Scandinavian Journal of Educational Research

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/csje20

Teachers' Focus of Attention in First-grade Classrooms: Exploring Teachers Experiencing Less and More Stress Using Mobile Eye-tracking

Saswati Chaudhuri, Heli Muhonen, Eija Pakarinen & Marja-Kristiina Lerkkanen

To cite this article: Saswati Chaudhuri, Heli Muhonen, Eija Pakarinen & Marja-Kristiina Lerkkanen (2022) Teachers' Focus of Attention in First-grade Classrooms: Exploring Teachers Experiencing Less and More Stress Using Mobile Eye-tracking, Scandinavian Journal of Educational Research, 66:6, 1076-1092, DOI: 10.1080/00313831.2021.1958374

To link to this article: https://doi.org/10.1080/00313831.2021.1958374

Published online: 06 Aug 2021.

SCANDINAVIAN JOURNAL OF EDUCATIONAL RESEARCH
2022, VOL. 66, NO. 6, 1076–1092
https://doi.org/10.1080/00313831.2021.1958374

Routledge
Taylor & Francis Group

Teachers' Focus of Attention in First-grade Classrooms: Exploring Teachers Experiencing Less and More Stress Using Mobile Eye-tracking

Saswati Chaudhuri, Heli Muhonen, Eija Pakarinen and Marja-Kristiina Lerkkanen

Department of Teacher Education, University of Jyväskylä, Jyväskylä, Finland

ABSTRACT

This study investigated teachers' focus of attention and stress in first-grade classrooms. Teachers' (n = 53) focus of attention was recorded in fall and spring with a mobile eye-tracking device, and the teachers reported stress via questionnaires. Correlation analysis was used to examine association between teacher stress (exhaustion, cynicism, and inadequacy) and focus of attention. Then, one teacher reporting more stress and one reporting less stress were selected for a case study to examine variations in their focus of attention. The results showed positive associations between teachers' perceived inadequacy and overall focus of attention (whole eye-tracking recording) both in fall and spring. Teachers' focus of attention during specific activity settings of management/routines and transitions correlated positively with all three stress domains in fall. In addition, a positive association was also found between teacher inadequacy and focus of attention during teacher-directed large group activity setting.

ARTICLE HISTORY
Received 21 September 2020
Accepted 14 July 2021

KEYWORDS
Mobile eye tracking; focus of attention; teacher stress; inadequacy; first-grade classroom

1. Introduction

The teaching profession has been acknowledged as very demanding and stressful. Research has shown that teachers experience higher stress, compared to many other professions (e.g., Aloe, Shisler, et al., 2014; Herman et al., 2020). Teachers must deal with many challenges and demands that can affect their well-being and influence their ability to create a supportive learning environment for their students. For each lesson, teachers must identify relevant information and classroom details to produce effective management routines and practices beneficial to their students' learning (e.g., van den Bogert et al., 2014). This demanding moment-to-moment process requires teachers' focussed attention in changing situations (Pennings et al., 2018) where several unpredictable events may take place simultaneously, each one requiring an immediate response (van den Bogert et al., 2014). Recent research has shown that during teaching interactions, the teacher's eye contact with students forms an essential part of learning (McIntyre & Mainhard, 2020). However, teachers' focus of attention could differ, depending, for example, on their work experience (McIntyre et al., 2017). Teachers have also been found to distribute their attention unevenly amongst their students, instructional materials and other details in the classroom (e.g., Dessus et al., 2016; Haataja et al., 2019). Although it is well recognised that teaching is a demanding profession, no studies have been conducted on how teacher stress may affect their focus of attention in authentic classroom situations. Therefore,

CONTACT Saswati Chaudhuri saswati.s.chaudhuri@jyu.fi Department of Teacher Education, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland

this study aims to explore the extent to which teacher stress is associated with their focus of attention in authentic classroom settings. A case study design was utilised to explore in more detail the variations in focus of attention of two teachers reporting more and less stress. The purpose of the case studies is to provide concrete examples about the associations of teacher stress and focus of attention.

1.1. Teachers' Focus of Attention in the Classroom

Teachers' focus of attention can be defined as teachers' gaze on relevant targets during a lesson and their ability to process information present in the classroom environment (van den Bogert et al., 2014). In educational research, several terms are used interchangeably to address eye tracking in the classroom: focus of attention (van den Bogert et al., 2014), teacher visual attention (Cortina et al., 2015), gaze behaviour (McIntyre et al., 2017; McIntyre et al., 2019; McIntyre & Mainhard, 2020), teacher gaze (McIntyre et al., 2019), eye movements (Henderson, 2011, p. 4), and teacher vision and attentional distribution (Wolff et al., 2016). In the present study, the term focus of attention is used to investigate the distribution of teachers' gazes on students as well as on instructional materials and non-instructional materials during a lesson. Using mobile eye-tracking devices, eye movements objectively provide insights into moment-to-moment changes in teacher attention in the classroom where students' learning needs are supposed to be met (McIntyre & Mainhard, 2020; Tatler et al., 2014).

Teachers' classroom behaviour and focus of attention affect each other, as teachers target their gaze and monitor relevant tasks and situations (Tatler et al., 2014). For example, students' classroom behaviour may affect the teacher's focus of attention, because disruptive students who are not concentrating during a lesson can frequently attract teacher's focus of attention (Yamamoto & Imai-Matsumura, 2012). Additionally, research has suggested that experienced teachers tend to focus more attention on the reactions of students around the disruptive students, whereas novice teachers narrow their focus of attention on the disruptive students (Wolff et al., 2016). Previous research has confirmed that during lessons, teachers focus more attention on students with whom they are engaging in elaborating their responses and providing individual feedback (Cortina et al., 2015). In addition, in a case study of a Finnish teacher, Haataja et al. (2019) revealed that based on scaffolding intentions during a math lesson, the teacher focussed more attention on the students' faces during affective scaffolding in problem-solving. However, most studies using mobile eye tracking to date have been conducted in secondary schools (e.g., Cortina et al., 2015; Haataja et al., 2019; McIntyre et al., 2017, 2019; McIntyre & Mainhard, 2020; Yamamoto & Imai-Matsumura, 2012); thus, our understanding of teachers' focus of attention amongst younger children is limited, such as in first-grade classrooms. There has been a long tradition of eye-tracking studies related to teachers and teaching in controlled laboratory settings, for example, studies on teachers' focus of attention have used remote eye tracking on pre-recorded classroom videos (van den Bogert et al., 2014; Wolff et al., 2016; Yamamoto & Imai-Matsumura, 2012). However, new research has encouraged investigation of educational practices in authentic classroom settings (Jarodzka et al., 2020), for example, by using mobile eye tracking (Cortina et al., 2015; Haataja et al., 2019; McIntyre et al., 2017, 2019; McIntyre & Mainhard, 2020).

Fixation data obtained in the form of time duration is a frequently used measure in eye-tracking research (e.g., Cortina et al., 2015; Haataja et al., 2019; Yamamoto & Imai-Matsumura, 2012). Fixations are defined as the duration in which the eye is relatively steady, providing the ability to process visual information from the surroundings (van den Bogert et al., 2014). Researchers have confirmed that fixations are clustered at informative regions of the scene (Henderson 2011, p. 5). In the context of a classroom, a teacher's fixations on informative areas might change according to their students' needs. For example, Haataja et al. (2019) noticed longer fixation durations on students' faces and hands during behaviour management segments of a lesson due to teacher–student conversations. According to Holmqvist et al. (2015), fixations depict the focus of attention on an

object when an individual processes information, although the durations of fixations alone may not accurately represent a teacher's cognitive processing of classroom events. Therefore, an eye-tracking methodology should be coupled with supporting data that provide background information for the recorded eye movements to justify the fixations (van den Bogert et al., 2014). Consequently, in the present study, we examined possible variations in teachers' focus of attention on students, instructional materials and non-instructional materials in authentic classrooms in relation to teachers' self-ratings of stress.

1.2. Teachers' Stress

Teachers' work-related stress can be defined as their experiences of negative emotions, such as anxiety, frustration and tension, resulting from their work (Kyriacou, 2001). Teaching is a highly stressful profession (Kyriacou, 2001), and elementary school teachers have reported moderate to high levels of stress at work (Herman et al., 2018). Work-related stress can arise from situations in the workplace that adversely affect an individual physiologically, socially and psychosocially (Friedman-Krauss et al., 2014). Previous research has stated that teachers experience stress when the demands of the classroom environment are beyond their perceived capacity of resources to cope (Herman et al., 2020). Teachers may face challenges in the classroom while catering to their students' needs for behavioural and instructional support. Specifically, teachers have reported high levels of stress from perceptions of challenging student behaviours (Friedman-Krauss et al., 2013), disruptive classrooms and differentiated instructions (Kyriacou, 2001). Previous research confirmed that when classroom management self-efficacy decreases, emotional exhaustion increases among teachers (Aloe, Amo, et al., 2014).

Teachers' perceived stress and burnout can be examined through domains of emotional exhaustion, cynicism and feelings of inadequacy (Salmela-Aro et al., 2010). Emotional exhaustion (emotional component) focusses on the fatigue caused by increased workloads, while cynicism (cognitive component) refers to a loss of interest and feelings of indifference towards work and the people at work (Salmela-Aro, Pietarinen, & Pyhältö, 2011). The feelings of inadequacy (behavioural component) is a consequence of exhaustion or cynicism and refers to reduced efficacy in professional competence and accomplishments at work (Maslach & Leiter, 2016; Salmela-Aro et al., 2011). In addition, teachers' reduced feelings of professional competence, achievements and accomplishments in the job could be reflected in their classroom behaviour towards different students (Salmela-Aro et al., 2010). Therefore, teachers' perceived inadequacies related to their work could reveal variations in their focus of attention during a lesson. In addition, experiencing higher levels of stress in the teaching profession has been associated with lower self-efficacy and increasing reprimands, whereas teachers who experience lower stress and who have higher coping mechanisms have reported higher self-efficacy and increased student pro-social behaviour (Herman et al., 2020). Furthermore, teachers with lower levels of efficacy beliefs are prone to stress, exhaustion and anxiety (Jeon et al., 2017), thereby affecting their instruction and the quality of their teacher–student interactions in the classroom (Virtanen et al., 2019). However, little is known about how teacher stress may be reflected in their focus of attention in the classroom.

1.3. The Aim of the Study

Studying teachers' focus of attention, especially in authentic classroom settings, is a relatively new field amongst educational classroom studies. The first aim of the present study is to explore the extent to which teacher perceived stress is associated with their focus of attention in authentic classroom settings. The second aim is to explore in more detail the variations in focus of attention between two teachers reporting more and less stress. The present study will add to the existing research by combining the measures of teachers' self-reported stress and mobile eye-tracking

data to study teachers' focus of attention on students, instructional materials and non-instructional materials within first-grade classrooms of the academic school year.

The research questions are:

1. To what extent is teacher-reported stress associated with their focus of attention in first-grade classrooms?
2. How does a teacher with more than average stress and a teacher with less than average stress distribute their focus of attention in the classroom?

The present study was conducted in Finland where 9 years of elementary school begins at age 7. The placement of students in school is only based on the school's proximity to their residence. All teachers are highly qualified with master's degrees in education, and the same teacher typically teaches the same class for several years in elementary school. Most of the schools are public schools, and they follow the national core curriculum designed by the Finnish National Board of Education.

2. Methods

2.1. Participants and Procedure

The participants of the present study were 53 Finnish Grade 1 teachers (50 females, 3 males; M_{age} = 44.6, SD = 8.92) from 36 schools. The schools were located in five municipalities in Central Finland and included both urban and rural areas. The teachers reported their work experience in years (M_{exp} = 16.07, SD = 9.43, Min_{exp} = 0.5, Max_{exp} = 39) and class size (M_{cs} = 19.3, SD = 4.34, Min_{cs} = 7, Max_{cs} = 25). Teachers' education showed that 90.6% were qualified as class teachers, 7.5% had double qualifications for teaching (most typically as class teachers and kindergarten teachers), and 1.9% were qualified as special education teachers. The reported study is part of a larger project focusing on the role of teacher and student stress on teacher–child interactions (Lerkkanen & Pakarinen, 2016–2022). Before commencement of the study in 2016, approval from the ethics committee of the university was received.

In fall 2017, teachers were invited by phone or email to participate in the larger study during the 2017–2018 academic year. Participation in the study was voluntary, and teachers and children's parents provided written consent for their participation prior to data collection. Questionnaires regarding teachers' self-reported stress and background information were sent to the teachers and returned via postal mail. Questionnaires concerning the family's background information were also sent to the children's parents via postal mail. The parents' responses indicated that 2.5% had a comprehensive school degree (9 years of education), 32.8% had completed high school or had a vocational school degree (12 years of education), 7.9% had completed college-level training (14 years of education), 26.2% had completed polytechnic school or had a bachelor's degree, 26.7% had completed a master's degree, and 3.9% had completed a doctoral degree.

Tobii Pro Glasses 2 were used to record eye-tracking videos for all lessons in this study. Using the Tobii Pro Glasses 2 mobile eye-tracking glasses, eye-tracking data were collected from all 53 teachers during their normal school day. Each teacher had two lessons recorded, one in the fall and one in the spring, respectively. Two research assistants were trained to collect the data; they also helped the teachers with wearing the glasses and conducted a 3-point calibration before each lesson started. In order to maintain the data quality, each teacher was asked to look at three marked points on the wall at the beginning of the video recording. The research assistants then confirmed that the teacher's gaze met the three points correctly. The eye-tracking video recordings ranged from 20 to 25 min. During the course of the recordings, the research assistants noted the course of the lesson, the seating plan in the classroom and the materials used. The Tobii Pro Glasses 2 (see Tobii Pro Glasses 2 Product Description Manual, 2018) used in the present study have four cameras for corneal reflection and pupil tracking. The resolution of the scene camera was 1920 × 1080 pixels at 25

frames per second. The scene camera visual angle was 82 degrees horizontal and 52 degrees vertical. The frame dimensions were $179 \times 159 \times 57$ mm. For further investigation, two teachers were selected—one with more than average stress and one with less than average stress—based on their self-ratings on their questionnaires (see Table 3).

2.2. Measures

Teachers' Stress. A Finnish short version of the Bergen Burnout Inventory (BBI-9; Salmela-Aro et al., 2010) was used to measure teachers' self-perceived stress using a questionnaire. The inventory had nine items from three domains with ratings from 1 (completely disagree) to 6 (completely agree); namely, exhaustion (e.g., 'I am snowed under with work'), cynicism (e.g., 'I feel dispirited at work and I think about leaving my job'), and inadequacy (e.g., 'I frequently question the value of my work') at work. These domains focussed on work-related stress and burnout. The exhaustion domain focussed on the fatigue caused by increased workloads. The cynicism domain referred to a loss of interest and feelings of indifference towards work and the people at work. The inadequacy domain identified reduced efficacy in professional competence and accomplishments at work. Cronbach's alpha reliability of the domains in fall were as follows: exhaustion .53, cynicism .65 and inadequacy .74, and in spring as follows: exhaustion .46, cynicism .70 and inadequacy .77. The 3-factor structure of BBI-9 has been tested for factorial validity and showed invariance across all cross-sectional samples in a study across organisations including educational institutions (Feldt et al., 2013). Moreover, sources of work-related stress were measured by asking the teachers to answer an open-ended question on the questionnaire: 'What causes you the most stress and exhaustion at work?'. Teachers' answers were used to gain deeper understanding on the work-related stress of the two teachers.

Teachers' Focus of Attention. As a first step, separate targets in the classroom were identified as teachers' areas of interest (AOI), using Tobii Pro Analyser software v. 1.128. An AOI was defined as parts of a stimulus that would explain gaze behaviour. A stimulus could be an action or an object that instigates gaze behaviour. In the present study, an authentic classroom scenario was the stimulus where students and instructional materials were the teachers' targets during the lesson. Holmqvist et al. (2015) suggested that manual coding was best suited when total dwell time on a target is required to answer the research question. Therefore, manual mapping feature was used for mapping gaze behaviour in eye-tracking recordings using a coding criteria.

Eye-tracking video recordings with 70% and above gaze sample percentages were selected for the study to ensure that one or both eyes were detected during 70% of the recording's duration. Therefore, in fall and spring, 3 out of 53 videos at both time points were not coded due to gaze sample percentages of less than 70%, poor quality of the recording and defects in the eye-tracking recording project file. Codes specific to students, instructional material, teaching assistants, research assistants and non-instructional material were used to define the AOI in the eye-tracking videos by taking screenshots of the video recordings. The coder started gaze mapping from the teacher's first look at a student AOI in the classroom and ended coding when the teacher took off the mobile eye-tracking glasses. Two coders who coded the eye-tracking videos were pursuing studies in teacher education and had experience with collecting eye-tracking recordings in authentic classroom settings. Inter-coder reliability was checked by double coding 20% of the videos from the whole data set for the fall and spring separately. Double coding agreement for the fall ranged from 89% to 93% with an average of 91.43%, and for the spring from 84.80% to 94.03% with an average of 90.09%. The total fixation durations on each student, instructional materials and non-instructional materials were obtained after coding the eye-tracking recordings to investigate teacher focus of attention. Previous studies have suggested that fixation is a relatively steady eye gaze when the eye takes in and processes visual information from the surroundings, allowing viewers to process a scene cognitively in a coherent way (Henderson, 2011, p. 2-3; Holmqvist et al., 2015).

The teachers operated during the normal school day in authentic classroom settings, and subjects or activity settings were not fixed beforehand. In fall, the subjects taught in the eye-tracking recordings of lessons were 41.18% literacy, 35.29% math, 7.84% science and 15.69% art. Additionally, in spring, the subjects taught in the eye-tracking recordings of lessons were 52% math, 40% literacy, 6% art and 2% other, e.g., Independence Day quiz, Friendship's Day activity.

Activity settings were coded in the lesson to analyse the eye-tracking data descriptively. The eye-tracking videos were divided into segments based on the dominant activity in which the teacher and the majority of the students were engaged. An activity was coded as a separate activity segment if it lasted a minimum of 30 s. Activities lasting less than 30 s were considered a part of the larger ongoing activity. Activity settings were broadly classified into academic content-based activities and non-academic activities. Non-academic activities were grouped as management, routines or transitions when the teacher managed student behaviours, and facilitated routines and transitions between play times. Academic activities were grouped as teacher-directed large group activities, individual work, and small group or pair work.

2.3. Analyses

The first research question aimed to investigate the extent of the association between teacher stress and focus of attention. A statistical measure of distribution called the Gini coefficient was calculated with the R program to explain the distribution of teachers' focus of attention in the classroom on students, instructional materials and non-instructional materials, using the total fixation duration on each target during the whole video recording and each activity setting (see also Cortina et al., 2015; Dessus et al., 2016). The Gini coefficient ranges from 0 to 1, where 0 refers to an equally distributed focus of attention on all targets and 1 refers to an unequal distribution, in which case only one target receives all the focus of attention (Cortina et al., 2015). Using IBM SPSS Statistics 26, correlation analyses were conducted to examine the relation between perceived stress and the Gini coefficient (focus of attention) in the whole eye-tracking video recording and within activity settings in all lessons.

The next aim was to explore variations in teachers' focus of attention between a more-stressed and a less-stressed teacher, using a case study design. The teachers' stress scores were used to select two teachers, i.e., one with more than average stress and one with less than average stress, for an in-depth investigation. First, the teachers' stress scores and background information were described. Second, to visually represent the teachers' focus of attention on students, instructional materials and non-instructional materials, total fixation durations during a math lesson from both teachers were used at both time points in the fall and spring to avoid the possible effect of different subjects. Finally, activity settings during the lesson from the eye-tracking video recordings were considered.

3. Results

3.1. Teacher Focus of Attention in Relation to Teacher Stress

The first research question examined the extent to which teacher stress is associated with a teacher's focus of attention. As can be seen in Table 1, teachers reporting exhaustion in fall and sense of inadequacy in spring gave more individual focus of attention to students during individual work activity setting in fall and small group/pair work activity setting in spring. The results showed a positive correlation between inadequacy and focus of attention (using the Gini coefficient) in the whole recording ($r_{fall} = 0.33$, $p < 0.05$) in fall (see Table 2). In addition, teacher's sense of inadequacy also marginally correlated with focus of attention in the whole recording ($r_{spring} = 0.27$, $p < .1$) in spring (see Table 2). This indicates that teachers' reduced efficacy in their professional competence is associated with less individualised distribution of focus of attention amongst students in fall and spring.

Table 1. Descriptive information of teacher stress domains and focus of attention in different activity settings.

	Teachers (n = 53) Fall Mean (SD)	Teachers (n = 52) Spring Mean (SD)
Teacher Stress[a] Exhaustion	3.75 (0.95)	2.99 (0.91)
Cynicism	2.03 (0.93)	2.09 (1.00)
Inadequacy	1.92 (0.95)	2.11 (1.05)
Focus of attention[b] (n_{fall}=50,n_{spring}=49)	0.51 (0.10)	0.51 (0.10)
Management/Routines and Transitions[c] (n_{fall}=46, n_{spring}=47)	0.39(0.10)	0.44(0.13)
Teacher directed large group activity[c] (n_{fall}=48, n_{spring}=45)	0.38(0.11)	0.39(0.13)
Individual work[c] (n_{fall}=30, n_{spring}=24)	0.51(0.16)	0.49(0.17)
Small group/pair work[c] (n_{fall}=12, n_{spring}=15)	0.47(0.20)	0.59(0.15)

[a]Teacher stress scale was 1 (completely disagree) to 6 (completely agree).
[b]Gini coefficient from full eye-tracking video recordings.
[c]Gini coefficient from activity settings in lessons.

Table 2. Correlations between teachers' stress domains and focus of attention in activity settings.

			Exhaustion[c]		Cynicism[c]		Inadequacy[c]	
	N_{Fall}	N_{Spring}	Fall (N^c = 53)	Spring (N^c = 52)	Fall (N^c = 53)	Spring (N^c = 52)	Fall (N^c = 53)	Spring (N^c = 52)
1. Focus of attention[a]	50	49	.079	−.048	.165	.177	.330*	.258[†]
2. Management/Routines and Transitions[b]	46	47	.344*	−.138	.306*	.065	.333*	.131
3. Teacher directed large group activity[b]	48	45	.096	−.205	.217	−.075	.268[†]	−.106
4. Individual work[b]	30	24	−.001	−.149	−.028	−.085	−.038	−.280
5. Small group/Pair work[b]	12	15	.308 .375[d]	−.334 −.438[d]	−.119 .128[d]	−.344 −.329[d]	.205 .387[d]	−.297 −.256[d]

Note. ** $p < .001$* $p < .05$, [†] $p < .1$.
[a]Gini coefficient for the full lesson.
[b]Gini coefficient for activity setting.
[c]stress domains.
[d]Spearman's correlation coefficient.

Each lesson was further divided into segments based on the dominant activity setting in which the teacher and students were engaged. Correlational analysis between domains of stress and focus of attention during particular activity settings revealed that exhaustion ($r_{fall} = 0.34$, $p < 0.05$), cynicism ($r_{fall} = 0.30$, $p < 0.05$) and inadequacy ($r_{fall} = 0.33$, $p < 0.05$) positively correlated with focus of attention during management/routines and transitions activity setting in the fall. In addition, teacher inadequacy correlated marginally significantly ($r_{fall} = 0.26$, $p < .1$) with focus of attention during teacher-directed large group activity setting in fall.

3.2 Closer Investigation of More- and Less-stressed Teachers' Focus of Attention

3.2.1. Backgrounds of the Two Teachers

The second research question examined variations in the focus of attention between two teachers—one with more than average stress and another with less than average stress. Teacher 1 (Te1), who reported more than average stress in both fall and spring (see Table 3), was new to the workplace during the time of data collection. Her class size ranged between 21 and 22 students in fall and spring. The causes of reported stress were students with behaviour problems and a fixed-term service contract at the workplace. Additionally, in fall, Te1 reported that no students in the classroom required special needs support. In spring, the causes of stress reported by Te1 were similar as in fall with one additional challenge, which was an adversity of resources for the upcoming academic year, in particular, a special needs instructor. It was reported that in the spring, seven students needed support with learning and five students with socio-emotional behaviour problems. However, there was no special education needs teacher available in the classroom.

Table 3. Descriptive background information and stress scores of Teacher 1 and Teacher 2.

	Teacher 1 (Te1)	sTeacher 2 (Te2)
Background information		
Gender	Female	Female
Age (years)	38	43
Education: MA degree in education	class teacher	class teacher
Work experience (years)	10	12
Class size: Fall semester	22	24
Class size: Spring semester	21	24
Students needing special support: Fall semester	0	4
Students needing special support: Spring semester	12	5
Classroom support available:		
School Counsellor	X	X
Special Education Needs Teacher		X
Teacher Stress[a]		
Exhaustion: fall	4.00	1.67
Exhaustion: spring	5.00	1.33
Cynicism: fall	3.00	1.00
Cynicism: spring	3.67	1.00
Inadequacy: fall	2.33	1.00
Inadequacy: spring	4.33	1.00
Focus of attention: fall[b]	0.36	0.57
Focus of attention: spring[b]	0.43	0.40

[a]Teacher stress scale was 1 (completely disagree) to 6 (completely agree).
[b]Gini coefficient.

Teacher 2 (Te2), who reported less than average stress (see Table 3) in fall and spring, had been in the current workplace for 7 years. Her class size was consistent at 24 students in both fall and spring. In fall, changes in assessment practices with the new curriculum and changes in working patterns were reported as her main causes of stress. Additionally, in fall, three students were reported as needing support in learning and one student with socio-emotional behaviour problems. However, in spring, Te2 reported three students with learning problems and two students requiring support with new language acquisition. In spring, Te2 reported challenges with developing reading skills and reinforcing reading fluency with some students as the main cause of stress. Additionally, she had support from the school counsellor and a special needs teacher in the fall and spring to support students with special needs.

3.2.2. Teachers' Focus of Attention in Fall and Spring

Teacher1 (Te1). During the whole lesson in fall, Te1 gave 52% of her overall focus of attention to students, 33% to instructional materials and 15% to non-instructional materials. Figure 1 describes the overall variations in focus of attention during the entire eye-tracking recording. Peaks in students' time series are during management/routine/transitions or non-academic activities, whereas peaks in instructional materials time series are during teacher-directed large group or academic activities. On average, Te1 focussed her attention on each student ($M_{\text{fixation duration}} = 1.17$s, SD = 2.09s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 18.78$s) and teaching material ($M_{\text{fixation duration}} = 2.56$s, SD = 3.84s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 19.66$s) during the 24-minute math lesson in fall. Te1 distributed her focus of attention relatively evenly as indicated by the Gini coefficient (0.36), which is lower than the average of the whole sample in fall (see Table 1).

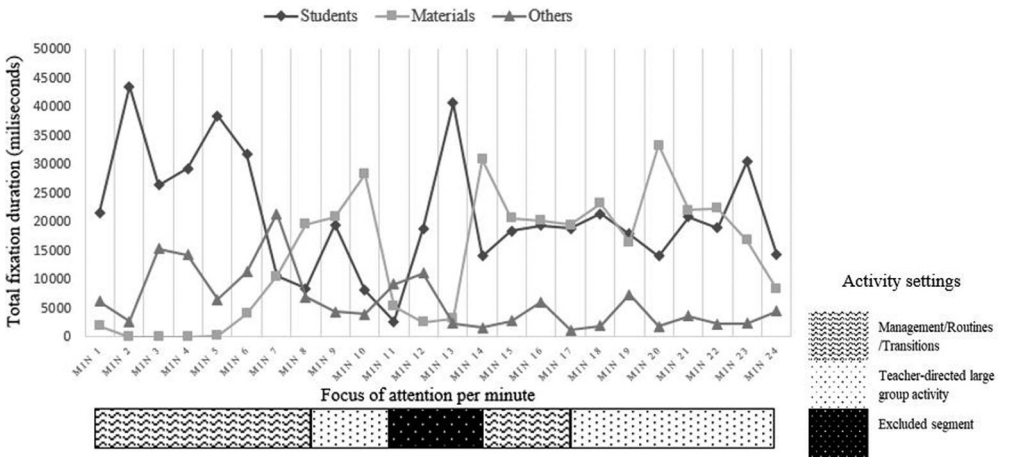

Figure 1. Variations in focus of attention of Teacher 1 (more-stressed teacher) in fall lesson.

The first graph explains the variations in the focus of attention as the lesson progressed. The second graph describes how much time was focussed (in percentages) on students, instructional materials and non-instructional materials during the individual activity settings. Both lessons in fall and spring were first divided into segments, based on the course of activity settings during each lesson (example, see Figure 1), and followed by analyses of focus of attention according to the activity settings (example, see Figure 2). While identifying the activity settings, it was noticed that Te1 used a teacher-directed large group activity for 11 min, where she focussed 30% of her time on students at segment 08:00–10:30 and 46% of her time on students at segment 16:00–24:30 to deliver math-related content (see Figure 2). During management, routines and transitions, 63% of her time was focussed on students at segment 01:00–08:00, and 52% of her time was focussed on students at segment 10:30–16:00 (see Figure 2). Therefore, the focus of attention was more on students during the non-academic activity settings. However, during the teacher-directed large group activity, the focus of attention was more on instructional materials (see Figure 2).

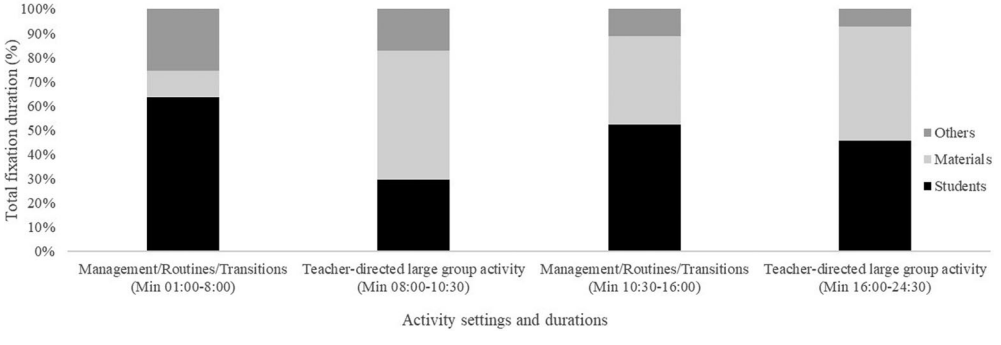

Figure 2. Distribution of Teacher 1's focus of attention in fall amongst activity settings.

In spring, Te1 gave 56% of her overall focus of attention from the lesson to students, 25% to instructional materials and 19% to non-instructional materials. Figure 3 describes variations in Te1's focus of attention in the spring lesson. Peaks are seen in the time series plot of total fixation duration on students and materials during the teacher-directed large group or academic activity.

However, the highest peak in the time series plot of total fixation duration on students was seen during the last management/routines/transitions or non-academic activity (see Figure 3). Overall, Te1 emphasised her focus of attention on students in most parts of the lesson, as depicted by the peaks in the time series plot (see Figure 3).

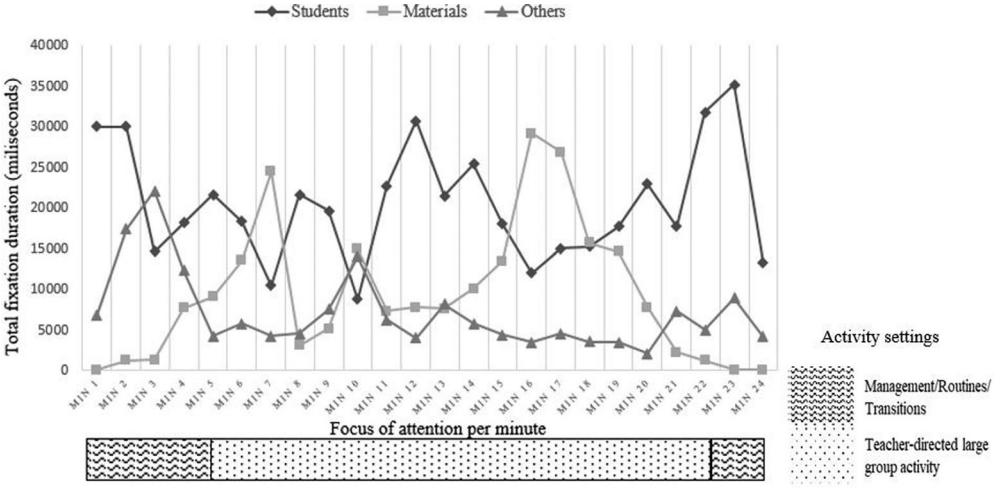

Figure 3. Variations in focus of attntion of Teacher 1 (more-stressed teacher) in spring lesson.

In spring, Te1 focussed attention on each student ($M_{\text{fixation duration}}$ = 1.07s, SD = 1.90s, $Min_{\text{fixation duration}}$ = 0s, $Max_{\text{fixation duration}}$ = 20.34s) and each teaching material ($M_{\text{fixation duration}}$ = 2s, SD = 4.34s, $Min_{\text{fixation duration}}$ = 0s, $Max_{\text{fixation duration}}$ = 28.71s) during a 24-minute math lesson. As can be seen in Figure 4, 16 min were used for a teacher-directed large group activity, where 73% of Te1's time was focussed on students at segment 05:30–22:30. Management/routines/transition activities used 7 min 30 s, where 58% of Te1's time was focussed on students at segment 0:00–05:30, and 80% of her time was focussed on students at segment 22:30–24:39 in the math lesson in spring. Te1 gave a more focus of attention to the students as a whole group during the teacher-directed large group activity. Te1 distributed her focus of attention relatively evenly amongst students as indicated by the Gini coefficient, which is lower (0.43) than the average of the whole sample in spring (see Table 1).

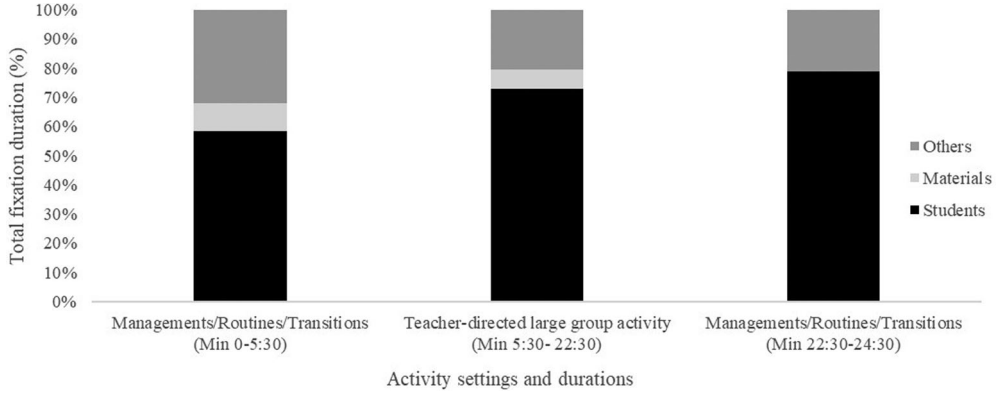

Figure 4. Distribution of Teacher 1's focus of attention in spring amongst activity settings.

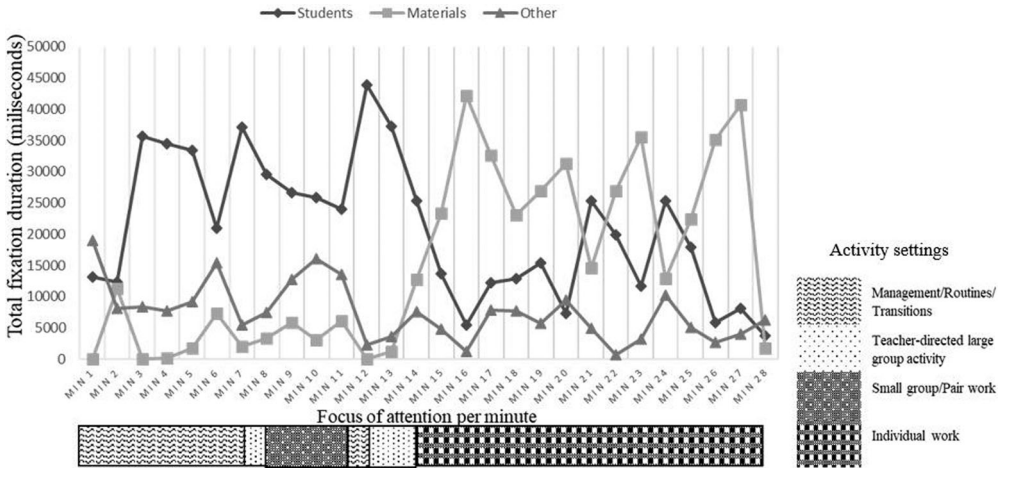

Figure 5. Variations in focus of attention of Teacher 2 (less-stressed teacher) in fall lesson.

Teacher2 (Te2). During the lesson in fall, Te2 gave 48% of her overall focus of attention to students, 35% to instructional materials and 17% to non-instructional materials from a duration total of 28 min. Figure 5 describes the overall variations in focus of attention of Te2 during the entire eye-tracking recording. Peaks are seen in Te2's total fixation duration on students from the beginning to the middle of the lesson and on materials from the middle to the end of the lesson. On average, Te2 focussed attention on each student ($M_{\text{fixation duration}} = 0.90$s, SD = 1.73s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 20.54$s) and each teaching material ($M_{\text{fixation duration}} = 0.50$s, SD = 2.05s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 10.92$s) within the 28-minute math lesson. Pair work and individual work activities were implemented during the lesson. Te2 may have provided individual support to students as indicated by the Gini coefficient (0.57; see Table 3).

Figure 6 shows two management/routines/transitions segments, 0:00–07:30 and 11:30–12:00, where Te2 gave 66% and 95% of her focus of attention, respectively, to students. Teacher-directed large group activities were during segments 07:30–08:00 and 12:00–14:00, where Te2 gave 73% and 71% of her focus of attention, respectively, to students. Te2 gave 57% of her focus of attention to students during a small group/pair work activity at segment 08:00–11:30. An individual work activity during the 14:00–28:00 segment showed that Te2 gave only 29% of her focus of attention to students in this activity setting. During this math lesson, the individual work activity setting was the longest duration. The duration of Te2's focus of attention on instructional materials during the individual work activity setting was 6 min and 15 s.

In the spring lesson, Te2 gave 64% of her overall focus of attention to students, 23% to instructional materials and 13% to non-instructional materials from the total duration of 21 min. Figure 7 shows Te2's overall variations in her focus of attention in the spring lesson. Most peaks in total fixation durations are seen on students in most parts of the lesson, and only three peaks are seen on materials during the academic activity settings of teacher-directed large group and small group/pair work activities. In spring, Te2 focussed her attention, on average, on each student ($M_{\text{fixation duration}} = 0.97$s, SD = 1.86s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 28.16$s) and each teaching material ($M_{\text{fixation duration}} = 1.17$s, SD = 3.38s, $\text{Min}_{\text{fixation duration}} = 0$s, $\text{Max}_{\text{fixation duration}} = 28.22$s) during the 21-minute lesson.

Figure 8 shows that Te2 implemented management/routines/transitions where 58% of her focus of attention was on students at segment 0:00–4:00, and 26% was on students at segment 18:00–19:00. During a teacher-directed large group activity at 04:00–08:30, Te2 focussed 81% of her

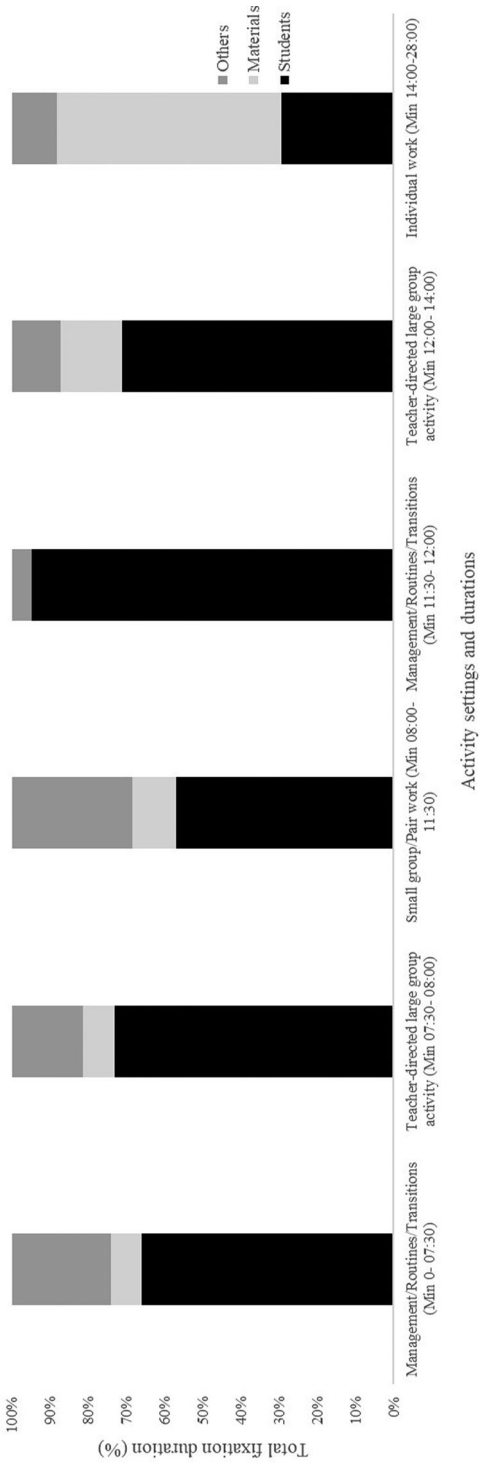

Figure 6. Distributions in focus of attention of Teacher 2 in fall amongst activity settings.

attention on students, and at segment 10:00–18:00, 58% of Te2's attention was focussed on students. During the small group/pair work segments, Te2 focussed 93% of her attention on students from 08:30–10:00 and 57% on students in segment 19:00–21:00. However, Te2 distributed her focus of

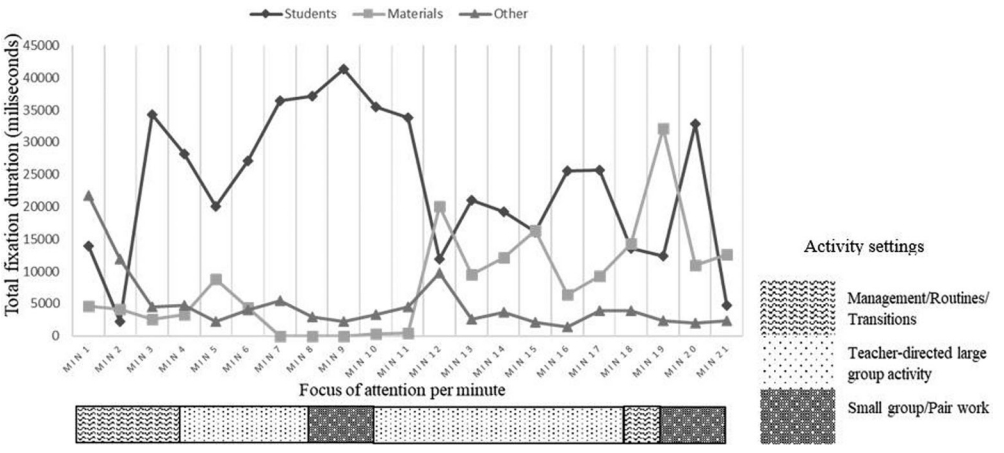

Figure 7. Variations in focus of attention of Teacher 2 (less stressed teacher) in spring lesson.

attention relatively evenly amongst all students as shown by the Gini coefficient (0.40), which is lower than the average of the whole sample in spring (see Table 1). Te2 incorporated a teacher-directed large group activity of a high duration, where instructional materials were used to deliver math content. However, pair work was used two times in the spring lesson, where the duration of Te2's focus of attention on students was longer.

4. Discussion

The present study had two aims: first, to explore the extent to which teacher stress is associated with their focus of attention in classroom settings and, second, to analyse in-depth the variations in the focus of attention between two teachers reporting more and less stress. The results showed, firstly, a positive association between teacher inadequacy at work and the overall distribution of focus of attention in the fall and a marginally significant positive correlation in spring. Furthermore, positive association was found between all domains of teacher stress and focus of attention during management/routines and transitions activity settings in fall. Thirdly, there was a marginally significant positive correlation between teachers' inadequacy and teacher focus of attention during teacher-directed large group activity in fall. Furthermore, the case studies served as examples that confirmed these findings and demonstrated the distribution of teachers' focus of attention.

First, we investigated the association between perceived teacher stress and focus of attention in the lesson using eye-tracking recording. Firstly, the results indicated that in the beginning of the first grade, teachers' sense of inadequacy was positively associated with their distribution of focus of attention. This is in line with previous research stating that reduced efficacy in professional competence in managing student behaviour could make teachers prone to be detached from students, stressed and exhausted (Aloe, Amo, et al., 2014; Salmela-Aro et al., 2011). Secondly, teacher stress was associated with teacher focus of attention during management/routines and transition activity settings in the fall. This finding supports prior research, which has shown that challenging student behaviour, and therefore higher need for classroom management, is associated with more teacher stress (Friedman-Krauss et al., 2013; Herman et al., 2018). The finding also suggests that teachers need to prioritise their immediate responses and attention (van den Bogert et al., 2014) to all students in the fall semester. Thirdly, teachers' sense of inadequacy was associated with focus of attention during teacher-directed large group activity settings in the fall. This finding could suggest that teachers may have stronger sense of inadequacy with little knowledge about the academic and behaviour needs of each student and may scan the whole classroom regularly

rather than provide individualised support. Teacher sense of inadequacy may also arise from the teacher's reduced control over distressful situations, limited means of action and uncertainty in the classroom, which could be emotionally overwhelming and, in turn, reflected in the teacher's behaviour and actions to manage classroom situations (Lindqvist et al., 2017).

The second research question involved a case study design to investigate in more detail the variation in focus of attention of two teachers one with more and another with less stress. In the fall, Te1 (more stress) reported that student behaviour problems were a cause of stress and her eye-tracking recording showed that she focused her attention longer on students during classroom management activity settings. This supports our finding with the whole sample that teacher focus of attention during classroom management activity setting associated with teacher stress at fall. In the spring, Te1 reported more students identified as needing support with learning and behaviour, and lack of resources from special needs teacher as a cause of her stress. Previous research confirmed that differentiating instructions and managing disruptive student behaviour contribute to more teacher's stress (Herman et al., 2018; Kyriacou, 2001). According to her eye-tracking recording in spring, Te1 now spent majority of time within teacher-directed large group activity providing more attention to students and spread her attention more evenly suggesting Te1's improved awareness of student needs during the school year. This supports our finding with the whole sample as well that teachers' sense of inadequacy associated with teacher overall focus of attention during the eye-tracking recordings in the spring. It is also noteworthy that despite the high students' needs, Te1 invested longer time in large group teaching.

Te2 (less stress) reported challenges in assessment practices with new curriculum and change in work patterns as her causes of stress in fall and her eye-tracking recording in fall showed that Te2 implemented longer individual work activity setting when she focused longer on materials. Individual support during academic tasks usually occurs during individual work activity settings and however, we did not find any associations between individual work and stress in fall. This could indicate that providing individual support might not be stressful during individual work activity setting. Te2 reported challenges with developing reading skills and reinforcing reading fluency with some students as her cause of stress in spring and her eye-tracking video in spring showed that she focused longer on students during small group/pair work activity settings. In small group/pair work activity settings, teacher assisted students in pairs and groups during academic tasks. However, we found no associations between small group/pair work and teacher perceived stress in fall and spring. During the school year, students could learn to work and interact in small groups and pairs requiring less monitoring that could make these activities less stressful for the teacher. These results and teacher cases provide some examples of how teacher focus of attention might vary between a more and less stressed teacher. However, to confirm these patterns they should be examined further in larger data sets.

4.1. Practical Implications

The present study has some practical implications. This study adds to the existing literature of teacher visual attention by establishing a link between teachers' feelings of stress at work and their focus of attention in the classroom. Teacher stress could be reflected in even/uneven distribution of visual attention during lesson, and thereby shape student classroom experiences. As teaching has been found as a stressful job (Aloe, Shisler, et al., 2014; Herman et al., 2020), it is important for teachers to be aware of how their occupational wellbeing could be reflected in their focus of attention in the classroom. The present study was among the first ones conducted in authentic classroom settings investigating teacher's visual attention with mobile eye-tracking in a dynamic and information-rich setting. Student teachers could benefit from the use of eye tracking during their teaching practice to become more aware of their focus of attention patterns in the classroom. In addition, reflecting on the video recording of their own teaching could open their eyes to their own classroom behaviour and actions. Eye-tracking can also be a powerful tool for teachers'

professional development at in-service trainings by providing them with objective information on their non-verbal interactions in the classroom towards different students during a lesson. According to Lindqvist et al. (2017), contemplative discussions about anticipatory distressful classroom situations in addition to viewing eye-tracking recordings could facilitate resolving sense of inadequacy at work and empower teachers to reflect on their classroom practices. Being more task focussed than emotion focussed during distressful classroom situations could help teachers overcome their sense of inadequacy at work and to focus their attention more on individual students.

4.2. Methodological Limitations and Future Directions

Collecting and analysing eye-tracking data is well recognised as time-consuming and expensive, which makes it challenging to conduct these studies. Although this study was amongst the first to investigate teachers' focus of attention in authentic classroom settings, it is not without its limitations. First, using a small sample size and a case study approach limits the possibilities to generalise the findings. Instead, case studies should be read entirely as a narrative (Flyvbjerg, 2006) and the essence of a case study lies in detailed investigation of a small sample focusing on specific aspects of an experience within a classroom (Tight, 2010). Therefore, the in-depth analysis of the case studies may provide a deeper and unbiased picture of how stress is reflected in focus of attention in real-life situations in current study. Additionally, the focus of attention of a larger data set of teachers could be used to confirm the trends found from the case studies. Second, since the present study was conducted in authentic classroom settings, differences in classroom characteristics could somewhat influence the results of this study. For example, arrangement of students and classroom layouts, personal characteristics of the teachers, different topics of the lesson, different positioning of the teacher with respect to students, and differences in teaching methods might also affect teacher focus of attention. Further research could focus on in-depth examinations of teachers' focus of attention on students during various activity settings with respect to other moderating factors, such as student academic achievement and motivation as well as special education needs. Third, the study captured only 20 min of eye-tracking recordings from every lesson, which may not be adequate to generalise about teaching quality and effectiveness of teaching. Fourth, authentic classroom settings provided higher ecological validity; yet, it could lead to little or no control over teachers' movements and light conditions during eye-tracking recording, which sometimes leads to lower gaze sample percentages. Therefore, the eye-tracking recordings with lower gaze sample percentages were not used in the study. Finally, since the case studies demonstrated teacher focus of attention only during math lessons, further research could consider investigating teacher focus of attention in more details in other subjects. Further investigation of teacher focus of attention in different subject areas could give deeper insights for improving teacher's instructional practices. In future research, the eye-tracking recordings should be complemented with teachers' qualitative interviews that can shed light on the emotional experiences of teachers and reasons for their actions during the recordings. Relatedly, future studies could consider a wider variety of stress measures and interviews in getting deeper understanding on the relations between teacher stress and focus of attention.

4.3. Conclusions

This exploratory study opened a new area of research concerning the associations between teachers' stress and their focus of attention in classrooms with Grade 1 students. Previous studies on teacher focus of attention have been conducted in secondary school classrooms (e.g., Cortina et al., 2015; Haataja et al., 2019) but these studies have not investigated the association between stress and teacher focus of attention at primary school with young children. Mobile eye-tracking methodology was used to investigate teachers' focus of attention providing insights about teachers' visual information processing during lessons in authentic classroom

settings. The findings suggest that teachers' perceived stress could be reflected in the variations of their focus of attention. In addition, examining teachers' focus of attention during various activity settings showed diverse associations with different domains of stress, and similar type of trends were demonstrated within the two teacher case studies. The case studies supported the findings that teacher stress was associated with teachers' focus of attention during classroom management activity settings in fall. This could suggest that student behaviour management can be stressful for the teacher, especially in the beginning of Grade 1 when students are learning how to study and behave in school classroom. Further investigation of these trends and possibilities is needed for developing an in-depth understanding of relationship between teacher stress and focus of attention in the classroom.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Academy of Finland: [Grant Number 317610]; Ella and Georg Ehrnrooth Foundation; Työsuojelurahasto (Finnish Work Environment Fund).

ORCID

Saswati Chaudhuri http://orcid.org/0000-0003-0327-7550
Heli Muhonen http://orcid.org/0000-0001-6199-7068
Eija Pakarinen http://orcid.org/0000-0001-7190-6705
Marja-Kristiina Lerkkanen http://orcid.org/0000-0002-5709-5800

References

Aloe, A. M., Amo, L. C., & Shanahan, M. E. (2014). Classroom management self-efficacy and burnout: A multivariate meta-analysis. *Educational Psychology Review*, *26*(1), 101–126. https://doi.org/10.1007/s10648-013-9244-0

Aloe, A. M., Shisler, S. M., Norris, B. D., Nickerson, A. B., & Rinker, T. W. (2014). A multivariate meta-analysis of student misbehaviour and teacher burnout. *Educational Research Review*, *12*, 30–44. https://doi.org/10.1016/j.edurev.2014.05.003

Cortina, K. S., Miller, K. F., McKenzie, R., & Epstein, A. (2015). Where low and high inference data converge: Validation of CLASS assessment of mathematics instruction using mobile eye tracking with expert and novice teachers. *International Journal of Math and Education*, *13*, 389–403. https://doi.org/10.1007/s10763-014-9610-5

Dessus, P., Cosnefroy, O., & Luengo, V. (2016). "Keep your eyes on 'em all!": A mobile eye-tracking analysis of teachers' sensitivity to students. *Adaptive and Adaptable Learning*, *9891*, 72–84. https://doi.org/10.1007/978-3-319-45153-4_6

Feldt, T., Rantanen, J., Hyvönen, K., Mäkikangas, A., Huhtala, M., Pihlajasaari, P., & Kinnunen, U. (2013). The 9-item Bergen Burnout Inventory: Factoral validity across orgnanizations and measurements of longitudinal data. *Industrial Health*, *52*(2), 102–112. https://doi.org/10.2486/indhealth.2013-0059

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Friedman-Krauss, A. H., Raver, C. C., Morris, P. A., & Jones, S. M. (2014). The role of classroom-level child behavior problems in predicting preschool teacher stress and classroom emotional climate. *Early Education and Development*, *25*(4), 530–552. https://doi.org/10.1080/10409289.2013.817030

Friedman-Krauss, A. H., Raver, C. C., Neuspiel, J. M., & Kinsel, J. (2013). Child behavior problems, teacher executive functions, and teacher stress in head start classrooms. *Early Education and Development*, *25*(5), 681–702. https://doi.org/10.1080/10409289.2013.825190

Haataja, E., Morena-Esteva, E. G., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S. (2019). Teacher's visual attention while scaffolding collaborative mathematical problem solving. *Teaching and Teacher Education*, *86*, 1–15. https://doi.org/10.1016/j.tate.2019.102877

Henderson, J. M. (2011). Eye movements and scene perception. In S. P. Liversedge, I. Gilchrist, & S. Everling (Eds.), (pp. 1-23) *The Oxford handbook of Eye movements*. Oxford University Press.

Herman, K. C., Hickmon-Rosa, J., & Reinke, W. M. (2018). Empirically derived profiles of teacher stress, burnout, self-efficacy, and coping and associated student outcomes. *Journal of Positive Behaviour Interventions*, *20*(2), 90–100. https://doi.org/10.1177/1098300717732066

Herman, K. C., Prewitt, S. L., Eddy, C. L., Savala, A., & Reinke, W. M. (2020). Profiles of middle school teacher stress and coping: Concurrent and prospective correlates. *Journal of School Psychology*, *78*, 54–68. https://doi.org/10.1016/j.jsp.2019.11.003

Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H., & DeWeijer, J. (2015). *Eye tracking: A comprehensive guide to methods and measures*. Oxford University Press.

Jarodzka, H., Skuballa, I., & Gruber, H. (2020). Eye-tracking in educational practice: Investigating visual perception underlying teaching and learning in the classroom. *Educational Psychology Review*, *33*(1), 1–10. https://doi.org/10.1007/s10648-020-09565-7

Jeon, L., Buettner, K., & Grant, A. A. (2017). Early childhood teachers' psychological well-being: Exploring potential predictors of depression, stress, and emotional exhaustion. *Early Education and Development*, *29*(1), 53–69. https://doi.org/10.1080/10409289.2017.1341806

Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational Review*, *5*(1), 27–35. https://doi.org/10.1080/00131910120033628

Lerkkanen, M.-K., & Pakarinen, E. (2016–2022). Teacher and student stress and interaction in classroom (TESSI) [Unpublished data]. University of Jyväskylä.

Lindqvist, H., Weurlander, M., Wernerson, A., & Thornberg, R. (2017). Resolving feelings of professional inadequacy: Student teachers' coping with distressful situations. *Teaching and Teacher Education*, *64*, 270–279. https://doi.org/10.1016/j.tate.2017.02.019

Maslach, C., & Leiter, M. P. (2016). Understanding the burnout experience: Recent research and its implications for psychiatry. *World Psychiatry*, *15*(2), 103–111. https://doi.org/10.1002/wps.20311

McIntyre, N. A., & Mainhard, T. M. (2020). Looking to relate: Teacher gaze and culture in student-rated teacher interpersonal behaviour. *Social Psychology of Education*, *23*(2), 1–21. https://doi.org/10.1007/s11218-019-09541-2

McIntyre, N. A., Jarodzka, H., & Klassen, R. M. (2019). Capturing teacher priorities: Using real-world eye-tracking to investigate expert teacher priorities across two cultures. *Learning and Instruction*, *60*, 215–224. https://doi.org/10.1016/j.learninstruc.2017.12.003

McIntyre, N. A., Mainhard, T. M., & Klassen, R. M. (2017). Are you looking to teach? Cultural, temporal and dynamic insights into expert teacher gaze. *Learning and Instruction*, *49*, 41–53. https://doi.org/10.1016/j.learninstruc.2016.12.005

Pennings, H. J. M., Brekelmans, M., Sadler, P., Claessens, L. C. A., van der Want, A. C., & van Tartwijk, J. (2018). Interpersonal adaptation in teacher-student interaction. *Learning and Instruction*, *55*, 41–57. https://doi.org/10.1016/j.learninstruc.2017.09.005

Salmela-Aro, K., Pietarinen, J., & Pyhältö, K. (2011). Teacher working-environment fit as a framework for burnout experienced by Finnish teachers. *Teaching and Teacher Education*, *27*(7), 1101–1110. https://doi.org/10.1016/j.tate.2011.05.006

Salmela-Aro, K., Rantanen, J., Hyvönen, K., Tilleman, K., & Feldt, T. (2010). Bergen Burnout Inventory: reliability and validity among Finnish and Estonian managers. *International Archives of Occupational and Environmental Health*, *84*(6), 635–645. https://doi.org/10.1007/s00420-010-0594-3

Tatler B., Kirtley C., Macdonald R., Mitchell K., Savage S. (2014) The Active Eye: Perspectives on Eye Movement Research. In: Horsley M., Eliot M., Knight B., Reilly R. (eds) *Current Trends in Eye Tracking Research*. pp. 3-16. Springer, Cham. https://doi.org/10.1007/978-3-319-02868-2_1

Tight, M. (2010). The curious case of case study: A viewpoint. *International Journal of Social Research Methodology*, *13*(4), 329–339. https://doi.org/10.1080/13645570903187181

Tobii AB. (2018). Tobii pro glasses 2 product description manual (v 1.95). https://www.tobiipro.com/siteassets/tobii-pro/product-descriptions/tobii-pro-glasses-2-product-description.pdf/?v=1.95

van den Bogert, N., Bruggen, J. V., Kostons, D., & Jochems, W. (2014). First steps into understanding teachers' visual perception of classroom events. *Teaching and Teacher Education*, *37*, 208–216. https://doi.org/10.1016/j.tate.2013.09.001

Virtanen, T. E., Vaaland, G. S., & Ertesvåg, S. K. (2019). Associations between observed patterns of classroom interactions and teacher wellbeing in lower secondary school. *Teaching and Teacher Education*, *77*, 240–252. https://doi.org/10.1016/j.tate.2018.10.013

Wolff, C. E., Jarodzka, H., van den Bogert, N., & Boshuizen, H. P. (2016). Teacher vision: Expert and novice teachers' perception of problematic classroom management scenes. *Instructional Science*, *44*(3), 243–265. https://doi.org/10.1007/s11251-016-9367-z

Yamamoto, T., & Imai-Matsumura, K. (2012). Teachers' gaze and awareness of students' behaviour: Using an eye tracker. *Comprehensive Psychology*, 2(6). https://doi.org/10.2466/01.IT.2.6