

Through the eyes of the teacher - Multimodal exploration of expertise differences in the  
perception of classroom disruptions

Mandy Klatt<sup>1</sup>, Dr. Gregor Kachel<sup>1, 2</sup>, Dr. Christin Lotz<sup>1</sup>, & Prof. Dr. Anne Deiglmayr<sup>1</sup>

<sup>1</sup> Leipzig University

<sup>2</sup> Max-Planck University for Evolutionary Anthropology

Author Note

We received funding from QualiFond of University Leipzig. We have no conflicts of  
interest to disclose. This article is based on data used at conference presentations  
(DACH-Nachwuchsakademie, 2022; EARLI SIG 11 2022; EARLI SIG 27, 2022).

Correspondence concerning this article should be addressed to Mandy Klatt,  
Dittrichring 5-7, 04109 Leipzig. E-mail: mandy.klatt@uni-leipzig.de

Through the eyes of the teacher - Multimodal exploration of expertise differences in the perception of classroom disruptions

## Introduction

Managing classroom disruptions is a crucial aspect of effective classroom management (Evertson, Weinstein, et al. (2006); Kounin (2006)).

Accordingly, teachers must be able to quickly notice and appropriately react to significant events in the classroom. This ability is referred to as classroom professional vision (Goodwin (2015); Sherin (2007)).

The process of professional vision can be divided into two main aspects: focusing on relevant situations for learning and teaching (“noticing”) and applying knowledge to draw appropriate conclusions in these situations (“knowledge-based reasoning”; Seidel and Stürmer (2014)).

Therefore, the early visual perception of classroom disruptions is a key component to effectively maximize students’ learning time and minimize classroom interruptions. According to Kounin (2006), these important classroom management strategies are called “withitness” and “overlapping” and can be summarized under the concept of monitoring (Gold and Holodynski (2017)).

Learning to develop such classroom management skills is a demanding and complex task for student teachers (Wolff, Jarodzka, Bogert, and Boshuizen (2016)). Research on teacher expertise showed that expert and novice teachers differ in their ability to perceive classroom events, “[...] whereas only a few studies have focused on the basal process of noticing, i.e. the recognition of possible disturbing situations” (Grub, Biermann, and Brünken (2020), p.75). Mobile eye-tracking data can fill this research gap by providing new insights in how expertise differences in teacher’s professional vision manifest in teacher-student interactions (Lachner, Jarodzka, and Nückles (2016); @Wolff et al. (2016)).

## Theoretical background

### Professional competence

### Classroom Management

- Disruptions definition

### Professional Vision

### Expertise

### Parameter/Indicators of professional vision

## Research Questions

This study examined how the degree of teaching experience influences (a) the number of fixations on relevant areas (e.g., the student performing the disruption), (b) the fixation duration in relevant areas and (c) the time to first fixation on relevant areas, using mobile eye-tracking data in a controlled, micro-teaching setting. Based on the existing literature, we expect expert teachers to outperform novices by (H1) showing more fixations on relevant areas with (H2) shorter fixation durations and (H3) perceiving classroom disruptions faster (cf. Van den Bogert, Bruggen, Kostons, and Jochems (2014)).

## Methods

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study.

### Participants

The sample consists of  $N = 28$  participants with  $n = 7$  expert teachers and  $n = 21$  novice teachers.

The inclusion criterion for experts was that they have successfully completed teacher

Table 1

*Demographic Information and Teaching Experience*

Group	N	Gender female in percentage	M Age in years	SD Age in years	Min Age in years	Max Age in years	M Exp. in years	SD Exp. in years
Expert	7	71.40	45.10	12.00	27.00	59.00	18.10	14.10
Novice	21	61.90	23.30	1.70	20.00	27.00	0.00	0.00

training and are actively employed in the teaching profession. According to Palmer, Stough, Burdenski, and Gonzales (2005), we selected teachers as experts who had at least three years of professional experience and ideally had worked in another teaching position, such as subject advisor or trainer for trainee teachers, in addition to their teaching profession in school. Novices were student teachers who had successfully completed their first internship in a school and gained one to four hours of teaching experience.

The expert teachers (5 women; 71.40%) had a mean age of 45.10 years ( $SD = 12$ ; range: 27-59) and an average teaching experience of 18.10 years ( $SD = 14.10$ ; range: 3-37). 71% of the experienced teachers were also engaged in an secondary teaching activity, such as lecturers at the university, main training supervisors for trainee teachers and subject advisers.

The novice teachers (13 women; 61.90%) had a mean age of 23.30 years ( $SD = 1.70$ ; range: 20-27) with an average teaching experience of 0 years. On average, the student teachers were in their 7.40 semester ( $SD = 2.50$ ; range: 3-11). Furthermore, they had an average teaching experience of 12 teaching units à 45min ( $SD = 8.60$ ; range: 0-36) through the internships during their studies. 90.50% of the student teachers were also engaged in an extracurricular teaching activity, such as tutoring or homework supervision.

The subjects were primarily recruited through personal contacts, social media (Facebook), e-mail distribution lists and advertising in lectures at the University Leipzig. All study procedures were carried out in accordance with the ethical standards of the University's Institutional Review Board. The authors received a positive vote on the study

procedures from the Ethics Committee Board of Leipzig University. All participants were informed in detail about the aim and intention of the study prior to testing. Participation in the study was voluntary and only took place after written consent has been given.

## Material

**Eye-Tracking equipment.** During the unit, teachers wore a binocular Tobii Pro Glasses 2 eye-tracker (<https://www.tobii.com/product-listing/tobii-pro-glasses-2/>). The system consisted of a wearable head unit and a recording unit. As shown in Figure 1, 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 the surrounding sounds. Infrared light illuminators supported the eye tracking sensors which recorded the eye orientation to capture the teacher's gaze point as shown in Figure 2. The videos were recorded with a sampling rate of 50 Hz in a video resolution with 1920 x 1080 at 25 frames per second. The scene camera had a field of view of 90 deg. in 16:9 format (82 deg. horizontal and 52 deg. vertical) and a frame dimension of 179 x 159 x 57 mm (width x depth x height).

**Video and Audio recording equipment.** The speech, sounds and voices of the participants were recorded with Zoom H3-VR Ambient Recorder (<https://zoomcorp.com/en/gb/handheld-recorders/handheld-recorders/h3-vr-360-audio-recorder/>) installed in the middle of the lab setting. The Zoom H3-VR recorded with four built-in mics arranged in an Ambisonic array with a bitrate of 4608 kBits/s.

Movements, facial expressions and gestures of the subjects were recorded by four Go Pro Hero 7 black cameras ([https://gopro.com/content/dam/help/hero7-black/manuals/HERO7Black\\_UM\\_ENG\\_REVC.pdf](https://gopro.com/content/dam/help/hero7-black/manuals/HERO7Black_UM_ENG_REVC.pdf)) from different angles. The videos were recorded with a sampling rate of 50 Hz in a video resolution with 1920 x 1080 at 50 frames per second in 16:9 format with a linear field of view.

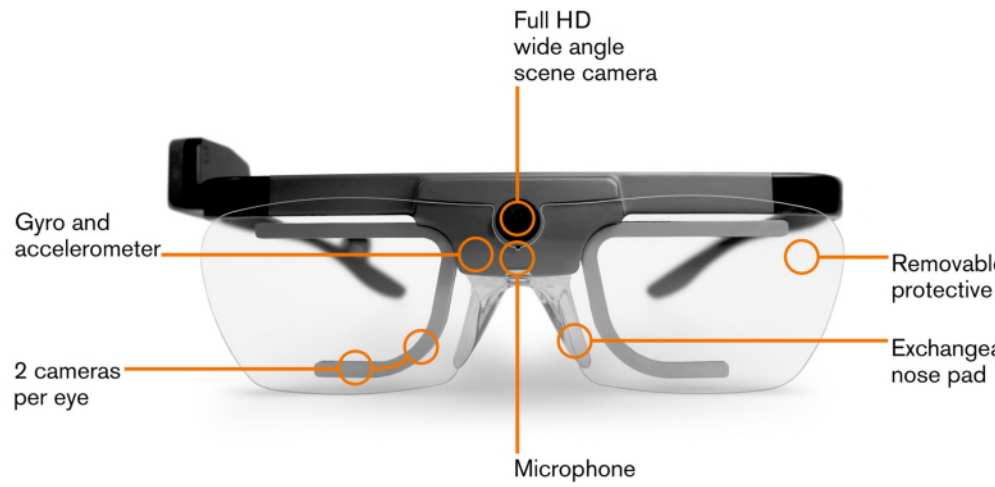


Figure 1. Tobii Pro Glasses 2; Source: <https://www.tobii.com/product-listing/tobii-pro-glasses-2/>

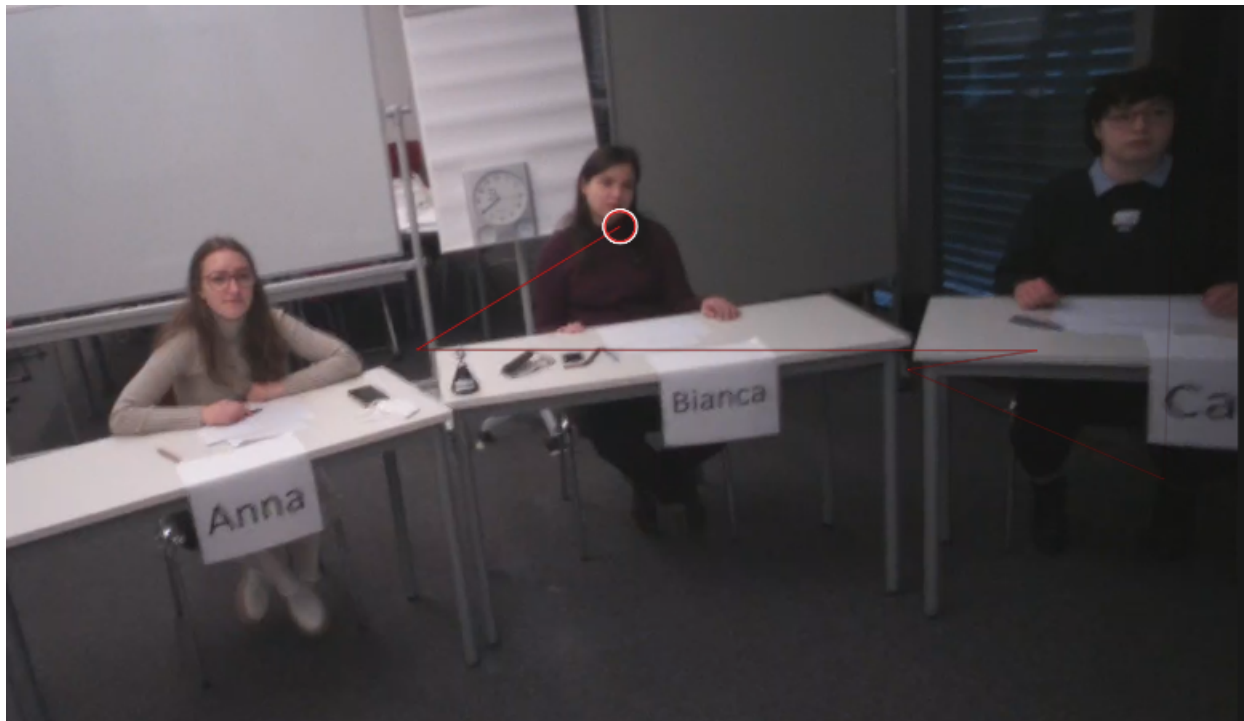


Figure 2. Teacher's Gaze Point

**Questionnaire.** After each micro-teaching-unit, the students answered items on teaching quality using a validated questionnaire (Helmke et al., 2014) and scales on the teacher’s presence behavior. In addition, participants were asked to give a self-assessment on classroom management by completing the questionnaire after each micro-teaching-unit. The questionnaire was a 4-point Likert scale (1 = Strongly Disagree; 2 = Disagree; 3 = Agree; 4 = Strongly Agree).

Table 2

*Scale analysis for teachers’ self-assessment*

	N Items	M	SD	Min	Max	Skewness	Kurtosis	alpha
Classroom Management	8.00	2.96	0.25	2.50	3.38	-0.02	1.78	0.21
Balance	3.00	3.21	0.54	1.67	4.00	-0.58	3.65	0.68
Presence	8.00	3.17	0.39	2.50	3.88	-0.05	2.38	0.72
Natural Behavior	3.00	3.23	0.59	1.67	4.00	-0.77	3.50	0.74

## Procedure

In June 2021, the study was piloted with student teachers volunteers to refine the study procedure. Data collection was conducted between July 2021, and July 2022.

## Data analysis

We investigated whether experts and novice teachers differed

All reported data analyses were conducted with the R (Version 4.1.3; R Core Team, 2021) and the R-packages *ARTofR* (Version 0.3.3; Zhang, 2021), *cowplot* (Version 1.1.1; Wilke, 2020), *dplyr* (Version 1.0.8; Wickham, François, Henry, & Müller, 2022), *forcats* (Version 0.5.1; Wickham, 2021), *ggplot2* (Version 3.3.5; Wickham, 2016), *gridExtra* (Version 2.3; Auguie, 2017), *lrm* (Version 1.2.0; Rizopoulos, 2006), *lubridate* (Version 1.8.0; Grolemund & Wickham, 2011), *MASS* (Version 7.3.55; Venables & Ripley, 2002), *moments* (Version 0.14; Komsta & Novomestky, 2015), *msm* (Version 1.6.9; Jackson, 2011), *needs* (Version 0.0.3; Katz, 2016), *papaja* (Version 0.1.0.9999; Aust & Barth, 2020), *polycor* (Version 0.8.1;

Fox, 2022), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 2.1.2; Wickham, Hester, & Bryan, 2021), *readxl* (Version 1.4.0; Wickham & Bryan, 2019), *sjPlot* (Version 2.8.10; Lüdecke, 2021), *stringr* (Version 1.4.0; Wickham, 2019), *tibble* (Version 3.1.6; Müller & Wickham, 2021), *tidyr* (Version 1.2.0; Wickham & Girlich, 2022), *tidyverse* (Version 1.3.1; Wickham et al., 2019), *tinylabls* (Version 0.2.3; Barth, 2022), *viridis* (Version 0.6.2; Garnier et al., 2021a, 2021b), and *viridisLite* (Version 0.4.0; Garnier et al., 2021b) and IBM SPSS 28.

## Results

## Discussion



## References

- Auguie, B. (2017). *gridExtra: Miscellaneous functions for "grid" graphics*. Retrieved from <https://CRAN.R-project.org/package=gridExtra>
- Aust, F., & Barth, M. (2020). *papaja: Prepare reproducible APA journal articles with R Markdown*. Retrieved from <https://github.com/crsh/papaja>
- Barth, M. (2022). *tinylabls: Lightweight variable labels*. Retrieved from <https://cran.r-project.org/package=tinylabls>
- Evertson, C. M., Weinstein, C. S., et al. (2006). Classroom management as a field of inquiry. *Handbook of Classroom Management: Research, Practice, and Contemporary Issues*, 3(1), 16.
- Fox, J. (2022). *Polycor: Polychoric and polyserial correlations*. Retrieved from <https://CRAN.R-project.org/package=polycor>
- Garnier, Simon, Ross, Noam, Rudis, Robert, ... Cédric. (2021a). *viridis - colorblind-friendly color maps for r*. <https://doi.org/10.5281/zenodo.4679424>
- Garnier, Simon, Ross, Noam, Rudis, Robert, ... Cédric. (2021b). *viridis - colorblind-friendly color maps for r*. <https://doi.org/10.5281/zenodo.4679424>
- Gold, B., & Holodyski, M. (2017). Using digital video to measure the professional vision of elementary classroom management: Test validation and methodological challenges. *Computers & Education*, 107, 13–30.
- Goodwin, C. (2015). Professional vision. In *Aufmerksamkeit* (pp. 387–425). Springer.
- Grolemund, G., & Wickham, H. (2011). Dates and times made easy with lubridate. *Journal of Statistical Software*, 40(3), 1–25. Retrieved from <https://www.jstatsoft.org/v40/i03/>
- Grub, A.-S., Biermann, A., & Brünken, R. (2020). Process-based measurement of professional vision of (prospective) teachers in the field of classroom management. A systematic review. *Journal for Educational Research Online*, 12(3), 75–102.
- Helmke, A., Helmke, T., Lenske, G., Pham, G., Praetorius, A.-K., Schrader, F.-W., &

AdeThurow, M. (2014). Unterrichtsdiagnostik mit EMU. *Aus-Und Fortbildung Der Lehrkräfte in Hinblick Auf Verbesserung Der Diagnosefähigkeit, Umgang Mit Heterogenität Und Individuelle Förderung*, 149–163.

Henry, L., & Wickham, H. (2020). *Purrr: Functional programming tools*. Retrieved from <https://CRAN.R-project.org/package=purrr>

Jackson, C. H. (2011). Multi-state models for panel data: The msm package for R. *Journal of Statistical Software*, 38(8), 1–29. Retrieved from <https://www.jstatsoft.org/v38/i08/>

Katz, J. (2016). *Needs: Attaches and installs packages*. Retrieved from <https://CRAN.R-project.org/package=needs>

Komsta, L., & Novomestky, F. (2015). *Moments: Moments, cumulants, skewness, kurtosis and related tests*. Retrieved from <https://CRAN.R-project.org/package=moments>

Kounin, J. S. (2006). *Techniken der klassenführung*. Waxmann Verlag.

Lachner, A., Jarodzka, H., & Nückles, M. (2016). What makes an expert teacher? Investigating teachers' professional vision and discourse abilities. *Instructional Science*, 44(3), 197–203.

Lüdecke, D. (2021). *sjPlot: Data visualization for statistics in social science*. Retrieved from <https://CRAN.R-project.org/package=sjPlot>

Müller, K., & Wickham, H. (2021). *Tibble: Simple data frames*. Retrieved from <https://CRAN.R-project.org/package=tibble>

Palmer, D. J., Stough, L. M., Burdenski, T. K., Jr, & Gonzales, M. (2005). Identifying teacher expertise: An examination of researchers' decision making. *Educational Psychologist*, 40(1), 13–25.

R Core Team. (2021). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://www.R-project.org/>

- Rizopoulos, D. (2006). Ltm: An r package for latent variable modelling and item response theory analyses. *Journal of Statistical Software*, 17(5), 1–25. Retrieved from <https://doi.org/10.18637/jss.v017.i05>
- Seidel, T., & Stürmer, K. (2014). Modeling and measuring the structure of professional vision in preservice teachers. *American Educational Research Journal*, 51(4), 739–771.
- Sherin, M. (2007). *The development of teachers' professional vision in video clubs. Video research in the learning sciences. R. Goldman, r. Pea, b. Barron and SJ derry*. Mahwah, NJ, Lawrence Erlbaum.
- Van den Bogert, N., Bruggen, J. van, Kostons, D., & Jochems, W. (2014). First steps into understanding teachers' visual perception of classroom events. *Teaching and Teacher Education*, 37, 208–216.
- Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with s* (Fourth). New York: Springer. Retrieved from <https://www.stats.ox.ac.uk/pub/MASS4/>
- Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis*. Springer-Verlag New York. Retrieved from <https://ggplot2.tidyverse.org>
- Wickham, H. (2019). *Stringr: Simple, consistent wrappers for common string operations*. Retrieved from <https://CRAN.R-project.org/package=stringr>
- Wickham, H. (2021). *Forcats: Tools for working with categorical variables (factors)*. Retrieved from <https://CRAN.R-project.org/package=forcats>
- Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., . . . Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software*, 4(43), 1686. <https://doi.org/10.21105/joss.01686>
- Wickham, H., & Bryan, J. (2019). *Readxl: Read excel files*. Retrieved from <https://CRAN.R-project.org/package=readxl>
- Wickham, H., François, R., Henry, L., & Müller, K. (2022). *Dplyr: A grammar of data manipulation*. Retrieved from <https://CRAN.R-project.org/package=dplyr>

Wickham, H., & Girlich, M. (2022). *Tidyr: Tidy messy data*. Retrieved from  
<https://CRAN.R-project.org/package=tidyr>

Wickham, H., Hester, J., & Bryan, J. (2021). *Readr: Read rectangular text data*.  
Retrieved from <https://CRAN.R-project.org/package=readr>

Wilke, C. O. (2020). *Cowplot: Streamlined plot theme and plot annotations for  
'ggplot2'*. Retrieved from <https://CRAN.R-project.org/package=cowplot>

Wolff, C. E., Jarodzka, H., Bogert, N. van den, & Boshuizen, H. (2016). Teacher  
vision: Expert and novice teachers' perception of problematic classroom  
management scenes. *Instructional Science*, 44(3), 243–265.

Zhang, H. (2021). *ARTofR: Who ever care about the [art of r] scripts?* Retrieved  
from <https://CRAN.R-project.org/package=ARTofR>