



Girls are disciplined and boys rebellious. The influence of implicit gender associations on noticing of disruptive student behavior: an eye-tracking study

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Abstract

Professional vision is an important situation-specific competence for teachers. Particularly for classroom management, a good learning environment requires early recognition of potential disruptions, the correct interpretation of such situations, and fair, appropriate consequences. Group associations can influence perceptual processes and, especially in complex, dynamic situations, (pre-service) teachers risk misinterpreting behavior by following implicit associations rather than actual behaviors. The connection between associations and perceptual processes in the context of professional vision has rarely been investigated. This study aims to investigate the relationship between the implicit gender-specific associations of pre-service teachers and their noticing of disruptions from a female versus a male student. We conducted a randomized repeated measures experiment with $N=62$ pre-service teachers, who observed four video vignettes of a virtual classroom with either a female or a male student exhibiting disruptive behavior. Implicit associations were assessed using the implicit association test, while gaze behavior was measured using the eye-tracking method. The results indicated a higher attentional focus on the female student, however, there was no deeper cognitive processing for the female student, which was expected for more inconsistent information according to the continuum model of impression formation. The findings did not demonstrate a direct connection between implicit associations and noticing. In the discussion, we underscore the importance of valid stimulus material and suitable methods for measuring implicit associations, thus providing valuable insights for future research.

Keywords Noticing · Implicit attitudes · Gender · Prospective teachers · Disruptive behavior · Eye tracking

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1 Introduction

Professional vision is an important situation-specific competence for teachers, particularly for classroom management (Grub et al., 2020, 2022a). This means early recognition of potential disturbances (noticing) and accurate interpretation (reasoning; Blömeke et al., 2015; Seidel & Stürmer, 2014). Cognitive as well as motivational-affective dispositions such as professional knowledge, beliefs, and motivational factors influence the recognition and interpretation of signals from the classroom (Blömeke et al., 2015; Gegenfurtner, 2025; Seidel et al., 2025). Stereotypes or attitudes are not explicitly mentioned in these models, but it is well known from social psychology research that such group associations also influence perception and decisions (e.g., Fazio, 1990; Fazio & Olson, 2014). For example, it is understood that (pre-service) teachers can misinterpret situations and behaviors due to their associations between members of a social group and the attributes of that group rather than of the individual (e.g., Denessen et al., 2022; Pit-ten Cate & Glock, 2019). For example, studies indicate that in classrooms where teachers more strongly endorse a “science-is-male stereotype” (Thomas, 2017, p. 37), gender differences in students’ self-concept and interest in physics are more pronounced, typically to the detriment of female students. Nürnberger et al. (2016) found that teachers with stronger gender stereotypes are more likely to apply gender-specific recommendation practices when advising students on course selection—favoring language-oriented tracks for female students and science-oriented tracks for males. In respect of classroom management male students are associated with more externalizing behaviors (such as noisiness or active disturbances), while female students are more associated with internalizing behaviors (e.g., passive reactions, such as withdrawing), which also leads to gender-specific rather than individual consequences (e.g., Gajda et al., 2022; Glock & Kleen, 2017). By analyzing teacher behavior in real classroom settings, Gajda et al. (2022) demonstrated that identical disruptive behaviors can lead to different consequences depending on the student’s gender (e.g., boys receive relatively more criticism). Such differential treatment may impair teacher–student relationships and contribute to the reinforcement of gender stereotypes (Gajda et al., 2022). However, to foster a supportive learning atmosphere, it is of particular importance to respond with fair and proportionate consequences that are appropriately aligned with the specific nature of the individual misbehavior (Glock & Kleen, 2017; Marzano & Marzano, 2003).

The connection between group associations and perceptual processes—especially the noticing process—in the context of the professional vision of teachers has rarely been investigated. As such, this study aims to examine the relationship between pre-service teachers’ implicit gender-specific associations and their noticing of female or male students’ disruptions. To do so, we conducted a randomized repeated measures experiment with four video vignettes as stimuli, varying the students’ gender (male vs. female) and the type of disruption (active vs. passive). We assessed implicit associations using the implicit association test (IAT; Greenwald et al., 1998) and observed student teachers’ gaze behavior using the eye-tracking method (Grub et al., 2022a, 2025).

2 Theoretical background

2.1 Professional vision of teachers

Teaching in a complex, dynamic classroom requires constant attention to what is happening and the accurate interpretation of student behaviors to ensure a disturbance-free learning environment. The concept of professional vision was first introduced by Goodwin (1994) as a means of perceiving and understanding meaningful events in a specific professional context. Adapted for teacher professionalization research, the most proposed models agree on two key processes: noticing (selective attention of relevant cues and ignoring the irrelevant) and reasoning (drawing appropriate conclusions) (Seidel & Stürmer, 2014; Weyers et al., 2023). Other authors added decision making (making choices based on perception) (Blömeke et al., 2015; Jacobs et al., 2010) or shaping (constructing interactions to gain additional information) (van Es & Sherin, 2021). These processes are seen as context-related and situated (see Blömeke et al., 2015; Blömeke, 2025; Seidel & Stürmer, 2014), and substantially affected by knowledge (Blömeke et al., 2015; Blömeke, 2025; Gegenfurtner, 2025; Seidel et al., 2025). In terms of noticing, knowledge acts as a lens for searching for relevant cues within a classroom (top down-processes; see Gegenfurtner, 2025). For example, Wolff et al. (2016) found that experts with higher knowledge more frequently revisit regions showing student interaction (following body and posture movements, or looking at the faces of interacting students), while novices often revisited areas with no classroom activity (like walls, paintings) or only a single student. Group associations such as attitudes and stereotypes as potential influencing factors on teachers' professional vision have rarely been addressed in models of professional vision. An exception is a study by Gabel et al. (2025), in which attitudes were conceptualized as an aspect of declarative knowledge about groups and individuals. The study emphasized, that findings from social cognition research can provide promising insights for research on professional vision (Gabel et al., 2025).

The noticing process—or more specifically, the selective attention to relevant features—that is the focus of the present article can be captured using process-based methods such as eye-tracking for gaze behavior (Grub et al., 2020, 2025). Major advantages of this method are, first, that it enables the direct and unobtrusive recording of perception during the perceptual process, and second, that it is not influenced by conscious attentional processes (Grub et al., 2020, 2025; Rahal & Fiedler, 2019). One common use is the eye-tracking parameter “fixation count” as an indicator of attention and “fixation duration” as an indicator of cognitive processing depth (Grub et al., 2020, 2025; Holmqvist & Anderson, 2017; Rahal & Fiedler, 2019).

2.2 Group associations

From models in social psychology—particularly Fazio's (1990) MODE model and Fiske and Neuberg's (1990) continuum model of impression formation—it is known that group associations (including stereotypes and attitudes) influence impression formation of the vis-à-vis and, therefore, judgments and behaviors (e.g., Nesdale & Durkin, 1998). Stereotypes are mostly defined as a cognitive set of beliefs and asso-

ciations toward a social group, while attitudes often refer to evaluative judgments and affect toward a target (Ajzen, 1991; Eagly & Chaiken, 1993; Nesdale & Durkin, 1998). While the disjointed classification of affective-evaluative and cognitive features across the two constructs remains a matter of debate, the interdependence of these constructs is also discussed in the literature (Nesdale & Durkin, 1998). However, since there is a broad consensus regarding the effects of both stereotypes and attitudes on perception and decision-making processes (e.g., Eagly & Chaiken, 1993; Greenwald & Banaji, 1995; Nesdale & Durkin, 1998)—which is the focus of the present study—we use the term *group associations* as an overarching concept.

Group associations can take effect either automatically or more deliberately (e.g., Fazio, 1990; Gawronski & Bodenhausen, 2006). When these associations are automatically activated in a situation, it can lead to spontaneous and more unconscious responses, particularly when prompt, spontaneous decisions are required (Fazio, 1990; Gawronski & Bodenhausen, 2006). Complex and dynamic classrooms are examples of such situations, particularly for novice teachers (Pit-ten Cate & Glock, 2019). Implicit associations can serve as a filter for perception and, therefore, influence decisions and behaviors (Fazio, 1990; Fazio & Olson, 2014). That is, the activation of an association toward a target can lead to selective perception (i.e., if a negative association toward a person or group is activated, the focus of perception will lie more on the subject's negative qualities). This biased perception can contribute to biased judgments and behaviors. In the continuum model of impression formation, Fiske and Neuberg (1990) reported a continuum between automated and group-based information processing and elaborated individual-based information processing. They argued that information that is consistent with one's own associations can be processed automatically and does not require further cognitive elaboration, even if it is not suitable for the individual. This effect is particularly pronounced in situations characterized by high cognitive demands (Sherman et al., 2000). Tobisch and Dresel (2022) provided empirical support for this assumption using vignettes depicting students from different ethnic backgrounds. The authors applied blink rate and pupil diameter as implicit indicators of cognitive processing while participants evaluated the vignettes. Student teachers who held negative attitudes toward minority students exhibited deeper cognitive processing when interpreting the performance and behavior of these students compared to their interpretation of majority students. This intensified processing may be attributed to the incongruence between the teachers' existing rather negative stereotypes and the rather positive behavior, and good achievement of students.

When capturing group associations, participants' awareness of the assessed variable should be considered (Ajzen & Fishbein, 2005; Fazio, 1990; Fazio & Olson, 2003). When using explicit methods, such as questionnaires, participants' associations are directly assessed (e.g., Hofmann et al., 2005), albeit with the drawback of biases through social desirability (Fazio & Olson, 2003; Nesdale & Durkin, 1998; Petty, 2008). Implicit measurements are primarily based on reaction times and assess automated reactions on prime or stimulus material (e.g., Fazio & Olson, 2003; Hofmann et al., 2005). One widely used method is the implicit association test (IAT; Greenwald et al., 1998), which measures the strength of associations between (social)

categories and attributes according to response latencies (see also Pit-ten Cate & Glock, 2019) and, therefore, is applied in the present study.

2.3 Associations in the pedagogical context

To ensure a fair learning environment and further prevent the consolidation of stereotypes, all children should be treated based on their actual behaviors or achievements rather than on their membership in a group (e.g., Denessen et al., 2022; Gajda et al., 2022). A broad range of studies have demonstrated that many teachers possess unjustified associations toward different groups of students. In their meta-analysis, Pit-ten Cate and Glock (2019) summarized that in most studies both pre-service and in-service teachers hold more negative implicit attitudes toward groups of students that are marginalized by society (e.g., based on ethnicity, socioeconomic status, and obesity). Biased perceptions and expectations can lead to teacher behavior and decision-making that is driven more by group-based associations than by students' individual characteristics. Such biases have frequently been investigated in relation to subject-specific academic expectations (e.g., science vs. language; Denessen et al., 2022; Glock & Kleen, 2017; Nürnberger et al., 2016; Thomas, 2017). For example, a stronger endorsement of the "science-is-male stereotype" (Thomas, 2017, p. 35) among teachers is associated with a lower physics self-concept and a reduced perceived value of physics among girls. Moreover, teachers who more strongly endorse this stereotype are more likely to recommend language-oriented academic tracks to female students and science-oriented tracks to male students (Nürnberger et al., 2016).

In terms of gender and disruptive behavior, Arbuckle and Little (2004) noted that teachers experienced disruptive behaviors by male students as more concerning than when the same behavior was shown by female students. Glock and Kleen (2017) showed in their vignette study that externalizing behaviors (e.g., chattering, aggressive behaviors) are primarily associated with male students, whereas internalizing behaviors (e.g., withdrawing) are mainly associated with female students (see also Kessels & Hayder, 2020). Glock and Kleen (2017) demonstrated a link between teachers' implicit attitudes and the disciplinary consequences for male students: The more negative the implicit attitudes, the harsher the consequences for disruptive behaviors. Gajda et al. (2022) conducted observations in 34 classrooms in secondary schools and showed that teachers addressed admonitions more frequently in boys, while also encouraging boys to engage in competitive behaviors and girls in cooperative behaviors.

Research in teacher education regarding the assumption that attitudes form perception (Fazio, 1990; Fazio & Olson, 2014) remains scarce (Keskin et al., 2024). To the researchers' knowledge, only three studies have investigated the professional vision of teachers regarding social groups. Firstly, Ebright-Jones et al. (2025) investigated teachers' perceptual attention using mobile eye trackers in their classrooms and found a stronger visual focus (higher fixation count) on Black students in comparison to White students. Given that many teachers hold negative associations with Black students, they tended to monitor these students more closely, anticipating a higher likelihood of disruptive behavior. This pattern aligns with the assumptions of Fazio's MODE model particularly the notion that the valence of an attitude directs visual

attention toward corresponding features (Fazio, 1990; Fazio & Olson, 2014). Secondly, Keskin et al. (2023) investigated the relationship between attitudes and student teachers' gaze behaviors with a video vignette and determined that participants focused more often on students from ethnic minority backgrounds, particularly when holding positive explicit attitudes toward these students. Referencing the open comments of participants, the authors argued that this visual pattern could be explained by stereotypical expectations toward this group—such as anticipating a greater need for guidance. The positive correlation between explicit attitudes and higher attention toward minority students, may, in fact, reflect “positive levels of teacher recognition” (Keskin et al., 2023, p. 8) or possibly a self-serving bias in explicit attitude assessment (e.g., Fazio & Olson, 2003). This result is consistent with findings showing that the relationship between explicitly and implicitly measured attitudes is often weak or even nonexistent (e.g., Pit-ten Cate & Glock, 2019). Finally, Gabel et al. (2025) used video vignettes to investigate the differences in attention between male and female students with an ethnic minority background during a language lesson without any disturbing behavior. The authors demonstrated more positive implicit and explicit attitudes towards female students as well as a higher attentional focus on female students. The higher attentional focus on girls were interpreted as an effect of the positive attitudes towards females. However, when interpreting these results, it should be taken into account that the measured attitudes were related to the ethnic majority (e.g., through the use of German names in the IAT). Furthermore, it remains unclear whether students with an ethnic minority background are also subject to gender-specific expectations regarding their academic competencies (e.g., Kleen & Glock, 2018).

All the aforementioned studies assessed visual attention using the eye-tracking parameter fixation count, they did not examine the depth of cognitive processing (as indicated by fixation duration; see Sect. 2.1). According to Fiske and Neuberg (1990), cognitive processing is a crucial factor in distinguishing between category-based and individual-based perception. Therefore, the emphasis on visual attention alone may limit the extent to which the underlying perceptual processes can be fully understood.

2.4 Aims and hypotheses

The present study aims to investigate the relationship between implicit associations and pre-service teachers' noticing regarding students' disruptive behavior using an experimental eye-tracking setting with four video vignettes showing varying gender and disruptive behaviors of students.

Previous studies have seldom focused on the connection between associations and the concept of professional vision, especially the process of noticing (see the meta-analytical review of Keskin et al., 2024). The few existing studies have focused on students' origin or skin color (Ebright-Jones et al., 2025; Keskin et al., 2023), with only one study concentrating on gender (Gabel et al., 2025). The studies used either real classrooms (Ebright-Jones et al., 2025) or videos from real classrooms (Gabel et al., 2025; Keskin et al., 2023) as stimulus-material. The use of real-classroom stimuli increases the ecological validity; however, due to the higher complexity and reduced experimental control, it also makes it more difficult to clearly examine

the relationship between associations and perceptual processes. For this reason, we employ virtually constructed classroom scenarios, which allow for a higher degree of experimental control while still maintaining a contextually rich and realistic setting. Previous studies using eye-tracking technology to investigate the noticing process, have concentrated on attention by using fixation count as the interesting parameter. According to the model of Fiske and Neuberg (1990), mental effort is also a crucial indicator for impression formation. Therefore, we also implement fixation duration as an indicator for the depth of cognitive processing (Grub et al., 2020, 2025; Rahal & Fiedler, 2019).

Firstly, we seek to investigate whether we could find a difference in teachers' noticing of the disruptive behaviors of female versus male students (Research Question 1). Gabel et al. (2025) showed more attention toward females who exhibited disturbance-free classroom behaviors. An open question is whether this also applies when female students show disruptive behavior. As disruptive behavior is inconsistent with the feminine stereotype (Glock & Kleen, 2017), this may lead to greater attention and deeper cognitive processing for females than for males (Fiske & Neuberg, 1990). We expect a higher fixation count and a longer fixation duration for the female than for male student when exhibiting disruptions.

Secondly, we aim to examine a possible interaction between students' genders and the type of disturbance (passive vs. active) regarding professional vision (Research Question 2). As Glock and Kleen (2017) demonstrated, females are associated with more internalizing behaviors and males with more externalizing behaviors. The greater inconsistency of active disturbances with the female stereotype could lead to more attention and deeper cognitive processing for females when exhibiting active disruptions (Fiske & Neuberg, 1990). A precise pattern regarding gender and type of disruption cannot be anticipated. However, we expect that the fixation count and fixation duration should be highest for the female student exhibiting active disruptions.

Finally, we seek to explore the direct influence of implicit associations on noticing disturbing behaviors (Research Question 3). Following Fazio's (1990) assumption that associations bias perceptual processes, we hypothesize that participants with stronger implicit associations will exhibit greater inconsistencies when observing female students displaying disruptive behavior. Specifically, we expect that the effects outlined in Research Questions 1 and 2 will either occur exclusively among pre-service teachers with stronger implicit associations or be significantly more pronounced in this group compared to those with weaker associations.

3 Methods

3.1 Participants

The participants were pre-service teachers at a German university, who were recruited in lectures and gained credit for their studies. Participation was voluntary, and the study was approved by the university's ethics committee. Initially, 69 participants were recruited; six were excluded from the analysis due to insufficient data quality in the eye-tracking measure, while another was excluded because they did not recognize

Table 1 Demographic data

	Minimum	Maximum	Mean	SD
Age [years]	18	40	23.33	4.27
Semester	2	14	5.27	2.88
Number of school internships	0	5	2.35	1.52

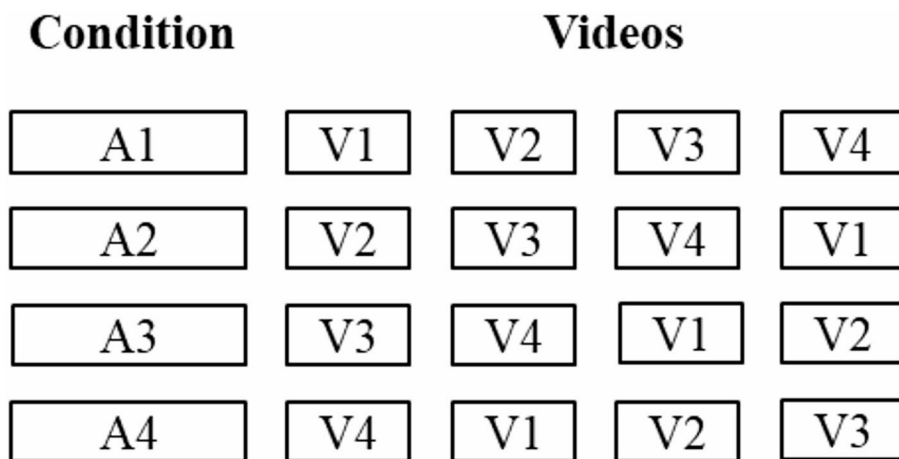


Fig. 1 Sequence of the presented videos, randomized with a Latin square. V1 = boy, passive disruption; V2 = girl, passive disruption; V3 = boy, active disruption; V4 = girl, active disruption

at least one disturbance. The demographics of the remaining $N=62$ participants (41 female, 20 male, one non-binary) are presented in Table 1.

3.2 Design and procedure

The experimental study comprised two parts. The first part was the eye-tracking experiment, which assessed professional vision. The participants viewed four short video vignettes of a virtual classroom with approximately 15 students, with each video showing a disruptive behavior (see Sect. 3.3). To control for possible sequence effects, the videos were balanced in terms of presentation order by a Latin square. Participants were assigned quasi-randomized to one of the four conditions (see Fig. 1). Gaze behavior was recorded while participants observed the video vignettes. The second part consisted of a demographic questionnaire and the IAT, which was used to assess implicit attitudes toward gender. Finally, participants had the opportunity to make open comments regarding the study if they wished to do so. The questionnaires and the IAT were administered via the online survey software SoSci Survey (Leiner, 2024).

3.3 Materials and methods

3.3.1 Videos

The videos depicted a classroom situation in virtual reality, created using the Teach-R open-source software (Wiepke et al., 2019). The videos were 15 s long and showed a silent work phase in a classroom (8th/9th grade) with approximately 15 students and one critical incident (disruptive student). The participants were provided with information about the class and told to observe the silent work phase without any specific observation focus. The disruptive student was either male or female, while the disruptive behavior was either passive (head on the table) or active (throwing paper). The other students silently worked at their task for the whole scene (see Fig. 2). Therefore, we conducted a 2 (student gender: male vs. female) $\times$ 2 (disruptive behavior: passive vs. active) mixed design with repeated measures of both factors, and implicit attitudes as the between-subjects factor. To verify whether participants had noticed the disruptions, after each video, they were verbally asked by the experimenter what they had noticed in the video. The experimenter then coded whether the disruption had been explicitly mentioned as such or not.

3.3.2 Eye-tracking apparatus

Gaze behavior was assessed under standardized environmental conditions using a stationary, binocular eye tracker (Tobii Pro Fusion, 250 Hz). We employed a 24-inch display monitor (1080×1920), keeping the distance between the eye tracker and par-



Fig. 2 Screenshot of one video. This screenshot shows the passive disruption by the girl (marked with the rectangle). The boy, who shows disruptions in other videos, is marked with an ellipse

ticipants as consistent as possible (approx. 65 cm), and ensured uniform illumination. Before recording, we conducted a 9-point automatic calibration followed by validation to ensure data quality; the calibration was performed again if the 9-point automatic calibration failed. High quality eye-tracking data were recorded (calibration accuracy: $M=0.53^\circ$, $SD=0.20^\circ$; calibration precision: $M=0.37^\circ$, $SD=0.24^\circ$). Data were exported from Tobii using the Tobii I-VT (fixation) filter with a standard setting (I-VT classifier), i.e., a threshold of 30/s.

3.3.3 Professional vision

Gaze behavior was recorded as an indicator of professional vision. We utilized fixation count as an indicator of attention and average fixation duration as an indicator of the depth of cognitive processing (see Grub et al., 2020, 2025). We used dynamic polygon AOIs (areas of interest) for disruptive students. AOIs were active for the duration of the video.

3.3.4 Implicit associations toward gender

To assess implicit associations toward gender, we conducted an IAT (Greenwald et al., 1998). The IAT assumes that persons can more easily group words with different categories when they have developed a strong association between these categories; therefore, the strength between category associations can be assessed. In the present study, one category was gender and the second was behavior. The gender of the students was represented through eight typical names for boys and girls, while behavior was operationalized with eight adjectives that described positive or negative behavior (see Table 2). The names and adjectives were taken from Glock and Kleen (2017). To calculate the D -measure, we utilized Greenwald et al.'s (2003) improved scoring algorithm, where positive D values indicated more positive implicit attitudes toward girls and more negative implicit attitudes toward boys. The IAT's internal consistency was calculated as the correlation between the results of the trials and those of the tests ($r=.67$). For the analyses, groups were formed using the median split of the D -value.

Table 2 Items of the IAT

	Names of girls	Names of boys	Positive behavior	Negative behavior
The items were presented in German	Emma	Ben	Sweet-natured	Arrogating
	Mia	Paul	Exemplary	Aggressive
	Hannah	Lukas	Adjusted	Loud
	Lena	Jonas	Silent	Naughty
	Lea	Leon	Respectful	Anxious
	Emily	Nico	Attentive	Untrustworthy
	Marie	Felix	Concentrated	Unfocused
	Leonie	Nils	Disciplined	Disrespectful

Table 3 Descriptives for fixation count and mean fixation duration for male and female students, as well as for passive and active disruptions

	Fixation Count		Mean Fixation Duration in msec	
	M	SD	M	SD
Male, passive	7.94	3.30	0.43	0.19
Male, active	10.82	3.65	0.41	0.17
Female, passive	10.90	3.50	0.37	0.17
Female, active	13.97	4.38	0.34	0.11

Table 4 Descriptives for fixation count and mean fixation duration for student gender and type of disruption depending on implicit associations

	Level of Association	Fixation Count		Mean Fixation Duration	
		M	SD	M	SD
Male, passive	Weak	7.59	3.49	0.48	0.23
	Strong	8.30	3.11	0.38	0.16
Male, active	Weak	10.31	3.35	0.42	0.16
	Strong	11.37	3.92	0.42	0.19
Female, passive	Weak	9.72	2.56	0.40	0.19
	Strong	12.17	3.94	0.33	0.14
Female, active	Weak	13.88	4.16	0.36	0.13
	Strong	14.07	4.68	0.32	0.08

Level of association: The *D*-value of the IAT was separated by median split (*Mdn*=0.35; *range*: -0.55 to 1.27); descriptives for the group with weak associations: *M*=-0.04, *SD*=0.28; with strong associations: *M*=0.60, *SD*=0.21

4 Results

To analyze research questions 1 and 2, we conducted ANOVAs with repeated measures for the factors student gender and disturbance type separately for each eye-tracking parameter. For Research Question 3, we added implicit associations (median split) as a between-subjects factor. The analyses were conducted using SPSS 29, with an alpha level of 0.05.

Research Question 1. Difference of noticing toward gender: The focus of attention was higher for the female student (higher fixation count: $F(1,61)=59.53$, $\eta^2=0.49$), and cognitive processing was less deep for female (lower average fixation duration: $F(1,61)=16.08$, $p<.01$, $\eta^2=0.21$; see Table 3).

Research Question 2. Interaction effect of student gender x type of disturbance: There was no statistically significant interaction effect for either eye-tracking parameter (fixation count: $F(1,61)=0.07$, $p=.80$; average fixation duration: $F(1,61)=0.09$, $p=.77$; see Table 3).

Research Question 3. Interaction effect of student gender x implicit association: We did not find a statistically significant interaction effect for either eye-tracking parameter (fixation count: $F(1,60)=0.30$, $p=.58$; average fixation duration: $F(1,60)=0.14$, $p=.71$; see Table 4).

5 Discussion

With this study, we wanted to investigate the relationship between implicit gender associations and noticing of disruptive behaviors as a central aspect of professional vision. This study is among the first to examine this relationship in teacher professionalization research and conducted a randomized methods design using four videos with varying student genders and disturbance types.

Firstly, we aimed to investigate whether there was a difference in noticing of students of different genders showing disruptive behavior (Research Question 1). Our results showed that disruptive female students got more attention than male students, although the cognitive processing was higher for male students. The greater attentional focus on incongruent stimuli goes in line with our assumption based on the model of Fiske and Neuberg (1990) and is also consistent with the work of Gabel et al. (2025), who found a higher attentional focus on female students who showed non-disturbing behavior. Another possible explanation for the higher attentional focus on the female certainly could lie in the stimulus video: The female student was sitting alone at a table, while the male student was surrounded by other students, meaning that the female student was more salient in the scene (Fig. 1). However, we also expected deeper cognitive processing—indicated by a longer fixation duration—when observing the female student displaying disruptive behavior, which was not confirmed by our findings. These inconsistent results may also reflect differing cognitive preferences in the perception of inconsistent information, as suggested by Sherman et al. (2000). They distinguished between perceptual encoding (identification) and conceptual encoding (comprehension of meaning). The results of their studies indicate that perceptual encoding is associated with a preference for inconsistent information (which would correspond to higher fixation counts for inconsistent stimuli), whereas conceptual encoding is linked to a preference for consistent information (which would correspond to lower fixation duration for inconsistent information). This distinction may also be reflected in our descriptive findings, which show that the participants exhibiting strong associations demonstrated higher fixation counts alongside lower fixation durations for the disturbing female as an inconsistent information (Table 2). This effect may be particularly pronounced in the case of strong associations, where the degree of inconsistency for the girl displaying a disruption is expected to be higher. However, as these results are not statistically robust, any interpretation must remain preliminary.

Secondly, we sought to investigate the interaction effect of student gender and types of disturbance (Research Question 2). Since female students are more associated with internalizing or passive behaviors (Glock & Kleen, 2017), active disturbances from female students should be more inconsistent with general gender association (Fiske & Neuberg, 1990). We expected the highest attentional focus and deeper cognitive processing for females displaying the active disturbance. In our study, the focus of attention lay more on active disturbance due to its higher saliency (Kilbury et al., 2024), but the effect was independent of student gender. Finally, we wanted to investigate whether implicit associations—assessed with an IAT—influence student teachers' noticing behaviors (Research Question 3). This was not the case in our data; we did not find a statistically significant interaction effect between student gender and

implicit associations. That means that the strength of associations had no effect on professional vision, neither in terms of attentional nor cognitive processes.

One substantive explanation would be that student teachers' implicit associations do not influence their noticing of the behaviors exhibited by students of different genders, since disruptive behaviors are considered disruptive regardless of who is acting, because of a given saliency (Kilbury et al., 2024). An indicator could be found in the responses in the study's comment section: Following the experiment, participants had the opportunity to comment on the experiment in an open-answer format. Approximately one-third of the participants answered that they found active disturbances most disturbing independently of the student's gender. Another explanation concerns whether the gender association or rather which associations were activated with the stimuli. According to Fazio (1990), an association can only influence perceptual and behavioral processes when it is activated. Unfortunately, we neither activated the questioned association before the stimuli were viewed, nor did we ask the participants afterwards. Furthermore, the stimuli showed the same students in all four videos because we wanted to eliminate possible confounding factors. Thus, we cannot completely exclude the notion that the disruptive behavior of one student in the first video influenced the viewing behavior in the following.

5.1 Limitations

We conducted a well-designed experiment with a comparatively large sample and controlled conditions. Further, we not only focused on attentional processes but also on the depth of cognitive processing. Nevertheless, the study had some limitations. At first, the investigation focused on pre-service teachers. Given that they may be more likely to have a perception bias through implicit associations due to their limited experience and knowledge (Pit-ten Cate & Glock, 2019), it is also important to investigate experienced teachers. Most studies found no evidence of differences in associations between groups with varying levels of expertise (Denessen et al., 2022; Pit-ten Cate & Glock, 2019). However, biased judgements may be influenced by cognitive load, especially given the demands of a complex and dynamic classroom settings (Pit-ten Cate & Glock, 2019), which can result in more biased responses among novices.

A second, closely related limitation lies in the use of video stimuli, which cannot fully capture the complexity of real classroom interactions and therefore reduce ecological validity. Virtual classroom environments, which require participants to engage in interactions and respond to more demanding tasks, may amplify the expected effects.

Third, as noted above, we did not manipulate or control whether the targeted group association was activated in participants. Group associations can only influence perception and information processing if they are activated (Fazio, 1990; Fazio & Olson, 2014; Macrae & Bodenhausen, 2000). It is therefore possible that, although participants held implicit associations, these were not triggered in the given situation and thus did not affect their perception. To ensure activation of group associations, techniques such as implicit priming techniques or the explicit verbal or visual presen-

tation of stereotype category can be applied (Macrae & Bodenhausen, 2000; Kunda & Spencer, 2003).

Fourth, we only used eye-tracking data and no additional assessment of participants' verbal data, which complicates the interpretation of the eye-tracking data. Asking participants what specifically caught their attention—such as which students or behaviors they focused on—potentially by showing them their own eye-tracking data, could enrich the gaze data with qualitative insights and help illuminate the underlying cognitive processes (Biermann et al., 2023; Grub et al., 2022b, 2025; Stahnke & Blömeke, 2021).

A last critical limitation is the use of the IAT as the implicit association assessment. As Bar-Anan and Nosek (2012) stated, the IAT requires a contrasting category, so the gender categories are not independent from another. A high *D*-value indicates that someone has strong associations between males and negative behavior *and* between female names and positive behaviors, which must not be the case and complicates the interpretation.

5.2 Implications for future research

In our view, the use of standardized videos (for example, generated with virtual classroom software) in a standardized experimental setting can provide initial insights into the relationship between teachers' implicit associations and perceptual processes as a mediator for professional decisions and behaviors. For future research, it is essential to investigate not only perceptual processes related to disruptive behavior, but also those concerning desired behavior such as students' signaling. As a first step, this requires reducing the complexity of the stimulus material to examine the effects of group associations independently from external factors such as pixel size, the number of students per social group, classroom position, and the saliency of disruptive or desired behavior. Subsequently, to increase ecological validity, the complexity of the stimuli should be enhanced—for example, by generating longer video sequences and using different students to avoid sequencing effects. To explore not only the relationship between group associations and professional vision, but also the factors influencing teachers' decision-making and professional behavior (see Blömeke et al., 2015; Gegenfurtner, 2025; Seidel et al., 2025), the use of virtual classrooms should be considered. These environments allow controlled interactions with virtual students and offer a promising avenue for studying teacher behavior in realistic yet controlled settings (e.g., Goldberg & Fütterer, 2025). To enrich the eye-tracking data, we recommend employing stimulated recall (Biermann et al., 2023; Gegenfurtner & Stahnke, 2025; Grub et al., 2022b). This would allow for an investigation of participants' cognitive processes or activated associations and a better interpretation of the eye-tracking data. As an alternative assessment of implicit associations, methods that do not require a contrasting category are recommended to separately assess the associations toward groups (e.g., Bar-Anan & Nosek, 2012).

Research should also contribute to the development of theoretical frameworks. In this context, the integration of group associations as a potential influencing factor on professional vision warrants further consideration. Nevertheless, such an extended framework requires precise and consistent definition of the terms used in different

research contexts. For example, it remains unclear whether group associations are supposed as affective or cognitive factors; as in the field of social cognition the relationship between attitudes and stereotypes remains an open question—particularly whether they are hierarchically structured or operate independently (e.g., Nesdale & Durkin, 1998). Gabel et al. (2025) conceptualized group associations as individual declarative knowledge about groups. Following Blömeke and Kaiser (2017), such associations may be understood as beliefs shaped by contextual influences, including shared beliefs within the professional community or broader societal norms. Moreover, in frameworks of professional vision, the term knowledge refers to different levels. Some frameworks use the term in the meaning of academic knowledge in a normative sense, that is the professional knowledge which should be acquired through academic education (Blömeke et al., 2015; Seidel et al., 2025). However, the term is also used to refer to knowledge in a more subjective sense as individual mental structures (Gabel et al., 2025; Gegenfurtner & Stahnke, 2025). In the framework of Neuweg (2014), the former would be designated as *knowledge 1* (or *world-3* objects sensu Popper, 1979), the latter as *knowledge 2* (or *world-2* objects sensu Popper, 1979). To ensure conceptual clarity, it is crucial to avoid *jingle-jangle fallacies* (e.g., Hanfstingl et al., 2024): That is, the erroneous assumption that different terms refer to different constructs when they do not (*jingle*), or that the same term refers to the same construct across contexts when it does not (*jangle*).

6 Conclusion

The perception and treatment of students should be based on individual behaviors and achievements, rather than on expectations based on membership in a social group. Therefore, this examination of the relationship between group association and professional vision of teachers is important as the perceptual process can be seen as an important mediator between individual expectations and behavior. This study's results can serve as a basis for more experimental studies to gain a deeper understanding of the mediating role of professional vision between group associations and teachers' behaviors.

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Declarations

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