numbers). [↑](#footnote-ref-7)
7. Before conducting the analysis, 21.33% of data points were excluded because the participant either did not fixate on the disruption or had fixation times of zero or longer than 30 seconds, exceeding the defined threshold (see Data Analysis). Removing them ensured a focus on meaningful and interpretable gaze detection times. [↑](#footnote-ref-8)
8. See Appendix D (Table D1) for a correlation table including all gaze behavior measures and classroom management measures for all participants. [↑](#footnote-ref-9)