To What Extent Does Punishment Insensitivity Explain the Relationship Between Callous-unemotional Traits and Academic Performance in Secondary School Students?

Antisocial behaviour is a challenge in schools, predicting poor student academic engagement and performance, truancy, school exclusion, and teacher-student conflict (Carroll, Houghton, Durkin, & Hattie, 2009; Doumen et al., 2008), and is a major contributor to teacher stress, burnout and decision to leave the profession (Spilt, Koomen, & Thijs, 2011). The time teachers spend managing disruptive behaviour in the classroom not only negatively impacts the learning of individual students who misbehave, but also that of their classmates (Westling, 2010). The effective use of teacher discipline is known to promote children's academic achievement (Pasternak, 2013), while the absence of discipline or harsh, inconsistent discipline predict poor achievement (Carrell & Hoekstra, 2009; Yang, 2009). The negative effects of academic underachievement are wide-ranging, including disengagement from school and early drop-out, increased risk for criminal offending, unemployment and lower incomes, health problems, early mortality and public service usage (Moretti, 2005; Doll, Spies, & Champion, 2012). As such, academic underachievement has been a prominent issue for antisocial children for a long time.

There is increasing evidence for callous-unemotional (CU) traits as a temperamental risk factor for poor school outcomes for antisocial children. CU traits comprise low empathy, lack of guilt, shallow emotions and a lack of concern about performance (Frick et al., 2014). Antisocial children with elevated CU traits show a more severe, aggressive and chronic pattern of antisocial behaviour, unique biological, emotional, social-motivational and cognitive correlates, and reduced responsiveness to intervention compared to antisocial children with low levels of these traits (Allen, Hwang, & Huijding, 2020). The most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) therefore introduced CU traits as a specifier for conduct

disorder under the label of ‘limited prosocial emotions’. Educational classification systems, however, have yet to acknowledge the role of CU traits in relation to students’ poor behavioural and academic adjustment, despite its clear potential to inform education policy and practice (Warren, Jones, & Frederickson, 2015).

One of the most robust findings in relation to factors underlying the association between antisocial behaviour and poor academic achievement is the presence of verbal ability deficits in antisocial youth (Allen, 2017). This relationship remains significant even after controlling for socioeconomic status, ethnicity, and test-taking motivation (Moffitt, 1993). However, there is consistent evidence that CU traits are related to poor academic achievement even when accounting for the influence of externalizing problems (#### blinded for peer review; Horan, Brown, Jones, & Aber, 2016; Vaughn et al., 2011), despite the fact that CU traits are not associated with deficits in verbal intelligence (Allen, Briskman, Humayun, Dadds, & Scott, 2013; DeLisi et al., 2011), This link between CU traits and poor achievement has been established in studies employing person-centred and variable-centred approaches to analysis, across different subjects (e.g., English/Reading Achievement, Maths, Science), forms of assessment (e.g., teacher questionnaire ratings, standardized test scores) and during both the primary and secondary school periods (####, blinded for peer review; Ciucci, Baroncelli, Franchi, Golmaryami, & Frick, 2014; DeLisi et al., 2011; Horan et al., 2016; Vaughn et al., 2011). This has led to the suggestion that there may be heterogeneous risk pathways for poor academic outcomes for antisocial children with high versus low levels of CU traits (####, blinded for review, DeLisi et al., 2011; Horan et al., 2016).

One critical way in which antisocial children with CU traits differ from antisocial children without these traits is decreased sensitivity to punishment cues, including reduced recognition and responses to others’ expressions of fear, pain or sadness (Dawel, O’Kearney, McKone, & Palermo, 2012; Jones, Laurens, Herba, Viding, & Barker, 2009; Lockwood et al.,

2013). Children with CU traits tend to pursue desired goals using aggressive or antisocial means, showing little concern for the potential consequences of their behaviour, including anticipated feelings of guilt, others' distress or disciplinary action (Pardini & Byrd, 2012). Theory has identified a lack of affective discomfort in response to discipline as one mechanism explaining poor conscience development and reduced responsiveness to discipline-based parenting strategies for children with CU traits (Blair, 2017; Hawes, Price, & Dadds, 2014; Kochanska, 1993). This lack of arousal in response to discipline prevents avoidance learning from taking place, and the child fails to internalise the moral or social norm that his or her parent (or teacher) wishes to convey (Pardini & Frick, 2013). Consistent with this view, antisocial children high in CU traits show less distress when placed in time out than children low in CU traits (Bansal et al., 2019; Hawes & Dadds, 2005). Uncaring or insensitive responses to punishment have also been proposed as a mechanism explaining the link between CU traits and poor achievement (DeLisi et al., 2011; Horan et al., 2016). DeLisi et al. (2011) argued that children with CU traits are not distressed by the consequences of academic failure and subsequently lack the motivation to perform to the expectations of teachers or parents. The decreased sensitivity of children with CU traits to teacher discipline therefore leads to reduced school engagement and increased disruptive behaviour. Furthermore, Horan et al. (2016) suggested that CU traits may elicit harsher responses from their teachers due to this punishment insensitivity, with these negative teacher-student interactions exacerbating poor academic adjustment in these at-risk children.

Few studies have investigated links between CU traits and teacher discipline, but the existing evidence suggests that findings for reduced sensitivity to parental discipline may also apply to teacher-child interaction (Allen, Morris, & Chhoa, 2016; ####, blinded for peer review). For example, in qualitative interviews, secondary school teachers reported that discipline strategies were less effective for boys with elevated CU traits than their typically

developing peers (Allen et al., 2016). Qualitative analysis of teacher interviews of a subset of students in the current sample who self-reported as high (n = 24) and low in CU traits (n = 23) indicated that teachers perceived students high in CU traits as more resistant to discipline, and in greater need of monitoring and feedback to engage them in schoolwork (####, blinded for peer review). In the preschool context, time-out implemented by teachers was less effective for children high in CU traits compared to those low in CU traits (Garcia, Graziano, & Hart, 2018). Finally, a recent study found a moderating effect of CU traits on teacher harsh discipline and school engagement in South Korean primary school students, where teacher's harsh discipline at the start of the school year predicted less engagement in children with high, but not low levels of CU traits across the school year (Hwang, Waller, Hawes, & Allen, 2020). There were no reciprocal effects between CU traits and teacher harsh discipline; harsh teacher discipline predicted later antisocial behaviour, but not CU traits. These findings are consistent with theory highlighting the role of punishment insensitivity in CU traits (Blair 2017; Pardini & Frick, 2013), and suggest that these traits may even act as a protective factor against harsh teacher discipline.

Punishment insensitivity has yet to be formally tested as a mechanism explaining the link between CU traits and poor academic performance (####, blinded for peer review; DeLisi et al., 2011). This is surprising given that a better understanding of mechanisms explaining how CU traits affect school success may help to identify students at risk for low grades. We examine this possibility in students in years 7 to 9 of secondary school, a period when students simultaneously encounter more varied, challenging school work and higher expectations from teacher to show independence in their learning compared to the primary school period. This stage of schooling also features a shift from primarily receiving instruction from one classroom teacher, to having different teachers for different subjects. This means that there is less opportunity for secondary school teachers to develop a better

understanding of their student's needs and to form a close relationship than in earlier periods of schooling. For these reasons, managing academic pressure may be heightened during this period and students are more likely to 'burn out' or disengage from schoolwork (Midgley & Urdan, 1992; Salmela-Aro & Upadyaya, 2014).

In this study, we sought to explore punishment insensitivity as a mechanism explaining the association between CU traits and poor academic outcomes, controlling for sociodemographic disadvantage and externalizing problems. Student grades in the three core subjects of the National Curriculum for England: English, Maths and Science were assessed using curriculum set assessments. Student grades in all three subjects were examined as separate outcomes which were allowed to covary in one model while controlling for teacher effects. This allowed us to examine potential differences in pathways for each subject grade in relation to different classroom characteristics or teaching methods across subjects, while simultaneously accounting for relationships between subject grades. We predicted that CU traits would be significantly related to English, Maths and Science grades, and that these associations would work indirectly through punishment insensitivity.

Method

Participants

Participants were students aged 11 to 14 years (M = 12.50, SD = 0.96) in Years 7 to 9 of a state secondary school in England. Of the 503 students that were approached, 437 (87%) agreed to participate in the present study. Students comprised 216 girls and 221 boys. Most children were White (95%, n = 420) and had English as their first language (77%). The remainder of the sample (4%, n = 17) identified their ethnicity as follows: Black, Mixed Black and White, Asian, or Mixed White and Asian. Only a minority of children belonged to a single-parent family (16%) and 46 students (11%) were eligible for free school meals.

These are largely consistent with the UK's average rate of single-parent families and eligible students for free school meals (22% and 13%, respectively) (Department for Education, 2017; Office for National Statistics, 2017). Children attended different classes for English (n = 8), Science (n = 9), and Maths (n = 9) based on ability level. The number of children per classroom ranged between 15 and 31 children (M = 21.38, SD = 4.07), while the number of participating students ranged between 12 and 30, with a median of 21 students.

Procedure

Prior to data collection, study procedures were approved by the university ethics review board. An invitation letter was sent to the school containing information about the research and seeking permission to approach students to participate. The school sent parents an opt-out parental consent form; parents were given a week to return the form if they did not want their child to participate. No reply slips were returned. On the day of the assessment the investigator informed students of the study aims and gave students the option of omitting certain items or returning the questionnaire uncompleted without giving a reason. Students completed the questionnaires in their regular lesson time in class groups under exam conditions. All data collection was conducted on the same day.

Measures

Academic Performance. Child grades for English, Maths, and Science were collected from school records. These are core, compulsory subjects in state secondary schools in England during Years 7 to 9 (Key Stage 3). Teachers assess child achievement using compulsory set assessments corresponding to the National Curriculum programmes of study in England (see www.gov.uk/nationalcurriculum/overview), with aggregated scores

converted to final grades using a 9-point scale. Higher scores indicate a higher level of student achievement.

Callous-Unemotional Traits. Child report of CU traits was assessed using the Inventory of Callous Unemotional Traits (ICU; Frick, 2004). The revised scale excludes two items from the original 24-item ICU (i.e., item 2 and item 10) due to poor item-total correlations of less than 0.10 (Ray, Frick, Thornton, Steinberg, & Cauffman, 2016). Children rate each item on a 4-point Likert scale from 0 (not true at all) to 3 (definitely true) (e.g., 'I care about how well I do at school', 'I'm concerned about the feelings of others'). The revised 22-item ICU scale has shown good reliability and construct validity in previous studies with alphas ranging from .78 to .81 and showing significant associations between higher total ICU scores, low empathy and more severe aggression (Kimonis et al., 2008; Ray et al., 2016). Cronbach's alpha was .79 for the 22-item ICU in the current sample.

Punishment insensitivity. The punishment insensitivity scale of the Multidimensional Assessment of Preschool Disruptive Behavior (MAP-DB; Wakschlag et al., 2012) was used to assess response to discipline. The punishment dimension consists of 7 items rated on a 6 point-Likert scale from 0 (never) to 5 (always). The MAP-DB is a parent report measure that shows good reliability and validity (Nichols et al., 2015; Wakschlag et al., 2012). We used a modified version of the punishment insensitivity scale that adapted the wording for child self-report (e.g., 'You do not care when you are punished', 'You continue to misbehave no matter what your teacher does'). The child-report version has shown good internal consistency (alpha = .82) and significant associations with teacher and child report of CU traits and antisocial behaviour in a previous study of English secondary school students (Allen et al., 2016). Cronbach's alpha in the current sample was .88.

Externalizing problems. To assess children's externalizing problems, we selected 9 items from the Reward Sensitivity scale of the revised Sensitivity to Punishment and

Sensitivity to Reward Questionnaire (SPSRQ-C; Colder et al., 2011) that tap into hyperactivity and deficits in response inhibition. As the self-report SPSRQ is designed for adults (Torrubia et al., 2001), several items are not suitable for children (e.g., 'When you start to play a slot machine, is it difficult for you to stop?', 'Do you often take the opportunity to pick up people you find attractive?'). We therefore modified the wording of items from the parent-report SPSRQ-C to be suitable for child report. For example, 'Your child often has trouble resisting the temptation of doing forbidden things' was changed to 'You often have trouble resisting the temptation to do forbidden things'. Children rated the 9 items on a 5-point-Likert scale from 1 (strongly disagree) to 5 (strongly agree). Youth report on a modified version of standard SPSRQ (Torrubia et al., 2001) that covers similar items and changes to item wording to the child-report SPSRQ-C has shown good reliability and validity (Vandeweghe et al., 2016). Confirmatory factor analysis in a previous study featuring the current sample (####, blinded for review) found that the externalizing problems scale had good construct validity, with this model showing an excellent fit to the data (CFI=1.00 SRMR=.01, RMSEA=.00). Alpha for the externalizing problems scale was .75 in the current sample. Teacher report of externalizing problems on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was also significantly related to child-report on this externalizing problems scale (r = .32, p = .05) in a subset of this sample (n = 38).

Sociodemographic Characteristics. A child report questionnaire assessed their age in years, self-reported gender (1=male, 0=female), English as a second language (1=yes, 0=no). As an indication of socio-economic status, we used family composition (1=single-parent, 0=two parent) and eligibility for free school meals (1=yes, 0=no).

Data Analysis

Analyses were performed in SPSS statistical software (version 25) (IBM Corporation, 2017) and the Mplus statistical package (version 8) (Muthén and Muthén, 2017). We first explored the descriptive statistics and bivariate correlations among the study variables. Then we fitted a Structural Equation Model (SEM) to test if the association between CU traits and academic outcomes could be explained by punishment insensitivity. In order to take missing data into account (% of missingness in each variable ranged from 0 to 5.26, see Table 1), full information maximum likelihood estimation (FIML) was used. The following indices were used to check model fit: Chi-Square Test of Model Fit, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean squared Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). CFI and TLI values higher than .95 are generally considered to indicate good fit, with values between .90 and .95 indicating acceptable fit (Hox & Bechger, 1998). Likewise, SRMR values lower than .05 indicate good model fit and values between .05 and .10 indicate acceptable fit. RMSEA is considered to indicate good fit if the value is lower than .05 and an acceptable fit if the value is between .05 and .08 (Hu & Bentler, 1999). According to the above recommendations, the model showed a good fit in the current sample [χ^2 (*df*=71) =129.22, *p*<.001; CFI=.94; TLI=.90, SRMR=.02; RMSEA=.04]. All academic outcomes were examined in the same model and were allowed to covary. The sample was nested within the classroom for each subject (English, *n* = 8; Maths, *n* = 9, Science, *n* = 9), and therefore multilevel modelling was conducted in a previous study (####, blinded for peer review) that featured the same sample. However, the current SEM model featured a large number of parameters (n = 558) and a small number of clusters (range, n = 8–9), which can lead to poor estimation accuracy in a multilevel model (Meuleman & Billiet, 2009; Schunck, 2016). Hence, we did not proceed with this approach. The intra-class correlations (ICCs) of each subject ranged from .00 to .12, therefore we created dummy variables for each classroom and used them as covariates to control for potential clustering

effects. We also included the following covariates in the model: child age, self-reported gender, single parent household, free school meals, English as a second language, and externalizing problems.

Results

Descriptive Analyses

Table 1 shows the descriptive statistics and bivariate correlations among the study variables. The mean score of CU traits was similar to those in previous studies of community samples with a similar age range (Essau, Sasagawa, & Frick, 2006; Roose, Bijttebier, Decoene, Claes, & Frick, 2010). Grades from all three subjects were significantly negatively related to child externalizing problems, CU traits, and punishment insensitivity. CU traits were positively related to externalizing problems and punishment insensitivity. Externalizing problems also were significantly positively related to punishment insensitivity. Age was negatively related to English and Maths grades, but not Science grades. English, but not Maths and Science grades were higher for girls than boys. Science grades, but not English and Maths grades, were lower for students who receive free school meals. Both Maths and Science grades were lower for students from a single parent family or for whom English is a second language. Punishment insensitivity was higher for for boys than girls, and higher for students from a single parent family or who receive free school meals.

Structural Equation Modelling and Mediation Analysis

Results from the SEM investigating potential pathways from CU traits to school grades are presented in Figure 1. We examined all academic domains in one model and Table 2 presents all paths from CU traits to punishment insensitivity and each academic grade.

Child's age, gender, and English as a first language were significant predictors of English grade, independently of other covariates. Similarly, child's age, family status, and first language were significant predictors of Maths grade, while a family status, free school meals, and first language predicted lower Science grades. However, the effects of CU traits on academic grades were not explained after we controlled for all the covariates and the mediator.

Regarding the path between CU traits and punishment insensitivity, we found that CU traits was a significant predictor of punishment insensitivity even after controlling for externalizing problems, gender, and socio-economic status indexed by membership of a single-parent household and eligibility for free school meals. However, this association did not, in turn, predict English grades. In contrast, CU traits were significantly related to higher punishment insensitivity, which in turn predicted poorer Maths grades. Although CU traits were not directly associated with Maths grades after controlling for confounders, the indirect effect of punishment insensitivity on the link between CU traits and Maths grade was significant (Table 3). Likewise, CU traits were indirectly associated with Science grades via punishment insensitivity (Table 3).

Discussion

This study is the first to formally test a potential mechanism explaining the relationship between CU traits and poor academic achievement in English, Maths and Science. The findings partly supported our hypothesis, with punishment insensitivity explaining the association between CU traits and low grades in Maths and Science. Importantly, indirect associations were present between CU traits and Maths and Science grades via punishment insensitivity when accounting for teacher effects as well as student age, gender, sociodemographic disadvantage, and externalizing problems. Specifically, CU traits were

positively associated with punishment insensitivity, which in turn were negatively associated with academic performance in Maths and Science. Punishment insensitivity is a well-established correlate of CU traits (Frick et al., 2014), and past research has shown that CU traits are related to impairment in academic performance in a range of disciplines (Ciucci et al., 2014; Horan et al., 2016). Consistent with theory (DeLisi et al., 2011; Horan et al., 2016), our study extends this work and makes a meaningful contribution to the current theory by identifying punishment insensitivity as a mechanism explaining the association between CU traits and poor academic outcomes. Furthermore, results revealed complete mediation for both Maths and Science grades, suggesting that punishment insensitivity plays a significant role in explaining the link between CU traits and poor achievement in these two subjects. Findings suggest that teachers are likely to need more intensive support and training to implement discipline strategies effectively with students high in CU traits, and that if successful, this additional support may have flow-on benefits for students' performance in Maths and Science. Although there is one teacher-child interaction-based intervention approach to enhancing academic achievement, the My Teaching Partner-Secondary programme (Allen, Pianta, Gregory, Mikami, & Lun, 2011), existing interventions aiming to improve academic performance in the secondary school period have largely focused on literacy development (Ofsted, 2013). Our findings suggest that interventions aiming to promote academic performance in antisocial children should include greater support for teachers in the implementation of calm, consistent non-physical discipline for children with elevated CU traits.

CU traits were significantly related to lower English grades, consistent with past research showing a relationship between CU traits and poor reading ability (DeLisi et al., 2011; Horan et al., 2016; Vaughn et al., 2011). However, contrary to our hypothesis, findings indicate that factors other than punishment insensitivity influence the link between CU traits

and low English grades. One explanation for this finding relates to the different structure and format of these subjects. Maths and Science lessons follow a more structured, sequential pathway than English, with student completion of academic work dependent on their understanding of earlier content and their ability to apply previously learnt skills (Johnson, 2000; Stodolsky & Grossman, 1995). Qualitative findings suggest that students with elevated CU traits are more likely to be sent out of class (####, blinded for peer review), and may therefore miss out on teaching that is essential for the completion of tasks in Maths and Science. Another explanation is that verbal skills are easier to 'pick up' outside of the classroom (Berninger, Abbott, Vermeuleu, & Fulton, 2006). As such, English performance may not be as dependent on sensitivity to discipline as Maths or Science (Slater, Davies, & Burgess, 2012). Finally, deficits in processing emotional language may reduce the ability of children with CU traits to comprehend the more subtle or contextual aspects of language (Hiatt & Newman, 2006). Therefore, emotion processing deficits may be an alternative mechanism explaining the link between CU traits and English performance. Indeed, theory has identified a number of mechanisms that may explain the association between CU traits and low grades, including low intrinsic motivation and problematic peer interactions (### blinded for review; DeLisi et al., 2011), as well as additional dimensions of teacher-child interaction including teacher reward-based strategies, instructional methods, and teacher-student relationship quality (DeLisi et al., 2011; Horan et al., 2016; Hwang et al., 2020). Future studies should include a broad range of child dispositional and contextual risk factors to examine their relative contributions to the link between CU traits and poor academic achievement in different disciplines.

The present study findings should be interpreted in light of several limitations. We tested the associations between CU traits, punishment insensitivity and academic performance cross-sectionally which does not allow us to determine the direction of

relationships between these constructs over time. However, we estimated all paths among the main study variables simultaneously through the SEM analysis. Therefore, more appropriate inferences regarding the nature of the dual roles of the mediator as both a cause and an effect can be made compared to the use of separate regression analyses. Given the absence of prior research on potential mechanisms explaining the link between CU traits and poor academic performance, initial investigation within a cross-sectional design provides useful information to inform longitudinal research that is by nature more time and resource-intensive. Our sample was recruited through one state secondary school in England. However, we had a high participation rate and the sociodemographic characteristics of our sample were largely similar to those of the English population when compared to national statistics (see ##### blinded for review).

Another limitation is that CU traits and punishment insensitivity were assessed solely on the basis of child report, therefore significant relationships between these variables may reflect shared method variance. Future research should include teacher, parent and child perspectives to gain a more comprehensive view of child characteristics and behaviour. Child self-report may also be prone to bias due to the presence of CU traits, externalizing problems and/or poor quality relationships with teachers. Classroom observation methods would enable a more objective assessment of children's responsiveness to discipline, as well as determining whether teachers are implementing discipline strategies in an effective manner. Current findings need to be replicated in the primary school setting, given that the secondary school period features increased academic demands and higher expectations for student behaviour and independence in combination with less intensive support from teachers—potentially altering the nature and strength of relationships between CU traits, punishment insensitivity and academic performance. Finally, given evidence for differences in the presentation and correlates of CU traits in East Asian and Western nations (Allen, Shou, Wang & Bird, 2020;

Sng, Hawes, Hwang, Allen, & Fung, 2020), and differences in teacher classroom management practices and means of assessing student academic achievement (Lewis, Romi, Qui, & Katz, 2005; Romi, Lewis, & Roache, 2013), there may be cultural variation in the relationships between CU traits, punishment insensitivity and school grades. Future research should strive to investigate cultural differences in the interplay between CU traits and teacher-child interaction.

School success is vital in establishing healthy emotional and behavioural development (Henry, Knight, & Thornberry, 2012). The current study findings are the first to show that insensitivity to discipline appears to be an important mechanism through which CU traits is related to poor academic performance in Maths and Science, but not English. However, replication is needed given the novelty of our findings, preferably in a multi-informant, multi-method longitudinal design. Our findings support current theories highlighting the importance of inter-relationships between child temperament and sensitivity to discipline for the academic performance (DeLisi et al., 2011; Horan et al., 2016). Future research should formally test whether components of school-based interventions promoting the effective use of teacher discipline represent a mechanism of change for academic outcomes of students with elevated CU traits. CU traits has shown great utility in explaining differential response to treatment (Frick et al., 2014). Therefore, identifying the mechanisms linking CU traits and poor school outcomes informs our understanding of potential targets for school-based intervention personalized on the basis of temperamental risk. Our understanding of how best to support children with elevated CU traits in Maths and Science may also benefit from investigating alternative means of promoting student achievement to discipline, such as teachers' use of rewards and strategies aimed at promoting teacher-student relationship quality.

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Table 1

Descriptive Statistics and Correlations between the Study Variables

Variables	N	M(SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	437	12.50 (0.96)	1										
2. Gender (Female)	437	-	.04	1									
3. Single Parent	434	-	.08	-.06	1								
4. Free School Meals	427	-	-.07	-.13**	.14**	1							
5. English as First Language	431	-	-.07	-.01	.09	-.04	1						
6. Externalizing Problems	436	0.00 (1.00)	-.06	-.14**	.04	.06	-.03	1					
7. CU traits	435	21.28 (7.88)	.09	-.14**	.07	.12*	-.02	.21**	1				
8. Punishment Insensitivity	437	14.54 (6.55)	-.01	-.12*	.12*	.14**	-.01	.55**	.59**	1			
9. English Grade	414	3.65 (1.37)	-.46**	.16**	-.06	-.05	-.05	-.06*	-.16**	-.13**	1		
10. Math Grade	414	3.90 (1.20)	-.14**	.02	-.15**	-.05	-.11*	-.19**	-.18**	-.31**	.53**	1	
11. Science Grade	420	4.08 (1.04)	.09	.09	-.15**	-.17**	-.15**	-.19**	-.22**	-.33**	.41**	.72**	1

Note. *$p < 0.05$. **$p < 0.01$; CU traits = Callous-unemotional traits.

Table 2

Fully-adjusted paths for all academic outcomes

Parameter	B	SE	β	95% CI
Direct paths to English				
Punishment Insensitivity → English	-.02	.01	-.08	-.04, .00
CU traits → English	-.01	.01	-.05	-.03, .01
Age → English	-.62	.07	-.44***	-.75, -.48
Gender → English	-.42	.12	-.15***	-.65, -.19
Single Parent → English	-.00	.15	.01	-.31, .27
Free School Meals → English	-.27	.15	-.06	-.58, .04
English as First Language → English	.27	.13	.08*	.01, .52
Externalizing problems → English	.00	.06	.01	-.12, .12
Direct paths to Maths				
Punishment Insensitivity → Maths	-.05	.01	-.27***	-.08, -.02
CU traits → Maths	-.01	.01	-.01	-.02, .02
Age → Maths	-.19	.06	-.15**	-.31, -.06
Gender → Maths	.07	.12	.03	-.16, .31
Single Parent → Maths	-.34	.16	-.10*	-.66, -.03
Free School Meals → Maths	-.03	.17	-.01	-.38, .31
English as First Language → Maths	.32	.14	.11*	.07, .61
Externalizing problems → Maths	-.07	.06	-.06	-.18, .04
Direct paths to Science				
Punishment Insensitivity → Science	-.04	.01	-.23***	-.06, -.02
CU traits → Science	-.01	.01	-.05	-.02, .01
Age → Science	.09	.05	.08	-.02, .20
Gender → Science	-.04	.10	-.02	-.23, .15
Single Parent → Science	-.27	.12	-.10*	-.53, -.05
Free School Meals → Science	-.34	.17	-.10*	-.68, -.02
English as First Language → Science	.33	.11	.14**	.12, .55
Externalizing problems → Science	-.05	.06	-.05	-.16, .06
Direct paths to Punishment insensitivity				
CU traits → Punishment Insensitivity	.41	.04	.49***	.34, .49

Note. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. CU traits = Callous-unemotional traits. Dummy codes for each classroom were included as control variables in the model but these are not shown in the table.

Table 3

Total, Direct, and Indirect effects of Punishment Insensitivity on Academic Achievement

	English		Maths		Science	
	β (SE)	*95% CI*	β (SE)	*95% CI*	β (SE)	*95% CI*
Total Effect	-.08 (.01)	-.169, .000	-.14 (.01)**	-.254, -.040	-.16 (.01)**	-.255, -.067
Direct Effect	-.05 (.01)	-.145, .052	-.01 (.01)	-.126, .109	-.05 (.01)	-.153, .057
Indirect Effect	-.04 (.00)	-.086, .009	-.13 (.01)***	-.211, -.064	-.11 (.00)**	-.185, -.050

Note. ** $p < 0.01$. *** $p < 0.001$.

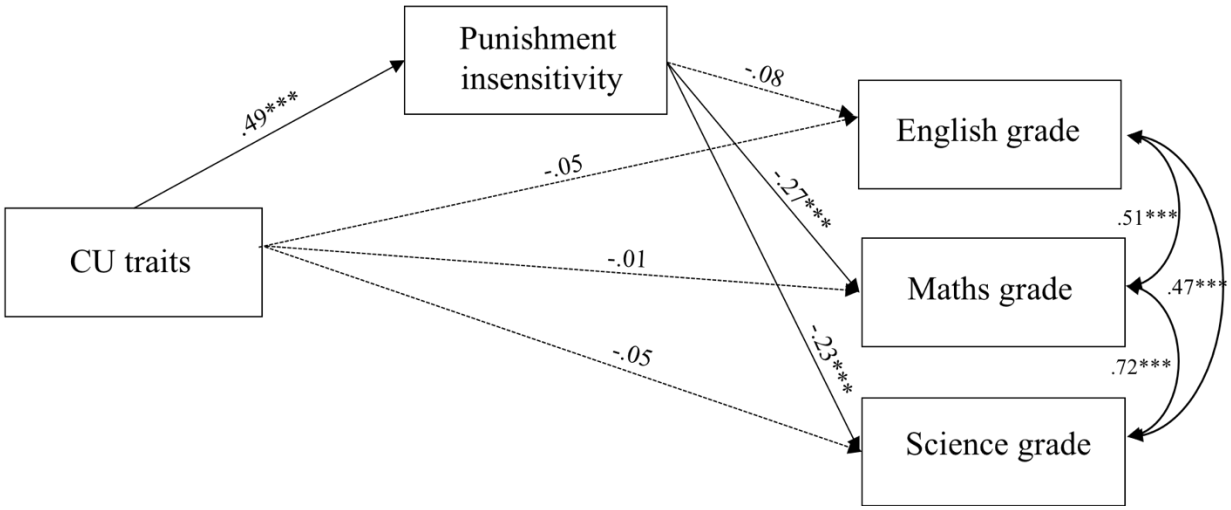

Figure 1.

Structural equation model to depict indirect associations between CU traits and academic grades via punishment insensitivity. Child age, gender, single parent, free school meal, language, externalising problems, and classroom effects were entered as control variables, but these are not shown. Standardized coefficients are presented. Double-sided arrows present covariances between outcomes.

** $p < .01$. *** $p < .001$.