

ORIGINAL ARTICLE

The relationship of students' classroom behaviour and word reading—The role of on-task behaviour as a mediator

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Abstract

The aim of the present study is to examine the relationship between students' classroom behaviour and word reading (decoding), considering the role of students' engagement in learning (defined as on-task behaviour, OTB, as part of the more global 'behavioural engagement' sensu Fredricks) as a mediator between behaviour and reading. A wide range of classroom behaviour of 171 first-grade students ($M=6.7$ years; $SD=0.30$), including internalizing and externalizing behaviour, was rated after 2 months of schooling in grade one. Reading was tested at the end of first grade. Results indicated that out of six behavioural dimensions we analysed, only depression, aggression and hyperactivity had significant indirect effects on reading test scores via students' on-task behaviour, but no direct effects. Impulsivity, withdrawal and oppositional behaviour showed no effects at all. Learning engagement had a significant effect on reading.

KEYWORDS

behavioural problems, mediator effects, on-task behaviour, reading

Key Points

- Three out of six behaviour dimensions (aggression, hyperactivity and depression) significantly affected reading abilities. These effects were mediated by on-task behaviour, highlighting the importance of maintaining focus during reading tasks.
- On-task behaviour serves as a key mediator between behavioural problems and reading skills. Some behaviour dimensions disrupt reading focus and hinder the development of reading skills.
- Teachers should train to identify reading difficulties early, recognize behavioural issues and implement strategies to ensure students remain focused on reading tasks.

INTRODUCTION

Word reading disorders are among the most commonly diagnosed developmental disorders in childhood, with a prevalence of about 3%–20% (Shaywitz et al., 2021) depending on the criteria used to define struggling readers (Moll et al., 2014; Yang et al., 2022). Reading problems negatively affect students' later mental health, as well as

their educational and vocational careers (Aro et al., 2018; Chapman & Tunmer, 2003).

The association between literacy achievement and behaviour problems is well documented. Research indicates that 40%–60% of children and adolescents with reading difficulties experience mental health problems (Schulte-Körne, 2010). This is the case for both externalizing behaviour, such as aggression (Zuppardo et al., 2023),

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antisocial behaviour (Trzeniewski et al., 2006) and internalizing behaviour, such as anxiety (Francis et al., 2019), depression (Francis et al., 2019) and withdrawal (Gasteiger-Klicpera et al., 2006; Zuppardo et al., 2023). However, the exact relationship between behaviour problem (BP) and reading is not clear. There are various reasons for this: for example, different methodological approaches such as methods of investigation (e.g., objective measures versus teacher/parent judgement; chosen reading components) (Liederman et al., 2005; Quinn, 2018), research design (cross-sectional versus longitudinal studies), differences in samples (e.g., age, gender, and clinical sample), definition criteria of disabilities (reading and behaviour; Volkmer et al., 2019) and the language used (Parhiala et al., 2015).

A key factor for positive school and professional outcomes (Andersson & Bergman, 2011; Aunola et al., 2002; Lundberg & Sterner, 2006; Olivier et al., 2018, 2020) is students' general engagement in learning and learning tasks, albeit a variety of terms and definitions exist on this issue. For instance, Fredricks et al. (2004) describe 'behavioural engagement' as a multifaceted construct involving behavioural, emotional and cognitive engagement. Behavioural engagement includes 'involvement in learning' like effort and task persistence (Martins et al., 2022, p. 794; Pekrun & Linnenbrink-Garcia, 2012). Other authors use the term on-task behaviour (OTB) to focus more on students' appropriate behaviour in learning situations, for example, directing attention to a specific task, looking carefully at the instructions and giving appropriate task-related answers (Johnson et al., 2024; Mahar et al., 2006). For this reason, we use the term OTB in the following.

OTB as a predictor for learning is also related to BP (Becherer et al., 2021; Cinar et al., 2023; Olivier et al., 2020). Therefore, some researchers (Linnenbrink-Garcia & Patall, 2015, as cited in De Neve et al., 2023; Metsäpelto et al., 2015; Morgan et al., 2008; Pekrun & Linnenbrink-Garcia, 2012) concluded that engagement in learning might be an important mediator between BP and learning outcomes.

EMPIRICAL FINDINGS

Empirical findings on the relationship of behaviour problems and word reading

Word reading problems and behavioural problems are commonly found to be associated. Wilmot et al. (2023) conducted a wide-ranging review to gain insight into the association of mental health and word reading problems. For the relationship between internalizing behaviour and reading, they primarily found that reading difficulties precede internalizing symptoms, results that are in line with the review and meta-analysis by Francis et al. (2019). They found a significant relationship for

reading and anxiety ($d=0.41$) as well as for reading and depression ($d=0.23$). Zuppardo et al. (2023) found that children with reading problems showed higher internalizing problems in general, especially withdrawal, anxiety, depression and somatic complaints, as well as social thought and attention problems. In a Finnish sample, Aro et al. (2022) also examined the association between behavioural-emotional problems and learning disabilities. Overall, they found a higher rate of clinical behavioural-emotional problems among children with learning disabilities (reading disabilities, math disabilities and both). Among children with an isolated reading disability, however, they found solely an elevated percentage of affective problems (for girls) and somatic symptoms (for boys).

Of special interest are studies that might inform about the causal direction of the relations in question. In the study of Parhiala et al. (2015), externalizing and internalizing behaviour were rated by parents prior to school and after a dyslexia diagnosis. Children who later received a dyslexia diagnosis exhibited attention problems prior to school more often than their normal reading peers. However, the effect was weak and no differences were found for the other areas of psychosocial functioning. In a reanalysis of the Parhiala et al. data, Robidoux et al. (2023) found a reverse association between grade 1 reading and later anxiety and depression. The association between reading and attention remained strong, even after controlling for earlier attention. Another study of this kind was conducted by McArthur et al. (2021). They compared data from four longitudinal studies that used comparable measures of internalizing and externalizing behaviour prior to reading instruction, right at the beginning of reading instruction and after primary reading instruction (age 9 or 11). The results revealed that only preschool externalizing behaviour was associated with later reading skills across all four studies. However, in one study, conduct problems and attention problems (preschool) were measured separately, and here only the association between attention and reading was significant. Gasteiger-Klicpera et al. (2006) found in an Austrian sample that preschool hyperactivity/attentional problems preceded reading problems, but poor readers with no preschool BP showed more oppositional behaviours as well as withdrawal in grade 4. In this study, however, evidence for the opposite direction was also found: children with preschool withdrawal and victimization showed poorer reading skills in grade 4.

In sum, the role of attention as a precursor of reading problems is well documented, while for other kinds of behaviour the causal chain remains unclear and the situation is still the one described by Hinshaw (1992), allowing four different hypotheses. Reading problems might affect behaviour; it might be a consequence of behavioural problems; there might be a reciprocal relationship; and a third (antecedent) variable (partially) might explain the association. For further evidence

on this issue, see Breslau et al. (2011), Fischbach et al. (2010), Horbach et al. (2020), Jordan and Dyer (2017), Kulakow et al. (2024), Kwon et al. (2018), Medford and McGeown (2016), Palmu et al. (2018), Van der Ende et al. (2016), Zimmermann et al. (2013) and Petersen et al. (2013).

Empirical findings on the relationship of behaviour problems and on task behaviour

There is evidence that behaviour problems affect academic engagement and particularly OTB. Olivier et al. (2018) applied a person-centered approach to this issue to examine latent profiles of behaviour and social adjustment in fifth and sixth graders and the link with student behavioural engagement according to Fredricks et al. (2004). They found that students with 'problematic profiles' (with either internalizing or externalizing BP) were at risk of behavioural disengagement as well as lower achievement. The authors argue students might perceive themselves as less able to fulfil school requirements, which subsequently contributes to disengagement as they move through their school years (Olivier et al., 2020). Hasty et al. (2023) examined the relationship of externalizing behaviour, teacher–student relationships and classroom engagement from grade 3 to grade 5. They found a negative longitudinal association of externalizing behaviour and classroom engagement. These findings were supported by Ribeiro et al. (2023) for an elementary school sample (ages 6–12). They found that externalizing behaviour is negatively associated with academic engagement.

A closer examination of these associations reveals the complexity of possible influencing factors. Externalizing behaviour can increase conflict situations (Henricsson & Rydell, 2004), which in turn can affect relationships with teachers and classmates (Shi & Ettekal, 2020), and this in turn can have a negative impact on engagement (Buhs et al., 2006; Olivier et al., 2020; Ribeiro et al., 2023; Stipek & Miles, 2008). On the other hand, the experience of failure during learning situations can have a negative impact on self-esteem and perception of self-efficacy (Georgiou et al., 2010; Sideridis, 2003) and also trigger expectations of failure (Nurmi et al., 2003). The resulting frustration can lead to aggressive behaviour (Miles & Stipek, 2006), lower effort levels and also task avoidance.

Empirical findings on the relationship of on task behaviour and reading

Empirical evidence for the effect of OTB on reading is somewhat inconsistent. Some research shows a reciprocal, cumulative relationship between OTB and academic performance. For instance, Aunola et al. (2002) and Onatsu-Arvilommi and Nurmi (2000) found small

effects of task avoidance (as the opposite of OTB) on reading in Finnish first graders. Lepola et al. (2005) examined, among others, the effect of task orientation on word recognition in a longitudinal study (kindergarten to grade 1) in a Finnish sample. They found no direct effect of early (preschool) task orientation on word reading fluency. But on the other side, later word reading fluency in grade 1 was predicted by task orientation in earlier grade 1. Thus, the authors concluded that high task orientation can positively influence word reading progress. Stephenson et al. (2008) found similar effects in their longitudinal study with an English-speaking sample. Task-focused behaviour was a consistent and stable predictor of word reading fluency, even after other predictors were controlled for.

Georgiou et al. (2011) compared Chinese-speaking (grade 2), English-speaking and Greek-speaking (both grade 3) children and found small effects of task-focused behaviour on reading fluency in all three groups. In a recent cross-cultural study (Canadian English speakers and Japanese), Inoue et al. (2021) found that task-focused behaviour was associated with reading skills (fluency and accuracy) in both samples at t1 (beginning of grade 2), but stronger in the English sample. On the other hand, Georgiou et al. (2010) found for a Greek sample that grade 1 task focus did not predict decoding or spelling in grade 2. Also, Georgiou et al. (2013) did not find effects of task avoidance on reading fluency in grades 4 to 6, a result in line with the study by Hirvonen et al. (2010) with a Finnish sample. Mägi et al. (2018) supported these findings. In a sample of sixth graders in Estonia, they found that task persistence contributed specific unique variance to word reading. This is in line with the results of a longitudinal study (preschool to grade 3).

On-task behaviour as a mediator between behaviour and reading

Empirical evidence shows the dependence of OTB on BP and (in some studies) the association of OTB and reading. From that, it is plausible that OTB might function as a mediator between BP and reading. Metsäpelto et al. (2015) investigated the relationships among externalizing behaviours (hyperactivity/attention deficit as well as conduct disorders), task-avoidant behaviours and academic achievement from first to fourth grade using a cross-lagged design. Their results support a mediation model. Task-avoidant behaviour mediated the relationship from externalizing behaviour to academic performance and vice versa. Becherer et al. (2021) criticized that the measure of externalizing behaviour in the Metsäpelto et al. study also included attention and hyperactivity. This would be problematic, as there is evidence that attention influences the effect of both externalized and internalized behaviour on reading (Duncan et al., 2007; Kulkarni et al., 2021; Liu et al., 2020;

McArthur et al., 2021). Becherer et al. (2021) investigated the effect of externalizing behaviour and task-focused behaviour on academic performance in secondary school. Their results were in line with Metsäpelto et al. (2015). They found indirect negative effects of externalizing behaviour via task-focused behaviour on academic achievement.

THE PRESENT STUDY

The present study contributes to the existing literature by examining the relationship between a wide range of internal and external BP, as well as hyperactivity/attentional problems and decoding, considering the role of students' OTB as a mediator between BP and reading. Understanding this relationship is essential because students who struggle with reading, combined with BP, are among the most at-risk groups in the educational system. They have an increased risk of negative academic outcomes (low educational attainment, truancy and dropout; Hakkarainen et al., 2016). These challenges also extend to their vocational prospects (e.g., unemployment) and psycho-social development (Algozzine et al., 2011; Hellendoorn & Ruijsenaars, 2000). On the other hand, research has shown that student engagement can help compensate for low achievement, school dropout and lack of interest and motivation, so it makes sense to consider this in the association between reading and BP (Metsäpelto et al., 2015).

In other studies on this issue, composite scores, such as a combination of arithmetic test scores with decoding, reading fluency or reading comprehension, were used as a measure of academic skills (e.g., Becherer et al., 2021; Metsäpelto et al., 2015). This is problematic, as the relationship between behaviour and learning depends on the school subject in question (DuPaul et al., 2004; Zimmermann et al., 2013). The reason is that easier tasks might be less influenced by lower OTB (Hirvonen et al., 2010), and decoding is a relatively easy task compared to reading comprehension (or even arithmetic tasks). Therefore, we focused solely on decoding. Furthermore, we narrowed our research on the effect of BP on OTB and reading (not possible reciprocal effects). Therefore, we measured BP shortly after school entry, at a point when behaviour might not yet have been influenced by reading failure, but teachers were already able to rate children's OTB.

Specifically, we had the following research question: Are there effects of externalizing and internalizing behaviour on word reading if on-task behaviour is considered as a mediator? Or are these effects indirect, mediated via OTB? Based on the findings cited above, it was hypothesized that externalizing behaviour has at least an indirect effect via OTB. Since there are only a few studies examining the relationship of internalizing behaviour and reading in general, and even fewer in

primary school specifically, there is no concrete hypothesis regarding internalizing behaviour.

Participants

The data stem from a longitudinal study of children's emotional and cognitive (academic) development from preschool to the end of first grade (Elies et al., 2021). The (unselected) sample comprised $N=171$ students (53.5% boys). The children's average age at the first measurement point was $M=6.7$ years ($SD\ 0.30$). The children came from randomly chosen schools in middle-class urban regions in North Rhine-Westphalia, which were as homogeneous as possible in terms of socio-economic conditions. Most participants were native German speakers; only 6.6% had a native language other than German, according to their parents' reports. Students who could not follow the test instructions due to either cognitive impairments or poor knowledge of the German language were excluded from the study.

Procedure

As mentioned above, the data stems from a longitudinal study in which the children were followed from the last year of kindergarten until the end of first grade. The kindergartens were informed about the project and voluntarily decided whether they wanted to participate in the study. In a next step, the parents were informed about the study and could decide whether their child should participate. The schools were determined through the transition of the children from kindergarten to primary school. After the school was identified, the teachers were informed about the project with a request to continue following the children. For the present study, two measurement waves are relevant for the analysis: one in december grade 1 (teacher ratings of internalizing and externalizing behaviour and OTB) and one at the end of grade 1 (a standardized reading achievement test). Data collection of reading took place during school lessons and was administered in a one-on-one setting, in a quiet room at school by trained master students. The testing took approximately 15 min per child. Students participated in the study after their parents gave informed consent according to procedures approved by the respective local ethics committee.

Measures

Externalized and internalized behaviour: Students' behaviour was rated by their teachers with the German version of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ

encompasses statements on four different areas of behaviour (emotional problems, behavioural problems, problems with peers and prosocial behaviour), which are each rated on a 3-point Likert scale (0=does not apply at all; 1=somewhat applies; 2=clearly applies). In order to capture a wider spectrum of behaviours, the oppositional-disruptive behaviour scale from the Integrated Teacher Report Form (ITRF; Volpe & Fabiano, 2013) was also included in this study. Here, 16 statements were rated on a 4-point Likert scale (0=behaviour is not problematic to 3=behaviour is severely problematic).

Learning behaviour/on-task behaviour: Learning behaviour was rated by teachers using six items from the learning behaviour subscale of the Lehrereinschätzliste für Sozial- und Lernverhalten (teacher rating scale of social and learning behaviour; Petermann & Petermann, 2013). The statements were rated on a 4-point Likert scale (0=does not apply at all; 1=rarely applies; 2=sometimes applies; 3=often applies).

Word reading: To measure word reading (decoding), we administered the Wiener Früherkennungstest ([Viennese early diagnosis test]) developed by Klicpera et al. (2008). The test consists of lists of 12 words and 10 nonwords. The words/nonwords were presented in blocks of four words each, on a sheet of white A4 paper in Fibel Nord font (black, 40pt), as this font is very similar to the one used in most German schools. The word length varied from two to five letters for both words and nonwords. All words and nonwords were composed of letters that had already been introduced during reading instruction (as reported by the children's teachers). Cronbach's alpha for a scale of all 22 words is $\alpha=0.97$.

Statistical analysis

Missing values and deviation from normal distribution: Reading test data as well as OTB data were available for all children. However, teacher ratings of behaviour at the beginning of first grade were only available for 124 children. An analysis according to Little and Rubin (2020) indicated that the data were missing completely at random (MCAR; $\chi^2_{(50)}=58.51$; $p=0.19$). Therefore, the data of all students for whom test reading data were available were used.

Structural equation modelling: We used the framework of structural equation modelling (SEM) both for constructing the scales (confirmatory factor analysis; CFA) and analysing the effects of classroom behaviour on OTB and reading (path analysis using CFA-derived scales). Missing values were estimated using the full information maximum likelihood (FIML; e.g., Graham, 2003) method. Using a priori power calculation for SEM (Moshagen & Bader, 2023) a sample size of 154 was sufficient to reach an effect of AGFI=0.90 and a

power of 0.80. Particularly, the behavioural variables were not normally distributed; therefore, we used the robust maximum likelihood method (Hu et al., 1992). Additionally, we repeated the parametric analysis based on 1000 bootstrap samples, which revealed essentially the same results for all analyses (in the following we present the bootstrap estimates). We used the following fit indices: (1) The χ^2 -test: This test compares the predicted model to the data and therefore has to be insignificant to indicate good fit. (2) Root Mean Square Error Approximation (RMSEA). The value of this index ranges from 0 to 1, with an acceptable value less than 0.08 to have a reasonable fitting model. (3) Comparative Fit Index (CFI): The value ranges between 0 and 1, with a value closer to 1 indicating better fit. A value of CFI above 0.90 is acceptable (El-Sheikh et al., 2017). (4) Normed Fit Index (NFI): The value ranges from 0 to 1. It should be >0.90 to indicate an acceptable model fit (Bentler & Bonett, 1980).

Specification of the models: We regressed (later) reading on all dimensions of early behaviour and OTB.

RESULTS

Scale construction

OTB scale: All items of the OTB scale load onto a single factor, which explained 66% of the variance (see Table 1). The factor score was used in all further analyses. Cronbach's alpha for the scale is $\alpha=0.90$.

Behaviour scales: Despite the fact that the SDQ is one of the most frequently used behavioural rating measures, its reliability and measurement invariance across groups as well as over time have recently been called into question (see DeVries et al., 2017). Therefore, we additionally used the ITRF. In order to appropriately account for the partially overlapping structure of the scales applied, we specified theory-driven latent behavioural dimensions based on sets of individual items across instruments (Elies et al., 2021). These were tested in a CFA and revealed an acceptable fit ($\chi^2(113)=191.6$, $p=0.00$, CFI=0.96, NFI=0.90; RMSEA=0.06). The structure and the loadings are given in Table 2.

TABLE 1 Factor loadings (PCA, varimax rotated) for OTB.

Factor	Variable	Loadings
On-task behaviour	Looks carefully at instructions	0.89
	Directs attention to specific task	0.85
	Performs a task completely independently	0.82
	Completes homework	0.79
	Prepares materials for the next day at school	0.78
	Handles school materials carefully	0.77

Descriptive and correlation of scales

The behaviour ranged between 0 (no problems at all) and a value close to (but not reaching) the scale maximum (Table 3). Of particular interest for our study are the correlations among the behaviour scales, OTB and reading. Table 3 shows significant correlations for OTB and behaviour explaining from 3% (withdrawal) to 38% of the variance in OTB. Correlations between reading and

behaviour are significantly lower (all p 's for the difference in correlations <0.01) and insignificant in the case of depression and withdrawal.

Effects of behaviour and OTB on reading

We regressed OTB as well as reading score on all behavioural dimensions and reading on OTB. This model revealed no significant direct paths from any behavioural dimension to reading. However, there were significant effects on OTB for aggression, hyperactivity and depression as well as a significant effect of OTB on reading. Fixing the effects of opposition, withdrawal and impulsivity to zero resulted in a statistically non-distinguishable model ($\chi^2_{(9)}=9.62$, $p=0.38$, CFI=0.98, NFI=0.99; RMSEA=0.02). This model revealed total effects of aggression ($\beta=-0.10$; $p<0.01$), hyperactivity ($\beta=-0.10$; $p<0.01$) and depression ($\beta=-0.04$; $p<0.05$). The model explains 49% of the variance in OTB and 7% of the variance in reading (Figure 1).

DISCUSSION

The goal of the study was to analyse the effect of classroom behaviour on reading when controlling for on-task behaviour as a mediator. Results indicated that three of the six behavioural dimensions analysed had a significant (indirect) effect on reading: aggression, hyperactivity and depression. No significant effects were found for opposition, impulsivity or withdrawal. Oppositional and impulsive behaviour, such as lying and calling out of turn, may be less involved in concentrated reading compared to hyperactivity/attention (e.g., getting easily distracted from the task) as well as aggression (e.g., pushing others, which not only disturbs others but also the learner himself). On the internalising side, the same might hold for depression (e.g., being unhappy or nervous), which might be more directly connected to concentrated reading activities compared to withdrawal (e.g., being alone).

TABLE 2 Results of a CFA for behaviour in class (standardized solution).

Latent	Manifest	Loadings
Aggressive behaviour	Pushes, hits or kicks others	0.89
	Does not respect others' privacy	0.72
	Quarrels and squabbles with fellow students	0.86
Opposition	Quarrels and squabbles with teachers	0.82
	Frequently lies or cheats	0.68
	Disobedient	0.89
Hyperactivity	Restless, overactive, can't sit still for long	0.95
	Constantly fidgety	0.85
	Allows him/herself to get distracted by others' negative behaviour	0.66
Impulsivity	Calls out of turn	0.52
	Quick-tempered/flies into rages	0.73
	Loses composure	0.87
Depression	Nervous or clingy in new situations	0.53
	Cries, whines, complains	0.77
	Often unhappy or gloomy; cries frequently	0.70
Withdrawal	Loner, typically plays by himself/herself	0.78
	Has no good friend	0.63
	Gets along better with adults than with children	0.56

TABLE 3 Correlations, mean (M), standard deviation (SD), minimum (Min.) and maximum (Max.).

	AGG	OPP	HYP	IMP	DEP	WITH	OTB	Min	Max (scale)	M	SD
AGG								0	9 (11)	1.69	2.25
OPP	0.67**							0	8 (10)	1.08	1.83
HYP	0.56**	0.57**						0	7 (9)	2.33	2.33
IMP	0.64**	0.59**	0.46**					0	8 (10)	1.55	1.89
DEP	0.28**	0.28**	0.15	0.23**				0	6 (9)	0.97	1.44
WITH	0.20**	0.21**	0.06	0.15	0.18*			0	6 (8)	0.78	1.37
OTB	-0.66**	-0.55**	-0.60**	-0.50**	-0.30**	-0.18*		0	19 (24)	13.36	4.51
READ	-0.22**	-0.22**	-0.26**	-0.23**	-0.14	-0.09	0.26**	2	22 (22)	19.34	3.92

Abbreviations: DEP, depression; HYP, hyperactivity; IMP, impulsivity; OPP, opposition; OTB, on-task behaviour; READ, reading; WITH, withdrawal.

* $p<0.05$; ** $p<0.01$.

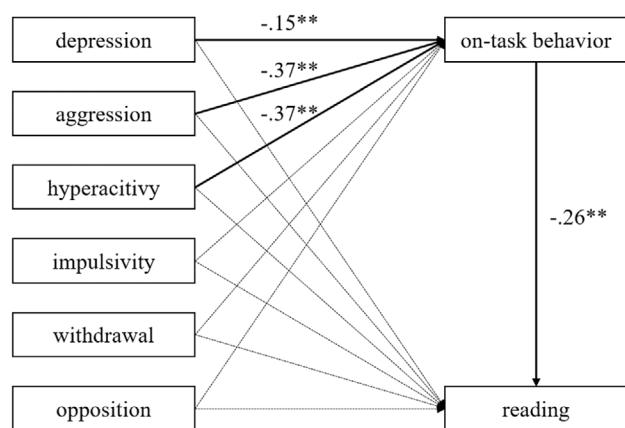


FIGURE 1 Path model behaviour with on-task behaviour (OTB) and reading. * $p < 0.05$, ** $p < 0.01$. Dotted lines correspond to non-significant parameters.

A significant effect of OTB was found, explaining approximately 7% of the variance in word reading. The relevance of OTB depends on how challenging a task is (Hirvonen et al., 2010). Due to the (relative) ease of reading acquisition in more transparent languages (i.e., orthographies with a relatively simple and easy to learn grapheme-phoneme mapping, Seymour et al., 2003) compared to languages with an opaque orthography, the effect of OTB on reading should be generally lower (Georgiou et al., 2010, 2017; Manolitsis et al., 2009).

All behavioural effects on reading were (significant) indirect (!), mediated by OTB. This emphasizes the important role of OTB as the key to explaining the effect of behavioural problems on reading. Externalising behaviours like aggression and hyperactivity prevent children from focusing on the reading process, resulting in less time spent with concentrated reading in class, which might hamper the development of the mental lexicon, which is crucial for word reading (Klicpera et al., 2020).

Practical implications

Of course, it is important to intervene directly whenever behaviour problems occur. However, our results show the additional importance of intervening. Particularly, this is the case for the three dimensions that we found to influence on-task behaviour. Teachers must consider three things. (1) They must be able to identify reading problems. Research shows that most teachers are very poor at recognizing early problems (Schabmann & Schmidt, 2009), (2) They must be able to identify behavioural problems like depression, aggression and hyperactivity. While this is easier for externalizing behaviour, teachers have problems identifying internalizing problems like depression (Bilz, 2014; Loades & Mastroiannopoulou, 2010). (3) They must undertake measures to avoid that behavioural problems affect

on-task reading behaviour. Children with behaviour problems should be trained to stay close to the reading tasks in school in addition to (or even before starting) a reading recovery program. Intervention might include, for example, scaffolding, self-regulation, self-monitoring and emotion regulation (Connor et al., 2014; Gaastra et al., 2016).

Limitations

Although our study found significant effects of OTB on reading, one must be aware that OTB was rated by teachers. There might be—at least in part—a bidirectional effect of teachers' perception of students' academic problems and OTB ratings in the sense of halo effects (Elies et al., 2021). Therefore, in future research, one should try to (additionally) measure OTB independently of teachers (being aware of the challenges of such an endeavour), perhaps using adequate methods of observation. Furthermore, there seems to be a reciprocal relationship between OTB and reading skills per se. Some studies (Aunola et al., 2002; Georgiou et al., 2017; Onatsu-Arvilommi & Nurmi, 2000; Stephenson et al., 2008) have shown that emergent literacy skills were predictors of task-focused behaviour, and these in turn predicted later reading. However, in this study, we only focused on the influence of early BP on reading, but (more) longitudinal studies are necessary to untangle the trajectory of the BP-OTB-reading relationship.

Furthermore, our sample is not representative in terms of a broader spectrum of social-economic status (SES) and region. This is a limitation insofar as there might be an additional influence, particularly of SES. Low SES goes hand in hand with a lower amount of help provided for the children concerning both behavioural and learning problems (Letourneau et al., 2013).

ACKNOWLEDGEMENTS

Open Access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

No potential conflict of interest was reported by the authors.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

All legal guardian/parents gave their informed consent for inclusion before their children participated in the study. All procedures performed in the study complied with the ethical principles for medical research involving

human participants of the 1964 WMA Declaration of Helsinki and its subsequent amendments.

CONSENT

All legal guardian/parents gave their informed consent for inclusion before their children participated in the study.

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How to cite this article: Schmidt, B.M., Elies, A., Plank, J. & Schabmann, A. (2025) The relationship of students' classroom behaviour and word reading—The role of on-task behaviour as a mediator. *Journal of Research in Special Educational Needs*, 25, 812–822. Available from: <https://doi.org/10.1111/1471-3802.70013>