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First steps into understanding teachers' visual perception of classroom events

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HIGHLIGHTS

- Experienced teachers process visual information in classrooms faster than novices.
- Novice teachers not only misinterpret classroom events, they tend to not see them.
- Experienced teachers distribute their visual attention more evenly across pupils.
- Novice teachers focus on disorders, experienced teachers focus on their effects.

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ABSTRACT

Student-teachers struggle to become competent at classroom management. To do so, Berliner (2001) and Feldon (2007) argue for the significance of speedy and accurate recognition of relevant cues for teacher action in the classroom. However, studies investigating how teachers obtain this information from the classroom are scarce. This study employed eye-tracking methodology to investigate teachers' visual perception and detection of classroom events. Results show that experienced teachers process visual information faster, and consistently check up on pupils more regularly. Also they are able to distribute their attention evenly across the classroom. Recommendations for future research and practical implications are discussed.

1. Introduction

Effective classroom management in the broad sense is considered one of the most important skills for beginning teachers to acquire (Evertson & Weinstein, 2006). Empirical evidence shows that adequate mastery of classroom management is strongly related to student achievement (Wang, Hartel, & Wahlberg, 1993). Educational researchers (Brouwers & Tomic, 2000) and teacher-educators alike identify classroom management as a major pitfall for beginning teachers. Insufficient mastery of this skill is related to teacher stress/burn-out (Blase, 1986; Borg, Riding, & Falzon, 1991; DeRobbio & Iwanicki, 1996; Friedman, 1995; Keiper & Busselle, 1996; Kyriacou, 1980; Lewis, 1999) and teacher attrition from the workforce is estimated between 25% (Boe, Cook, & Sunderland, 2008; Smith & Ingersoll, 2004) and 50% (Kaiser, 2011) after five years. Recognizing the importance of classroom management, a firm understanding of what adequate classroom management entails and how it could be conveyed to student-teachers is therefore vital to ensure that teachers become and remain competent and active members of the teacher workforce.

Definitions of classroom management usually include teachers' actions to establish and maintain order, engage students, or elicit their cooperation (Emmer & Stough, 2001; Lewis, 1999). The focus on teacher action in the definition, while common, presupposes that teachers are able to detect and identify relevant classroom events that require a teacher's intervention. This assumption, however, is not self-evident, considering the complexity of a classroom (Doyle, 1986) wherein many persons are present and many events take place (multidimensionality), often at the same time (simultaneity). Furthermore, there is a rapid pace to classroom life, and a high degree of unpredictability of events which often

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require a ready response from the teacher (immediacy). All these factors necessitate a teacher's constant attention. Sabers, Cushing, and Berliner (1991) had novice and expert teachers observe three perspectives of the same classroom, presented simultaneously on three television screens. They found that novice teachers were less able to notice pertinent classroom events compared to more experienced teachers. Novice teachers were unable to distribute their attention across the three monitors effectively to maintain a functional overview of the classroom. Besides, studies have been conducted investigating teachers' professional vision (Goodwin, 1994). This concept describes the teachers' ability to notice and interpret pertinent cues for teaching and student learning (Sherin, 2007; Van Es & Sherin, 2002). Studies such as Star and Strickland (2008) show that student-teachers are distinctly less proficient at noticing relevant classroom features and events (e.g. physical classroom environment, student tasks, mathematical content and communication), but can become better with training. Nevertheless, these studies tend not to focus on classroom management (i.e. students' attention and classroom disturbances). Furthermore, the studies described above suggest that novices do not perceive pertinent classroom events, but it still leaves room for the interpretation that novices do perceive the classroom events, but fail to recognize them as relevant. In line with this research the current study focuses on teachers' ability to detect and identify relevant classroom events, rather than teacher action.

In order to rapidly and flexibly recognize relevant classroom events, Berliner (2001) argues for the construction of an extensive base of case knowledge. He proposes that extensive case knowledge enables experienced teachers to flexibly cope with classroom situations. Case knowledge has been identified in other domains, such as chess (Gobet & Simon, 2000) and medicine (Norman, Eva, Brooks, & Hamstra, 2006), and is described as a key mechanism how experts fluently and rapidly arrive at solutions. 'Case knowledge' is not a collection of raw classroom experiences but encompasses a rich and well-organized knowledge base that holds meaningful abstractions of these experiences as schemata and scripts. Experienced teachers rely on an extensive memory repository of cases of classroom situations (Berliner, 2001), which they develop throughout their careers. Conversely, novices (who have not yet acquired such a repository of knowledge) cannot rely on recognition of pertinent cues and have to analyze the extensive situational information bottom-up. This notion goes back to De Groot (1965) seminal studies on expert chess players, where he found that patterns had to be abstracted and inferred by less skilled players, while they were readily perceived by expert chess players.

Chi (2006) argues that expert performance starts with successful detection and identification of domain relevant cues. This is demonstrated by empirical evidence from domains such as radiology (Lesgold et al., 1988), weather forecasting (Hoffman, Trafton, & Roebber, 2006), and teaching (Sabers et al., 1991). It is not the expert's visual acuity that is better, because novices' visual acuity is on par with that of experts in domains outside of their expertise. It is the experts' rich knowledge base that increases their sensitivity for domain relevant cues and patterns which facilitates early detection (Chi, 2006).

By early identification of cues for teacher action, experienced teachers are better able to manage their classrooms. Berliner (2001) and Feldon (2007) both emphasize the importance of two key points: teachers must have a keen ability to recognize relevant cues in the classroom, and they must have an extensive, well-organized knowledge base from which relevant strategies for teachers' actions can be easily retrieved. Both Berliner (2001) and Feldon (2007) theorize that experienced teachers rely on pattern recognition, and one of the key skills to expertise in teaching is to *"hold a more global and functional view of the situation"* (Berliner, 2001, p. 478).

The first key point identified by Berliner and Feldon can be traced back to Kounin's (1970) seminal studies on classroom management in which he coined the term *'withitness,'* i.e. effective teachers are aware of what is happening in the classroom and, through this keen insight, are better able to create and maintain a positive learning environment. While Kounin's research methods were behavioral (observing teacher strategies for classroom management), the term *withitness* directly relates to the cognitive skillset of the teacher. There, classroom management is directed at creating and maintaining a positive learning environment and the relationship between teacher perception, knowledge in interpreting situations and appropriate interactions become research foci.

In this study results are presented on teachers' direct visual perception (using eye-tracking methodology) and identification of events relevant to classroom management. Eye-tracking has been used to study perception of domain relevant situations by experts and novices such as taxi drivers (Borowsky, Oron-Gilad, & Parmet, 2010), air traffic controllers (Ellis, 1986; Hauland, 2003), and marine biologists (Jarodzka, Scheiter, Gerjets, & Van Gog, 2010). Eye-tracking is usually applied to static stimuli such as text (Rayner, Li, Williams, Cave, & Well, 2007; Reichle, 2006) and images (Antes & Kristjanson, 1991; Parkhurst & Niebur, 2003), although some research has been done on animation (De Koning, Tabbers, Rikers, & Paas, 2010). These types of stimuli enable the researcher to control and manipulate their experimental design to a high degree, often down to the millisecond. In contrast, in the current study naturalistic real-life recordings of classroom situations are used. As discussed above (Doyle, 1986) these situations are highly dynamic, incorporating multiple relevant cues. So analyses averaging data of teachers' eye movements across an entire video consisting of multiple authentic classroom events will unlikely be sensitive enough to give insight into the detailed visual processes the teacher employs. Therefore, it is necessary to develop a method for selecting video segments where distinct visual processes can be expected. In our approach, participants generate timestamps by pressing a button to indicate when they notice relevant events in the video. Clusters of timestamps (i.e. short segments in the video where many participants made timestamps) are identified. These segments are expected to include the most salient examples of event detection eye-movements, these segments are used in subsequent eye-tracking analyses.

Several differences between student-teachers and experienced teachers eye movements are inferred from the literature described above. These differences are described below and subsequently transcribed into expectations in terms of eye-tracking methodology. First, as noted above, experienced teachers are expected to process information faster and thus need less time to comprehend a classroom situation (Glaser & Chi, 1988). Second, we expect experienced teachers to maintain an up-to-date representation of the classroom, by checking (i.e. looking at) individual students more frequently than student-teachers. Third, the eye-tracking data of experienced teachers is expected to be more homogeneous across participants than student teachers. Last, experienced teachers should have a more global and functional view of the classroom situation (in terms of visual perception).

Described in terms of eye-tracking measures, we expect experienced teachers to (a) have shorter fixations than student-teachers, which indicates faster encoding (Gobet & Charness, 2006); (b) have more fixations per student, indicating regular check-ups; (c) have a smaller variance of fixation duration than student-teachers; and (d) distribute their visual attention more evenly across the students in the classroom, as opposed to student-teachers who are expected to concentrate their visual attention on just a few students in the classroom.