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Editorial: Advancing research on teachers' professional vision: implementing novel technologies, methods and theories

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Editorial on the Research Topic

[Advancing research on teachers' professional vision: implementing novel technologies, methods and theories](#)

The rapidly developing field of technology-enhanced educational research has revolutionized our understanding of teachers' professional vision in the classroom (Keskin et al., 2024; Witt et al., 2024). Over the past decade, the integration of eye tracking technology has gained significant traction, offering profound insights into the cognitive processes underlying teaching. This technology allows researchers to capture and analyze the mechanisms of visual information acquisition, integration and retrieval, shedding light on how teachers interact with their dynamic classroom environment. Eye tracking technology has proven invaluable in revealing how teachers selectively filter and interpret a variety of visual cues. This selective visual perception is fundamental to effective teaching because by focusing on relevant classroom events and quickly ignoring the irrelevant, teachers can make informed, timely decisions that improve student engagement and learning outcomes (Grub et al., 2020).

However, despite these advancements, researchers in the field have identified several limitations in current research (Jarodzka et al., 2020; Kosel et al., 2023; Witt et al., 2024). One major challenge is balancing experimental rigor with the complexity of real classroom environments, as this introduces confounding factors and variability that challenge the consistency of findings. Another issue is that studies are often conducted under varied settings, such as different subjects, age groups, and teaching methods, complicating the generalization of results. Additionally, non-standardized experimental setups and insufficient triangulation of eye tracking data with other data streams, such as think-aloud data, can lead to inconsistent results and reduced validity. Finally, the potential of eye tracking data to foster teachers' professional vision remains largely underexplored. The

aim of this Research Topic is to address these challenges and expand the scope of research on teachers' professional vision. By leveraging new methodological approaches, such as more advanced strategies for data triangulation and implementing innovative experimental designs, we seek to enhance the robustness and comprehensiveness of this research strand.

Steps toward balancing experimental rigor with the complexity of real classroom environments

Jarodzka et al. investigated the professional vision of pre-service, beginning and experienced teachers by assessing how they perceive and interpret visual cues in classroom management using mobile eye tracking glasses. In this study, $n = 22$ pre-service, $n = 17$ beginning, and $n = 19$ experienced teachers were eye-tracked while teaching their classes. The results revealed no significant differences in the efficiency of visual processing across different teaching experience levels throughout the lesson. Notably, by the end of the lesson, pre-service teachers showed a slight increase in fixation counts compared to the beginning. Although overall teaching experience did not significantly affect the dispersion of fixations, experienced teachers exhibited a broader visual span at the lesson's start than at its end. Additionally, teaching experience did not significantly impact average fixation durations; however, pre-service teachers experienced a slight decrease in fixation durations as the lesson progressed. The key finding of this in-action, mobile eye tracking study is that the authors found an interaction between teaching experience and phase of the lesson, suggesting that all teachers start the lesson in a similar way, but that pre-service teachers in particular seem to experience some sort of classroom management difficulties as the lesson progresses.

Miller et al. focused on noticing skills that classroom teachers need to monitor a group of students varying in interest, knowledge, and behavior while simultaneously presenting a lesson and adapting it on the fly to student questions and understanding. The study discusses that standard methods of classroom video are limited in their support of teacher professional vision, and the authors explore an alternative using mobile eye tracking that overcomes many of these limits. The combination of mobile eye tracking records and standard video enables participants to "re-experience" a situation in an intense way; while also seeing things they missed the first time through. In this study, pairs of $n = 24$ novice and $n = 24$ experienced teachers teaching the same students and then watched their own mobile eye tracking recordings while performing a retrospective think-aloud task. The results showed that experienced teachers were better able to describe high-level features and their significance in the lessons, while novices were more likely to talk about in-the-moment events such as things they failed to see while teaching. One of the study's new findings is that experienced teachers, while quick to grasp the overall meaning of classroom situations, may lack awareness of some lower-level features that inform those inferences. This highlights a potential trade-off in the perceptual processes of expert teachers.

Chaudhuri et al. investigated the association between teachers' physiological and psychological stress and their visual focus of

attention, as well as the mediating effect of teaching practices on this association in authentic classroom settings. The study involved $n = 53$ teachers and used multimodal methods: salivary cortisol levels for measuring physiological stress, a self-reported questionnaire for psychological stress, observed teaching practices during one school day, and eye tracking video recordings of classroom teachers during one lesson to assess visual focus of attention. The results showed that neither physiological nor psychological stress was directly related to teachers' visual focus of attention. However, teachers who employed more *student-centered* teaching practices, as opposed to teacher-directed practices, demonstrated a higher number of fixations on students, longer total fixation duration, and a more individualized distribution of visual focus on students. Teaching practices mediated the effect of psychological stress on teachers' fixation counts and distribution of visual focus. The findings suggest that teaching practices influence the visual attention teachers give to students and that teachers' stress affects their visual focus through these practices. These results highlight the importance of providing teachers with training and support to recognize their stress levels and understand how stress can impact their teaching. Enhancing awareness and management of stress, alongside adopting more child-centered teaching practices, can improve teachers' engagement with students.

Improving generalizability through a greater variety of teaching contexts and confounding factors

Stahnke and Friesen explored whether experienced teachers from different secondary school subjects (biology and mathematics) differ in their professional vision of classroom management. The study involved $n = 20$ experienced teachers and used video clips of classroom settings as stimuli. Teachers' eye tracking data and retrospective think-aloud data were recorded and analyzed using quantitative content analysis and epistemic network analysis. The study compared expert teachers' visual attention, their noticing of classroom management events, and their knowledge-based reasoning across both subjects. Results revealed subject-specific differences in professional vision. Experienced biology teachers were more focused on suggesting alternative classroom management strategies, especially those addressing planning aspects such as providing structure and preparing the classroom. Conversely, experienced mathematics teachers were more evaluative in their analysis, concentrating on behavioral management and ensuring student engagement in real-time. These findings highlight the importance of considering subject-specific contexts when studying professional vision in classroom management. Different subjects may require distinct strategies and considerations, influencing how teachers perceive and address classroom management challenges. This study underscores the need for tailored professional development that takes into account the unique demands of different teaching subjects to enhance classroom management skills effectively.

Duvivier et al. explored the visual strategies of $n = 6$ University Supervisor Trainers (UST) for teachers undergoing

the Upper Secondary Education Teaching Certification (AESS) in French-speaking Belgium and $n = 16$ pre-service teachers they train. The study aimed to understand how these two groups observe a teaching situation using eye tracking. The video analyzed showed the start of a geography lesson given by a trainee in a primary school class. The results showed that UST and pre-service teachers focus their attention on the same groups of students but do so differently. UST adopt visual strategies distinct from those of pre-service teachers, aligning their approaches with those of expert teachers in other studies using eye tracking. Specifically, UST demonstrated dynamic and floating visual strategies, characterized by more frequent revisits and shorter fixation durations compared to pre-service teachers. Additionally, UST spent less time fixating on very active students compared to pre-service teachers. When analyzing the UST gaze itineraries during the trainee's planning error, both common elements (e.g., teaching tools) and divergent elements (e.g., checking pupils) were observed. This study highlights that UST, compared to pre-service teachers, employ advanced visual strategies that involve dynamic and efficient revisiting patterns and shorter fixation durations, reflecting their expert status. This finding emphasizes the importance of training pre-service teachers to develop similar visual strategies to enhance their observational skills and overall teaching effectiveness.

Keskin et al. investigated whether more negative teacher attitudes and lower teacher recognition toward ethnic minority students are reflected in teacher gaze. The study sought to determine if teachers visually prefer ethnic majority students over ethnic minority students by examining the number of fixations, duration of fixations, and time to first fixation. An explanatory sequential mixed-method design was used with a sample of $n = 83$ pre-service teachers. The pre-service teachers watched a classroom video while their eye movements were recorded and then provided written reflections on their perceptions and related experiences. A standardized survey measured their demographic information, explicit attitudes toward ethnic minority students, self-efficacy for teaching ethnic minority students, and associated stereotypes. Contrary to the hypothesis, the results indicated that pre-service teachers had longer fixation durations on ethnic minority students compared to ethnic majority students. Additionally, positive explicit attitudes toward ethnic minority students were positively correlated with both the number and duration of fixations on ethnic minority students. Qualitative analyses revealed that pre-service teachers linked disadvantaged situations for ethnic minority students to teacher stereotypes and student language difficulties. They also related their reflections to their own experiences as ethnic minorities. These findings suggest that pre-service teachers who hold positive attitudes toward ethnic minority students tend to focus more on them, challenging the notion of visual preference for ethnic majority students. The study underscores the importance of addressing teacher attitudes and biases in teacher education and professional development to better handle student diversity. Further research is needed to explore the implications of these findings for improving equitable attention and recognition in diverse classrooms.

Optimized data triangulation methods

Biermann et al. focused on teachers' noticing as a fundamental precondition for effective teaching by targeting the ability to focus on relevant events in the classroom while ignoring the irrelevant. Many recent studies have utilized eye tracking technology in classroom observations to capture the continuous attentional processes of teachers. Despite the general validity of the eye-mind assumption, this study underscores the necessity of methodological triangulation to accurately determine the focus of attention and its underlying reasons. While previous studies have utilized different data sources like gaze and verbal data, these were often analyzed separately rather than in combination. In this study, verbal data (retrospective think-aloud; RTA) and a reaction-based concurrent measure (keystroke) were collected to assess the noticing process of $n = 34$ novice and $n = 37$ experienced teachers as they watched staged classroom videos. For direct triangulation, these data were combined with eye tracking parameters that indicate attentional processes, such as fixation count, average fixation duration, and revisits. The findings revealed that participants who detected critical incidents in the videos—either through keystroke or RTA—exhibited a higher number of fixations and more revisits to the relevant areas, but their average fixation duration was comparable. However, no significant expertise differences in accuracy were found between novice and experienced teachers. One of the study's strengths is its innovative approach to integrating multiple measures to assess the noticing process, which offers a more comprehensive understanding than eye-movement data alone. Despite only partially significant results, the study demonstrates the potential of combining RTA and keystroke methods to complement and possibly correct eye tracking data.

Wyss et al. examined the professional vision of $n = 31$ pre-service teachers and $n = 32$ in-service teachers by investigating differences in their noticing and reasoning about videotaped classroom events. The study aimed to determine if the groups differed in their observations and interpretations, if the video perspective influenced their noticing and reasoning, and to what extent their gaze behavior differed from their verbal statements. Participants watched an authentic teaching video from different perspectives, and their visual focus of attention was recorded using a remote eye-tracker. Subsequently, participants reported what they had noticed during an interview. The triangulated data revealed that the gaze behavior of pre-service teachers and in-service teachers did not differ, but the content of their verbal statements did. Depending on the video perspective, participants focused on different subjects; however, this difference was not reflected in their verbal reports, indicating an inconsistency between gaze behavior and verbal statements. This finding suggests that pre-service teachers and in-service teachers, while visually focusing on similar elements, interpret and articulate these observations differently. This study highlights the importance of using multiple data sources and types to explore professional vision comprehensively. The inconsistency between gaze behavior and verbal statements underscores the complexity of professional vision and suggests that further research is needed to understand this concept in depth. The results emphasize the need for training that helps pre-service

teachers align their visual focus with accurate and meaningful interpretations of classroom events.

Kosel et al. explored how experienced and novice teachers' reason about and diagnose different student characteristic profiles while observing classroom scenes. The profiles included three inconsistent profiles (overestimating, uninterested, and underestimating) and two consistent profiles (strong and struggling). Results indicated that experienced teachers generally achieved higher judgment accuracy in diagnosing student profiles compared to novice teachers. Furthermore, an epistemic network analysis of behavioral cues revealed that experienced teachers made more connections between a broader spectrum of surface cues (e.g., a student's hand-raising behavior) and deep cues (e.g., a student being interested in the subject). This comprehensive and robust reasoning in experienced teachers underscores the impact of professional experience on diagnostic skills. The study demonstrates that epistemic network analysis is a strong method to further analyze teachers' reasoning. The study highlights that experienced teachers' reasoning is not only more accurate but also more integrative, linking both surface and deep cues to form a holistic understanding of student characteristics.

First steps in using eye tracking materials to foster (pre-service) teachers' professional vision

Oellers et al. addressed the challenge of promoting a professional vision of teaching, a key factor in teachers' expertise, by investigating the learning processes involved in acquiring this vision. The study aimed to fill the gap in understanding how teachers develop professional vision through video-based intervention programs, which have traditionally focused on outcome measures rather than the learning processes. The study involved $n = 45$ undergraduate pre-service teachers enrolled in a course focused on classroom management. The course required students to apply their classroom management knowledge to analyze authentic classroom videos. The goal was to identify the variety of individual strategies used by students during their video analyses and to examine the relationship between these strategies and the quality of the students' analyses, as measured by their agreement with expert ratings of the video clips. Using a learning analytical approach, the study gathered process-related data to analyze students' behavioral patterns within a digital learning environment. Cluster analyses were conducted to identify video-based strategies and relate them to the quality of analysis outcomes. The results provided insights into the learning processes, revealing different approaches taken by students in analyzing classroom videos. The study identified clusters indicating meticulous and less meticulous approaches to video analysis and found significant correlations between process and outcome variables. These findings have implications for the design and implementation of video-based assignments aimed at promoting professional vision. They suggest the potential for process-based diagnostics and adaptive learning support to enhance the effectiveness of video-based learning activities in teacher education.

Kaminskienė et al. investigated the role of professional reasoning in teacher professional vision and how video with gaze overlay and heatmaps from a mobile eye tracker can support self-reflection and professional vision development in higher education. $N = 4$ university teachers wore a mobile eye tracker during a lecture segment. The study analyzed their gaze distribution on classroom targets alongside their reflective comments while watching recordings of their own behavior. The results showed that mobile eye tracking data provided valuable feedback on how teachers distributed their attention across different areas in the classroom and between students. Visualization of gaze distribution as heatmaps allowed teachers to reflect on their perceived vs. actual gaze allocation. Many teachers realized discrepancies between their perceptions and the eye-tracker data, prompting deeper reflection on their professional reasoning. This self-reflection encouraged teachers to analyze why they diverted their attention to certain areas and consider opportunities for improvement. The study highlighted that heatmap analysis based on mobile eye-tracker data can be a powerful tool for developing teachers' professional vision. It helps in engaging students through more balanced attention distribution. The findings suggest that incorporating mobile eye-tracker recordings and gaze distribution heatmaps into video-based professional development can significantly enhance teachers' reflective practices and professional growth.

Telgmann and Müller examined the noticing skills of pre-service teachers regarding classroom management during teaching. While previous research has shown positive effects of interventions on teachers' noticing during video observation, this study is among the first to investigate noticing during actual teaching. In this quasi-experimental study, $n = 46$ pre-service teachers participated in a standardized classroom simulation after receiving classroom management training. One group received additional prompting on evidence-based classroom management strategies before and during the simulation, another group received only the training, and a control group received no training. Mobile eye tracking and retrospective video observations were used to assess event-related and global noticing. Event-related noticing was measured by the count and accuracy of noticed classroom management events, while global noticing was assessed through eye movement parameters (visit/fixation counts and durations) on students. The results indicated that training and prompting significantly improved pre-service teachers' event-related noticing, with the experimental groups making fewer target and time errors compared to the control group. However, there were no significant differences in global noticing measures such as fixation and visit count and duration on students. A positive correlation was found between higher noticing accuracy and the share of fixations on students. This study expands upon previous research by using mobile eye tracking to obtain objective measures of teachers' noticing. It highlights the importance of knowledge for teachers' noticing during teaching and takes a significant step toward understanding how pre-service teachers' noticing can be enhanced through classroom management training.

Gabel et al. examined how instructional guidance affects pre-service teachers' visual attention to information relevant for classroom management in classroom videos. This mixed-methods eye tracking study compared three instructional conditions: (1) a specific task instruction before video viewing ($n = 45$),

(2) attention-guiding prompts during video viewing ($n = 45$), and (3) a general task instruction before video viewing as a control group ($n = 45$). Participants viewed two classroom videos and clicked a button whenever they identified situations relevant to classroom management. The study hypothesized that specific task instructions and prompts would better guide visual attention compared to general task instructions, as they provide informational cues to focus on specific dimensions of classroom management. It was also expected that both experimental conditions would activate cognitive schemata, resulting in knowledge-based processing of visual information, with specific task instruction having a similar attention-guiding effect as prompts during video viewing. Measurements were taken at the outcome level (mouse clicks) and the process level (eye tracking). Findings confirmed the hypotheses at the outcome level and partially at the process level regarding participants' gaze relational index. In a disruptive classroom situation, participants in the prompting condition demonstrated better attentional performance, evidenced by a higher number of fixations and shorter time to first fixation on disruptive students. Qualitative analyses revealed that without instructional guidance, pre-service teachers were less likely to identify disruptive situations and more likely to focus on other aspects of classroom management related to the teacher's actions. This study highlights the benefits of attention-guiding instructions in pre-service teacher education, emphasizing the economy of implementation and the salience of classroom situations. Both specific task instructions and prompts can significantly enhance pre-service teachers' ability to identify relevant information in classroom management, supporting the development of their professional vision.

Heinonen et al. investigated how university teachers' (mis)conceptions of teaching and learning relate to their ability to notice and interpret pedagogically significant incidents in the classroom, referred to as their professional vision. They also examined whether short pedagogical training could enhance teachers' conceptual understanding and professional vision. A total of $n = 32$ university teachers participated in the study, completing a teacher conception questionnaire and an eye tracking measurement with a stimulated retrospective recall (SRR) interview, using a pre-test/post-test design. The findings revealed that overall, there was no correlation between professional vision scores and (mis)conceptions of teaching and learning. However, in classroom situations requiring selective visual attention due to simultaneous interactions, teachers with more misconceptions and less sophisticated conceptions focused on the teacher's actions, while those with fewer misconceptions and more sophisticated conceptions focused on students' actions. Pedagogical training was found to improve the sophistication of less sophisticated conceptions of teaching and learning among university teachers. Statistically significant improvements in participants' noticing abilities were identified, though their interpreting skills did not show similar improvements. The study highlights the importance

of pedagogical training and the development of conceptual understanding for university teachers. These elements are crucial in supporting their pedagogical expertise and professional vision, particularly in relation to learning theories. Furthermore, the study introduces an innovative approach by combining mobile eye tracking with retrospective think-aloud tasks, providing a richer understanding of the noticing process. The methods used in this study are becoming more cost-effective and accessible, which could revolutionize both research and professional development in teaching.

Collectively, studies in this Research Topic affirm the critical role of eye tracking technology in advancing our understanding of teachers' professional vision. They advocate for a holistic approach that integrates technological, pedagogical, and contextual factors to develop more effective and equitable teaching practices. By addressing the limitations of current research and offering new methodological insights, this Research Topic paves the way for future studies that can further enhance the robustness and applicability of professional vision research in diverse educational settings.

Author contributions

CK: Conceptualization, Supervision, Validation, Writing – original draft, Writing – review & editing. A-SG: Supervision, Writing – review & editing. CH: Writing – review & editing. TS: Conceptualization, Resources, Supervision, Validation, Writing – review & editing.

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References

- Grub, A.-S., Biermann, A., and Brünken, R. (2020). Process-based measurement of professional vision of (prospective) teachers in the field of classroom management. A systematic review. *J. Educ. Res. Online* 12:75–102. doi: 10.25656/01:21187
- Jarodzka, H., Skuballa, I., and Gruber, H. (2020). Eye-tracking in educational practice: investigating visual perception underlying teaching and learning in the classroom. *Educ. Psychol. Rev.* 33, 1–10. doi: 10.1007/s10648-020-09565-7
- Keskin, Ö., Seidel, T., Stürmer, K., and Gegenfurtner, A. (2024). Eye-tracking research on teacher professional vision: a meta-analytic review. *Educ. Res. Rev.* 42:100586. doi: 10.1016/j.edurev.2023.100586
- Kosel, C., Mooseder, A., Seidel, T., and Pfeffer, J. (2023). Measuring teachers' visual expertise using the gaze relational index based on real-world eye-tracking data and varying velocity thresholds. *J. Expert.* 6:5143. doi: 10.48550/arxiv.2304.05143
- Witt, J., Schorer, J., Löffing, F., and Roden, I. (2024). Eye-tracking research on teachers' professional vision: a scoping review. *Teach. Teach. Educ.* 144:104568. doi: 10.1016/j.tate.2024.104568