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

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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 defintiion

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 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).

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 12.20 teaching units à 45min ($SD = 8.40$; range: 4-36) 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.tobiipro.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 capure the tacher'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).

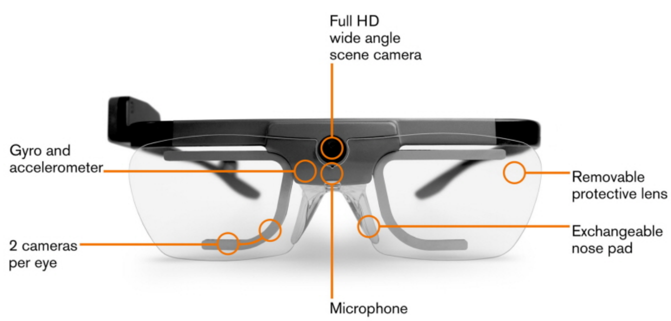

Figure 1. Tobii Pro Glasses 2; Source: https://www.tobiipro.com/product-listing/tobii-pro-glasses-2/

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.

Figure 2. Teacher's Gaze Point

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) 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.

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).

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.

One camera was installed to film the class from the side. Two more cameras were installed on the blackboard and at the end of the Lab to film the teacher and class from the front and back. Furthermore, the fourth camera was installed in such a way that only facial expressions and gestures of the teacher were recorded, which enables a semi-automated analysis of the movement sequences.

The Tobii Pro Glasses Controller software was used to record and calibrate the eye movements.

Data analysis

We investigated whether experts and novice teachers differed

All reported data analyses were conducted with the R (Version 4.1.2; 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), *lubridate* (Version 1.8.0; Grolemund & Wickham, 2011), *needs* (Version 0.0.3; Katz, 2016), *papaja* (Version 0.1.0.9997; Aust & Barth, 2020), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 2.1.1; Wickham, Hester, & Bryan, 2021), *readxl* (Version 1.3.1; Wickham & Bryan, 2019), *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), *tinylabels* (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

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