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Relationships between executive functioning and homework difficulties in students with and without autism spectrum disorder: An analysis of student- and parent-reports

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ABSTRACT

Despite the fact that homework forms an important cornerstone of student development, many students fail to capitalize on the long-term benefits of doing homework. Several executive skills, including cognitive flexibility, monitoring and planning are suggested as prerequisites for the completion of homework. It follows that homework difficulties may relate to such executive functions. A group of particular interest in this respect is students with Autism Spectrum Disorder (ASD), as they are known to suffer from executive dysfunction. The present study examines the extent to which differences in homework difficulties of seventh and eighth grade students with ($N = 100$) and without ASD ($N = 86$) may relate to their level of executive functioning. Homework difficulties were examined with student and parent versions of the Homework Difficulties Questionnaire (HDQ) and executive functioning was examined with the Behaviour Rating Inventory of Executive Functioning (BRIEF). In contrast to students with ASD themselves, parents of students with ASD perceived their children to suffer from more homework problems than students without ASD. For both groups, the level of executive functioning was related to the degree of homework difficulty experienced.

1. Introduction

Parents, teachers (Xu & Corno, 2003) and the majority of students (Xu, 2005) concur that doing homework helps students to acquire study skills and has been shown to contribute positively to students' academic achievement (Cooper, Robinson, & Patall, 2006; Trautwein, 2007). Despite the reported benefits of homework, it may also elicit some negative effects such as stress in students (Burnett & Fanshawe, 1997) and parents reporting conflict and problematic behavior during homework (Toney, Kelly, & Lanclos, 2003; Warton, 2001). From a – somewhat dated – study of Murphy and Decker (1989) it appeared that 19% of the students completed less than 60% of their homework.

Homework can be defined as schoolwork that students are to complete at home (Corno, 1996). It is given to provide students extended work time to reinforce class materials, to give students the opportunity to deepen the previously learned information, and to prepare for future class work (Hong & Milgram, 2000). During their homework, students have to perform different activities for different content areas, like workbook or worksheet assignments, writing essays (Corno, 1996) or studying textbooks (Murphy & Decker, 1989).

To fulfill the multifarious homework activities for different content areas, students need several skills, such as planning (e.g. completing different tasks for several subjects in time; Eilam, 2001), flexibility (e.g. selecting the most effective learning strategy; Evans, Kirby, & Fabrigar, 2003), and monitoring (e.g. managing progress and checking for mistakes; Kluwe, 1982). These skills are critical to the successful completion of homework and are predicated by human executive functioning (Geurts, 2003; Rajendran & Mitchell, 2007). In this study we address the extent to which different executive functions relate to students' homework difficulties.

To study the relation between executive functioning and homework difficulties, we focus on a specific population with known executive function deficiencies: students with Autism Spectrum Disorder (ASD). ASD is a disorder that affects the social interaction and communication and is characterized by repetitive and stereotyped patterns of behavior and interest (American Psychiatric Association, 2000). Students with ASD mainly have difficulties with planning, flexibility, working memory (Dawson et al., 2002; Geurts, 2003), and verbal fluency (Geurts, Verté, Oosterlaan, Roeyers, & Sergeant, 2004), whereas inhibition is usually spared (Pennington & Ozonoff, 1996). Research on self-monitoring has yielded mixed results, as some studies found monitoring deficits in students with ASD while others did not (Hill & Russell, 2002; Russell & Hill, 2001). Given these executive dysfunctions we expect relatively high levels of homework difficulties in students with ASD.

The primary concern addressed by the present study is: to what extent are homework difficulties in students with and without ASD

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related to their executive functioning skills of planning, flexibility and monitoring?

2. Materials and methods

2.1. Subjects

A total of 186 secondary-school students (100 with and 86 without ASD) and their parents[1] were selected from 13 different schools in the Netherlands, all of whom gave informed consent. All 36 Dutch secondary special education schools for students with ASD without mental retardation were contacted. Of these, 10 schools provided homework on a daily basis and were willing to participate. The headteachers selected all students from seventh and eighth grades with ASD. Parents were asked about the co-morbid Attention Deficit Hyperactivity Disorder (ADHD) as determined by a psychiatrist, as executive function deficits are consistently found in both ADHD and ASD, but the profiles of executive function deficits differ across the two conditions (Pennington & Ozonoff, 1996).[2] Therefore, 32 students with comorbid diagnoses of ADHD were omitted. As determined by a psychiatrist, students with ASD had an official DSM-IV classification of Pervasive Developmental Disorder among others established by the ADI-R: 15 students with Autism, 41 students with Pervasive Developmental Disorder — Not Otherwise Specified (PDD-NOS) and 12 students with Asperger Syndrome. Three schools were selected from regular education schools based on their willingness to participate. Of each school, two seventh and eighth grade classes were randomly selected.[3] The questionnaires were administered in the classroom, except in the case of three students with ASD who received the questionnaires individually due to the low number of students with ASD in their classes. The students' age ranged from 12.6 to 16.2 years old ($M = 13.9$, $SD = .9$). Students with and without ASD were comparable on age ($F(1,132) = 1.06$, $p = .31$), and IQ ($F(1,151) = .86$, $p = .36$) based on raw scores on the Standard Progressive Matrices (SPM: Raven, Court, & Raven, 1996). Students with and without ASD were not comparable with regard to gender as boys were overrepresented in the group with ASD (ASD: 59 boys, 9 girls; without ASD: 44 boys, 40 girls; $\chi^2(152) = 20.34$, $p < .001$).

2.2. Task and materials

Homework difficulties were measured with the Homework Difficulties Questionnaire (HDQ), a custom-made questionnaire based on the Homework Problem Checklist that lists the homework difficulties students face (Anesko, Schoiock, Ramirez, & Levine, 1987). The questionnaire was also based on the Student Survey of Homework Practices, which registers students' attitudes and practices with regard to homework completion (Gajria & Salend, 1995). The HDQ consisted of 19 statements on a 4-point scale (never, at times, often, very often) such as "I forget to take home the materials I need to complete my homework". To determine the validity of this questionnaire a pilot study was conducted with 51 regular seventh grade students (age 13/14). After removing two items due to low item-total correlations the pilot study resulted in a fairly reliable scale (Cronbach's alpha = .86). The internal consistency of the final scale was .84 for students' and .87 for parents' ratings of homework difficulties (see Appendix A for the item-total correlations).

General executive functioning of planning, flexibility and monitoring was measured by scales of the Behavior Rating Inventory of Executive Function Self-Report version (Guy, Isquith, & Gioia, 2004). The BRIEF-SR is a self-report measure of executive functioning in everyday environments for adolescents aged from 11 to 18 years. A Dutch version of the BRIEF-SR was constructed by applying Behling and Law's procedure (2000) for translating questionnaires. Following their procedure, the questionnaire was translated in Dutch and back to English until agreement was reached and the translation/back-translation was accepted by the first author of the BRIEF-SR (further called student-BRIEF). The three scales contain 28 items on a three-point scale. 'Planning' behavior was measured with items such as "I start projects (such as homework, recipe) without the right materials", 'Flexibility' with items such as "I get upset by a change in plans" and 'Monitoring' with items such as "I don't know when my actions bother others". The internal consistencies of the scales used in this study were high: Cronbach's alpha coefficients were .85 for 'Planning' (13 items), .82 for 'Flexibility' (10 items), and .73 for 'Monitoring' (5 items) (see Table 1). For ease of interpretation, the scores on the scales were reversed so that high scores indicated highly proficient executive functions.

To provide converging evidence of the level of executive proficiency of the students, parents also completed the HDQ and the BRIEF. The parent version of the HDQ consisted of the same items as the student version. The three used scales of the parent-BRIEF consists of 28 items that refer to the functions 'Flexibility' (8 items), 'Planning' (12 items), and 'Monitoring' (8 items), with an internal consistency above .85 for all scales, (see Table 1). The parent-BRIEF has been developed for Dutch use by Smidts and Huizinga (2009). Again, the scores on the scales were reversed for interpretation purposes.

2.3. Procedure

Prior to administering questionnaires to the students, their parents received a questionnaire consisting of the parent-BRIEF and the parent-HDQ. During the student sessions, each student first completed the SPM which took about 40 min, followed by the student-BRIEF and finally the student-HDQ. Students were allowed to take a short break between the tasks if they wanted to. All measures were completed at school in the presence of the researcher. In total the students spent 50 to 100 min on the tasks.

2.4. Analyses

To compare the reports of the students with and without ASD and their parents' reports, analyses of covariance, correlation analyses, *t*-tests, and stepwise regression analyses were applied. In the regression analyses structure coefficients (r_s), which are not suppressed or inflated by collinearity were calculated (Courville & Thompson, 2001; Thompson & Borrello, 1985). The level of significance was set at .05.

3. Results

3.1. Group comparisons

Students with and without ASD were compared with regard to their level of homework difficulties and their executive functioning.

Table 1
Internal consistency (Cronbach's α) of the HDQ and the BRIEF scales (N = 152).

Instrument	Scales	Number of items	Internal consistency
HDQ students	Homework difficulties	17	.84
HDQ parents	Homework difficulties	17	.89
BRIEF students	Planning	13	.85
	Flexibility	10	.82
	Monitoring	5	.73
BRIEF parents	Planning	12	.88
	Flexibility	8	.90
	Monitoring	8	.85

[1] Where parents are mentioned, parents or guardians should be read.
[2] Of students with ASD, eight students were also diagnosed with Anxiety Disorder, MCDD, Gilles de la Tourette Syndrome or Dysthymia, but we did not make use of this information as there is no evident relation of these problems with executive functioning.
[3] From the students of regular classes, two students with PDD-NOS were omitted from the analyses.