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ORIGINAL PAPER

A Comparison Between Caregiver-Reported Anxiety and Other Emotional and Behavioral Difficulties in Children and Adolescents with Autism Spectrum Disorders Attending Specialist or Mainstream Schools

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Abstract Increasing numbers of students with Autism Spectrum Disorder (ASD) are attending mainstream schools. Nonetheless, concerns about their emotional well-being and mental health in these settings have also been raised. This study sought to compare caregiver-reported anxiety and other emotional and behavioural problems in youth with ASD attending mainstream or specialist schools. Caregivers of 27 youth with ASD in mainstream schools (age 10.91 ± 3.44 years) and 69 youth with ASD in special schools (age 10.93 ± 2.81 years) matched for gender, age, adaptive functioning and autism symptom severity scores participated. Caregivers completed the Spence Children's Anxiety Scale–Parent, a measure of adaptive functioning, and a checklist of other emotional and behavioral difficulties. Students with ASD attending mainstream schools experienced higher levels of social anxiety symptoms compared to their specialist school counterparts. No other statistically significant differences were found in other aspects of emotional and behavioural functioning examined, but some differences emerged in item-level analyses. Uncertainties in navigating more complex social environments and increased social relating difficulties in mainstream schools are discussed as probable environmental triggers for increased social phobia related symptomatology, although other explanations for this small effect size difference are also considered. Limitations of the present study and recommendations for future research focusing on exploring environmental socio-ecological factors influencing anxiety and mental health in young people with ASD are also discussed.

Keywords Autism · Anxiety · Mainstream · Integration · Inclusion · Social phobia · Mental health

Introduction

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition primarily affecting reciprocal social communication and interaction as well as the individual's patterns of behaviour, activities and interests (American Psychiatric Association 2013), with often high levels of associated intellectual, medical, language, adaptive functioning, behavioural and mental health challenges (Lecavalier et al. 2011; Simonoff et al. 2013). At least one psychiatric comorbidity, including intellectual disabilities, ADHD, anxiety and mood disorders, is diagnosed in up to 70 % of individuals with ASD (American Psychiatric Association 2013; Matson and Shoemaker 2009; Taurines et al. 2012; White et al. 2009; Simonoff et al. 2008).

It is also estimated that approximately 60 % of young people with ASD are currently educated in mainstream schools in developed countries (Department for Education and Skills 2006; Wing 2007). However, their effective integration has been questioned and remains poorly understood (e.g., Frederickson et al. 2007; Humphrey and Symes 2013; Moore 2007; Wing 2007). Although some are successfully integrated (i.e., see Eldar et al. 2010; Lindsay et al. 2014; Saggers et al. 2011; Sansosti and Sansosti 2012), many young people with ASD experience being

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ostracised, alienated, and bullied more than students with other or no Special Educational Needs in mainstream schools (SEN; Wainscot et al. 2008). They are also at significantly greater risk than students with other disabilities or those with no SEN of receiving less social support from teachers, parents, siblings, and peers within these settings (Humphrey et al. 2013; Hebron and Humphrey 2013; 2014). Youth with ASD often present with difficulties in coping with the social and relational aspects of mainstream schools, including interacting with peers, understanding complex social and conduct rules, and socializing during recess or other less structured times (Attwood 1998; Barnard et al. 2000; Moore 2007; Wing 2007). Academic struggles, emotion regulation difficulties, and behavioural challenges are also common (Ashburner et al. 2010; Osborne and Reed 2011; Waddington and Reed 2006), in some cases leading to exclusion (Achilles et al. 2007; Granizo et al. 2006).

Taken together, it is plausible to hypothesize that the school environment may affect the emotional well-being and mental health of the child or adolescent with ASD, and in particular contribute to increased anxiety experiences as well as increased difficulties relating to others. However, there is a paucity of research exploring the potential role of such environmental factors in mental health in ASD, as most studies have so far focused on investigating the influence of child variables (e.g., age, gender, IQ, autism symptom severity, adaptive functioning) in anxiety and related difficulties (i.e., Lidstone et al. 2014; Magiati et al. 2016; Vasa et al. 2013; Wigham and McConachie 2014; see White et al. 2009 for a review).

The present study thus compared anxiety and other emotional and behavioural difficulties in children and adolescents with ASD attending mainstream or specialist school settings. It was hypothesized that children in mainstream school environments would experience increased anxiety, specifically social anxiety, and more emotional and behavioral difficulties compared to their peers in specialist educational settings, which are often more supportive and accommodating of their differences and needs.

Methods

Participants

Inclusion and Exclusion Criteria

Inclusion criteria were: (1) children's chronological age 6–18 years; (2) children with a clinical diagnosis of Autism, ASD, Asperger's Syndrome (AS), or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) by a qualified medical or other healthcare professional from a recognized public or private professional setting using DSM-IV-TR or ICD-10 diagnostic criteria; and (3) currently attending a mainstream or ASD-specific specialist primary or secondary school . Exclusion criteria were: (1) caregivers unable to understand written/spoken English or Mandarin; and (2) children with serious comorbid medical conditions (e.g., cerebral palsy).

ASD Diagnosis

All children had a formal clinical diagnosis of ASD from a medical or health professional[1] (i.e., paediatrician or psychologist). In this study, 71 participants (74 %) were diagnosed in one of the three leading public multidisciplinary child development/guidance clinic centres. These participants did not differ from the remaining 25 privately diagnosed participants on any of the main child or family demographics examined (all $p > 0.05$; all effect sizes d small <0.18). The Developmental Behaviour Checklist-Autism Screening Algorithm subscale (DBC-ASA; Brereton et al. 2002; see Measures) was also used as a measure of Autism symptom severity.

Participant and Informant Characteristics

Caregivers of 27 youth with a clinical diagnosis of ASD attending mainstream schools and 69 youth with a clinical diagnosis of ASD educated in special schools participated (see Table 1). Informants were 20 mothers (74.1 %) and 7 fathers (25.9 %) for the mainstream and 55 mothers (79.7 %), 13 fathers (18.8 %) and one other relative (3.7 %) for children in special schools (see Table 1).

Recruitment and Sample Selection Process

Participants attending special schools were a subsample from a larger study involving 241 caregivers of children and young people with ASD attending six specialist schools in Singapore (Magiati et al. 2016). Of those, 132 were from one ASD-specific specialist school which caters to 7–16 year old children with a clinical diagnosis of mild to moderate ASD and a non-verbal IQ of >70 as well as evidence provided by a health professional that the child is likely to be cognitively and verbally able to access the

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[1] It should be noted that the majority of the children and adolescents with ASD in Singapore are diagnosed in the country's two leading public child development units (0–7 years) or at the Child Guidance Clinic for 7–18 year olds (see Table 1). These are staffed by qualified and trained multi-disciplinary teams employing DSM-IV-TR (American Psychiatric Association 2000), DSM-5 (American Psychiatric Association 2013), or ICD-10 (World Health Organization 2011) diagnostic criteria and adhering to evidence-based ASD assessment practices (i.e. Ministry of Health 2010; Moh and Magiati 2012).

Table 1 Participant and informant characteristics

	Mainstream ($n = 27$) *M (SD) or N (%)*	Specialist ($n = 69$) *M (SD) or N (%)*	Statistics	p value	Effect size
Chronological age (years)	10.91 (3.44)	10.93 (2.81)	$t(94) = 0.03$	0.97	0.00
Gender: Males	22 (81.48)	61 (88.41)	$\chi^2(1) = 0.80$	0.37	0.18
SIB-R adaptive functioning standard score	88.30 (19.42)	84.90 (27.51)	$t(94) = 0.59$	0.56	0.13
SIB-R speech and communication raw score	27.04 (5.48)	26.55 (4.01)	$t(94) = 0.48$	0.63	0.11
Caregiver-rated verbal ability					
Uses up to 2–3 words at a time	0 (0.00)	6 (8.70)	$\chi^2(3) = 9.62$	0.02	0.32
Uses sentences with 4 or more words	1 (3.70)	17 (24.60)			
Often uses several sentences one after the other (i.e., typical verbal ability for his/her age)	24 (88.90)	40 (58.00)			
Not sure, not applicable, or missing	2 (7.40)	6 (8.70)			
DBC Autism severity algorithm (score ≥14)[a]	15 (55.56)	39 (56.52)	$\chi^2(1) = 0.01$	0.93	0.02
DBC Autism severity algorithm raw score	17.07 (9.27)	14.83 (8.79)	$t(94) = 1.11$	0.27	0.25
DBC social/communication Autism score	4.65 (3.02)	6.00 (3.22)	$t(94) = 1.93$	0.06	0.43
DBC stereotyped speech/behaviour Autism score	7.24 (4.74)	7.74 (3.79)	$t(94) = -0.49$	0.62	0.12
Socio-economic data					
Parents with university degree	19 (70.37)	34 (49.28)	$\chi^2(1) = 3.49$	0.06	0.19
Father employed (full/part-time)	25 (92.59)	62 (89.86)	$\chi^2(1) = 0.17$	1.00	0.04
Mother employed (full/part-time)	16 (59.26)	42 (60.87)	$\chi^2(1) = 0.02$	1.00	0.01
English-speaking household	21 (77.78)	62 (89.86)	$\chi^2(1) = 3.14$	0.08	0.18
Caregiver-reported diagnosis					
Autism or autistic disorder (AD)	2 (18.18)	61 (88.41)	$\chi^2(2) = 56.88$	**<0.01**	**0.77**
Asperger Disorder/Syndrome	19 (70.37)	7 (10.14)			
Pervasive developmental disorders-not otherwise specified (PDD-NOS)	6 (22.22)	1 (1.45)			
Place of diagnosis					
Public child development/guidance clinics	19 (70.37)	52 (84.06)	$\chi^2(1) = 8.69$	0.03	0.30
Others	8 (29.63)	17 (15.94)			
Caregiver-reported intellectual disability	19 (70.37)	41 (59.42)	$\chi^2(1) = 1.79$	0.41	0.14
Caregiver-reported additional diagnoses	13 (48.15)	23 (33.33)			
ADHD	9 (33.33)	13 (18.84)	$\chi^2(2) = 2.92$	0.23	0.17
Other medical conditions/syndromes (i.e., epilepsy, tuberous sclerosis, fragile X)	–	2 (2.90)			
Dyslexia, dyspraxia or specific language impairment (SLI)	1 (3.70)	5 (7.25)			
Others (i.e., attention-deficit hyperactivity disorder, dyslexia, dyspraxia, or specific language impairment)	3 (11.11)	3 (4.35)			
Caregiver-reported anxiety disorder diagnosis					
Yes, in the past	2 (7.41)	3 (4.35)	$\chi^2(2) = 1.26$	0.53	0.11
Yes, currently	2 (7.41)	2 (2.90)			

Bold values indicate the statistically significant differences

Cohen's d effect sizes were calculated using the Campbell's collaboration online calculators for variables which met the normality distribution assumption (http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD-main.php); Fisher's exact tests were used when cell count was <5; Chi-square effect sizes were calculated using the effect size estimate $\varphi = \sqrt{(\chi^2/N)}$; Mann–Whitney U effect sizes were calculated using the formula $r = z/\sqrt{(N)}$

[a] A cut-off of 14 has been proposed to have reasonably good sensitivity, but somewhat compromised (0.59) or acceptable (0.69) specificity to differentiate between young people with developmental or intellectual disabilities with and without ASD (Steinhausen and Metzke 2004)

mainstream academic curriculum within a structured group learning environment. Of the potential 132 participants from this school, 69 were selected after matching them in terms of age, gender, Autism symptom severity and socio-economic demographic variables to the 27 mainstream school participants, who attended one of the mainstream schools in Singapore (Ministry of Education 2004; 2010; Poon et al. 2014; Yeo and Choi 2011).

As access to personal information about the students with ASD in the mainstream schools was not possible, participants were recruited through advertising to parent support groups, organizing public workshops on supporting children with ASD in mainstream schools by the second author, and word of mouth. This study was part of a larger cross-sectional study on anxiety (Magiati et al. 2016) and all potential participants were similarly informed that this study aimed to find out more about the nature and impact of anxiety in young people with ASD.

School Environment

Caregivers reported which type of school their child with ASD was attending ("Not attending school", "Special Education School", "Special Class in Mainstream School", "Mainstream school" or "Other"). Caregivers who reported that their child was attending a mainstream school were also asked to report whether their child was receiving learning and behavioral support by either an Allied Educator (AE) or a Special Needs Officer (SNO). Of the 27 mainstream participants, 6 (22.2 %) reported that their children were receiving some 1:1 specialist additional support for an average of 2.00 ± 1.55 h per week (range 1–4 h), 12 (44.4 %) were not receiving any support, and 9 (33.3 %) did not provide a response.

Although some variability is expected in terms of the quality and level of support conferred for students with ASD, "all mainstream schools in Singapore have a core group of teachers (10 % in primary, 20 % in secondary) trained in Special needs to support students with mild special educational needs, including mild ASD" (MOE, 2010). At the same time, mainstream schools generally receive less infrastructural support for students with ASD as compared to those attending specialist schools in Singapore. In specialist schools, the teacher-to-student ratio is lower, classroom sizes are smaller and more homogenous, the noise level and sensory input are better controlled, and the teachers have more specialist training and experience to support and teach students with developmental, intellectual and/or multiple disabilities.

Measures

Spence Children's Anxiety Scale–Parent Version (SCAS-P; Spence 1998)

This is a 38-item caregiver-report questionnaire assessing anxiety symptoms in 6–18 year old children on a 4-point Likert scale (from 0 = never to 3 = always), with higher scores indicating greater anxiety. A Total anxiety score (range 0–114) and six subscale scores reflecting DSM-IV-TR criteria for Generalized Anxiety (6 items), Separation Anxiety (6 items), Social Phobia (6 items), Obsessive–Compulsive Disorder (6 items), fears of Physical Injury (specific phobia; 5 items), and Panic Attack and agoraphobia (9 items) are provided.

The SCAS-P has good internal consistency, 6 month test–retest reliability and convergent validity with other well-established anxiety checklists which have been locally validated with children in *[name of country]* without ASD (Woo et al. 2007; e.g., Nauta et al. 2004; Whiteside and Brown 2008; Li et al. 2011). Internal consistency is acceptable to excellent in studies with young people with ASD (Russell and Sofronoff 2005; Sofronoff et al. 2005; in this study $\alpha = 0.89$ for total score and >0.70 for four of the six subscales). Inter-informant agreement is moderate to good (Magiati et al. 2014) and acceptable sensitivity and specificity of 0.75 and 0.71 respectively has been reported for the SCAS-P when compared against a structured clinical diagnostic interview (Zainal et al. 2014). Raw scores were used in the present study.

Developmental Behaviour Checklist–Parent Version (DBC-P; Einfeld and Tonge 2002)

This checklist contains 96 items measuring common behavioural and emotional difficulties of children and adolescents aged 4–18 years with intellectual and developmental disabilities. Based on the last 6 months, caregivers rate each item on a 3-point scale (0 = not true to 2 = very true/often true; higher scores indicate more problems). The scale yields a Total Behaviour Problem raw Score (TBPS; range 0–192; α in this study = 0.95) and five subscale scores. The TBPS (Einfeld et al. 1997) was used in the present study as an overall measure of emotional and behavioral functioning. The DBC Autism Severity screening Algorithm score (DBC-ASA; 29 items; range 0–58; α in this study = 0.88) was used as a measure of ASD symptom severity (Brereton et al. 2002; Steinhausen and Metzke 2004; see Table 1). Two other DBC-derived raw scores were calculated and used as Autism symptom severity scores, the 8-item DBC Autism-specific social communication score ($\alpha = 0.71$) and the 15-item DBC Autism-specific behavioural/speech score ($\alpha = 0.72$; for more details on these, see Magiati et al. 2016), as the items included were more Autism specific than those included in the DBC-ASA.

Scales of Independent Behavior-Revised-Short Form (SIB-R; Bruininks et al. 1996)

With norms available for 0–80 year old individuals with developmental disabilities, the 40-item SIB-R Short form was used to provide an estimate of participants' overall adaptive functioning due to its ease of administration and large correlation with the Vineland Adaptive Behavior Scales ($r = 0.83$; Middleton et al. 1990). Caregivers rate items on a 4-point scale (0 = never or rarely to 3 = does very well). The SIB-R Short correlates highly with the full form ($r = 0.92$) and provides a Broad Independence Standard Score (mean = 100, SD = 15; range = 0–170), with higher scores indicating better adaptive functioning. Internal consistency (in the present study 0.89), test–retest reliability, and inter-rater agreement are good (Bruininks et al. 1996). Approximately half of the variance in SIB-R scores can be explained by cognitive level (Bruininks et al. 1996). In the present study, 11 items from the SIB-R measuring receptive and expressive language and communication skills were used as an approximate index of the participants' communication ability (example items include "says at least 10 words that can be understood by someone who knows him or her" or "asks simple questions"; raw score range 0–33; α in this study = 0.71).

Procedure

Ethical approval was granted by the National University of Singapore Institutional Review Board (IRB). Voluntary informed signed consent was obtained from all caregivers. Data was collected between May 2011 and August 2012.

Both English and officially translated in Mandarin published versions of the SCAS-P and the DBC were sent to caregivers, alongside the participant information sheet and the consent form. The SIB-R Short Form was translated and back-translated in Mandarin by native bilingual speakers and was sent to participants together with the English version. Depending on their preferred language, caregivers completed the survey in English (80, 83 %) or Mandarin (16, 17 %), the two most widely used languages in linguistically diverse Singapore and posted it back to the research team in stamped envelopes provided. Six of the 10 special schools distributed the questionnaire packages to caregivers of children meeting inclusion criteria through their school–parent communication books. The schools that declined cited 'research request overload' as their main reason. Based on the number of distributed and returned questionnaires, the approximate response rate was similar across both groups (69 out of 223 distributed surveys for mainstream [31 %] vs. 27 out of 65 [41 %], $\chi(1) = 1.22$, $p = 0.27$, Phi $\varphi = 0.11$). Furthermore, there were no differences in terms of the proportion of questionnaires responded to in English, as compared to Mandarin (specialist 81 % vs. mainstream 89 %, $\chi(1) = 0.84$, $p = 0.54$, Phi $\varphi = 0.09$).

Missing Data and Statistical Analyses

Missing data for the questionnaires were <5 % and were handled according to the manuals' instructions. All statistical analyses were conducted using SPSS (Statistical Package for Social Sciences, Version 20.0). All p values were based on two-tailed tests with $p \leq 0.05$, except for mainstream and specialist school comparison analyses of the caregiver-reported SCAS-P and DBC scores, where one-tailed tests were performed to reflect our a priori hypotheses. Continuous variables which were not normally distributed, as reflected by Shapiro–Wilk tests, were analysed using non-parametric methods, such as Mann–Whitney U tests for group comparisons. Normally distributed variables were analysed using parametric methods, such as independent sample t tests. Nominal variables (i.e., gender) were analysed using the χ^2 test and the Fisher's exact test was used when cell count was ≤ 5. Effect sizes (Cohen's d, Mann–Whitney U's r, or Phi φ) are reported and considered in the interpretation of findings.

Results

Preliminary Analyses

The specialist and mainstream school groups were not significantly different in chronological age, gender, SIB-R adaptive functioning standard scores, SIB-R communication skills raw score, family demographic characteristics, DBC total or subscale emotional and behavioural scores or Autism symptom severity scores, and all effect sizes were small (see Table 1). The only statistically significant differences were in the number of children diagnosed with Asperger's syndrome (more in mainstream than in specialist schools) and in caregiver-reported ratings of children's communication ability (more children from mainstream schools were rated to have better conversational ability and more age-appropriate language/communication skills with a small effect size difference). However, there were no differences in the SIB-R communication raw score also completed by the caregivers (see Table 1) .

Post-hoc analyses comparing children with Autism/ASD diagnoses to those with Asperger's syndrome revealed no statistically significant differences in any of the variables examined and all effect sizes were small. Caregiver reported SIB-R communication skill raw scores were also comparable between mainstream and specialist groups (Table 1) and between participants with ASD/Autism and those with AS, with small effect size differences (Table 3).

Main Analyses

Total Scores

There were no statistically significant differences between mainstream and specialist school groups in total anxiety SCAS-P scores, with small effect size differences (Table 2). However, somewhat more emotional and behavioral problems in the DBC total score were reported for mainstream children, but this was not statistically significant and was of a small effect size (see Table 2).

Subscale Scores

There were no statistically significant differences between the two groups in the SCAS-P separation, generalized, OCD, panic or physical injury subscale scores. Children in mainstream schools were reported to present with significantly more social anxiety symptoms compared to their specialist school peers with a moderate effect size ($d = 0.37$; see Table 2). Controlling for caregiver verbal communication ratings, children in mainstream school still were reported to have more social anxiety symptoms compared to their special school peers with a medium effect size and marginal statistical significance, $F(1, 93) = 2.97$, $p = 0.08$, $d = 0.40$. There were no other statistically significant differences in any of the DBC subscale scores and effect sizes were small (Table 2).

Item Level Analyses

Three SCAS-P items were statistically significantly different with medium effect sizes: children from mainstream (a) worried more that they would do badly in school (Item 10 specialist 0.68 ± 0.78; mainstream 1.07 ± 0.78; $U = 664.50$, $z = -2.34$, $p = 0.02$, $r = 0.24$); (b) reported more bad or silly thoughts they can't get out of their head (item 17; specialist 0.64 ± 0.73; mainstream 1.15 ± 0.81; $U = 589.50$, $z = -3.00$, $p = 0.003$, $r = 0.31$); and (c) had lower scores on item 37 "My child has to do certain things in just the right way to stop bad things from happening" (specialist 0.53 ± 0.70; mainstream 0.22 ± 0.42; $U = 718.50$, $z = -2.03$, $p = 0.04$, $r = 0.21$) compared to children in special schools. All other item comparisons were statistically not significant and of small effect size.

For the DBC items, children from mainstream school settings were reported to present with less echolalia (specialist 0.40 ± 0.52 vs. mainstream 0.15 ± 0.36; $U = 701.00$, $z = -2.62$, $p = 0.03$, $r = 0.23$), to become significantly more over-excited (specialist 0.68 ± 0.58 vs. mainstream 1.11 ± 0.64; $U = 614.00$, $z = -2.92$, $p = 0.003$, $r = 0.30$), to mix less well with their own age group (specialist 0.49 ± 0.76 vs. mainstream 0.89 ± 0.75; $U = 636.00$, $z = -2.62$, $p = 0.009$, $r = 0.27$) and to present with more unconnected thoughts and jumbled together ideas that are difficult to follow (specialist 0.48 ± 0.56 vs. mainstream 0.85 ± 0.77; $U = 687.50$, $z = -2.22$,

Table 2 Univariate comparison of overall and specific anxiety, emotional and behavioural problems between mainstream and specialist youth with ASD

	Mainstream ($n = 27$)		Specialist ($n = 69$)		Statistics	p value	Cohen's d
	M (SD)	Median	*M* (SD)	Median			
Spence children's anxiety scale							
Total	20.82 (10.35)	18	19.47 (12.29)	17	U = 826.50, z = 0.86	0.19	0.12
Separation anxiety	3.44 (2.41)	3	3.79 (3.14)	3	U = 907.00, z = 0.20	0.58	−0.13
Social phobia	4.48 (3.32)	4	3.29 (3.17)	3	U = 698.00, z = 1.92	**0.02**	**0.37**
Generalized anxiety	3.52 (2.12)	4	3.32 (2.28)	3	U = 847.50, z = 0.69	0.25	0.09
Panic attack/agoraphobia	1.79 (2.05)	1	1.78 (2.15)	1	U = 890.00, z = 0.35	0.36	0.004
Fears of physical injury	4.30 (2.67)	4	4.26 (2.61)	4	U = 923.00, z = 0.07	0.53	0.02
Obsessive–compulsive disorder	3.15 (2.30)	3	3.02 (2.93)	2	U = 837.00, z = 0.78	0.22	0.05
Developmental Behaviour Checklist							
Total behaviour problem score	46.73 (23.73)	44	40.51 (22.47)	38.5	$t(95) = 1.17$	0.12	0.27
Disruptive/antisocial	13.89 (9.27)	11	12.47 (7.68)	12	$t(95) = 0.70$	0.25	0.17
Self-absorbed	12.89 (7.62)	12	10.71 (7.31)	9	U = 761.50, z = 1.30	0.09	0.29
Communication disturbance	6.89 (3.30)	7	6.49 (4.05)	6	$t(95) = 0.50$	0.31	0.11
Anxiety	4.95 (3.52)	4	4.15 (2.82)	4	U = 819.50, z = 0.82	0.21	0.25
Social relating	5.00 (3.41)	5	4.25 (3.07)	4	U = 802.50, z = −096	0.17	0.23

Bold values indicate the statistically significant differences

One-tailed analyses were performed to reflect the a priori hypotheses of the present study

Table 3 Characteristics of participants with clinical diagnoses of ASD/Autism versus Asperger's syndrome

	Autism ($n = 63$) *M (SD) or N (%)*	Asperger's ($n = 26$) *M (SD) or N (%)*	Statistics	p value	Effect size
Chronological age (years)	11.07 (2.79)	10.46 (3.65)	$t(88) = 0.77$	0.45	0.19
Gender: Males	54 (85.71)	23 (88.46)	$\chi^2(1) = 0.12$	1.00	0.04
SIB-R adaptive functioning standard score	85.19 (27.53)	86.96 (19.95)	$t(88) = -0.30$	0.77	0.07
SIB-R speech and Communication raw score	26.57 (4.05)	26.73 (5.52)	$t(88) = -0.15$	0.90	0.04
Caregiver-reported speech ability					
Uses up to 2–3 words at a time	6 (9.50)	0 (0.00)	$\chi^2(3) = 6.96$	0.06	0.27
Uses sentences with 4 or more words	16 (25.40)	2 (7.70)			
Often uses several sentences one after the other (i.e., typical verbal ability for his/her age)	36 (57.10)	21 (80.80)			
Not sure, not applicable, or missing	5 (7.90)	3 (11.50)			
DBC Autism severity algorithm (ASA) raw score	14.70 (8.73)	16.00 (9.41)	$t(88) = -0.63$	0.53	0.14
DBC social/communication Autism score	4.66 (3.14)	5.42 (3.02)	$t(88) = -1.05$	0.30	0.17
DBC stereotyped speech/behaviour Autism score	7.15 (4.59)	7.54 (4.43)	$t(88) = -0.37$	0.71	0.09
Spence children's anxiety scale					
Total	18.04 (10.73)	22.93 (13.02)	$t(88) = -1.69$	**0.05**	0.41
Separation anxiety	3.42 (2.95)	4.38 (2.68)	$t(88) = -1.49$	0.07	0.34
Social phobia	3.00 (2.89)	4.65 (3.33)	$t(88) = -2.21$	**0.02**	0.44
Generalized anxiety	3.10 (2.14)	3.85 (2.31)	$t(88) = -1.41$	0.08	0.34
Panic attack and agoraphobia	1.62 (2.05)	2.31 (2.35)	$t(88) = -1.31$	0.10	0.31
Fears of physical injury	4.15 (2.55)	4.58 (2.80)	$t(88) = -0.68$	0.25	0.16
Obsessive–compulsive disorder	2.75 (2.55)	3.47 (3.33)	$t(88) = -0.98$	0.17	0.24
Developmental behaviour checklist					
Total behaviour problem score	39.69 (21.94)	44.41 (24.61)	$t(88) = -0.85$	0.20	0.20
Disruptive/antisocial	12.08 (7.31)	13.31 (9.83)	$t(88) = -0.57$	0.28	0.19
Self-absorbed	10.73 (7.38)	11.96 (7.89)	$t(88) = -0.68$	0.25	0.24
Communication disturbance	6.37 (3.94)	6.62 (3.85)	$t(88) = -0.27$	0.39	0.06
Anxiety	3.94 (2.67)	4.83 (3.37)	$t(88) = -1.21$	0.12	0.29
Social relating	4.23 (3.16)	4.58 (2.79)	$t(88) = -0.52$	0.31	0.12

Bold values indicate the statistically significant differences

Cohen's d effect sizes were calculated using the Campbell's collaboration online calculators for variables which met the normality distribution assumption (http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD-main.php); Fisher's exact tests were used when cell count was <5; Chi-square effect sizes were calculated using the effect size estimate $\varphi = \sqrt{(\chi^2/N)}$; Mann–Whitney U effect sizes were calculated using the formula $r = z/\sqrt{(N)}$

$p = 0.03$, $r = 0.23$) compared to the matched specialist school group. There were no other statistically significant differences at the item level and all effect sizes were small.

Because the two educational setting groups were different with regards to children's diagnosis, we also compared the SCAS-P and DBC total and subscale scores between the two diagnostic groups (ASD/Autism vs. Asperger). A statistically significant difference was found between the diagnostic subgroups in SCAS-P total ($d = 0.41$) and social phobia subscale scores ($d = 0.44$) with medium effect sizes (Table 3). There were no other differences in DBC total and subscale scores and all effect sizes were small

Discussion

Caregiver-reported SCAS-P scores in this study were generally comparable to other non-clinical samples of youth with ASD (Farrugia and Hudson 2006; Gillott et al. 2001; Greenaway and Howlin 2010), but, as expected, lower compared to other studies recruiting clinically anxious young people with ASD (e.g., Russell and Sofronoff 2005; Chalfant et al. 2007; Sofronoff et al. 2005).

In the present study, caregivers of youth with ASD attending mainstream schools reported that their children experienced higher levels of social anxiety symptoms despite being comparable to their specialist school counterparts in all other demographic and individual characteristics examined. It is possible that students with ASD attending mainstream schools may be more likely to experience anxiety difficulties compared to students with no or other SEN (e.g., depression; Barnhill 2001; Evans et al. 2005; Hebron and Humphrey 2014). However, our study suggests that, at least based on caregiver reporting, such increased challenges in mainstream school settings may be more specifically focused on socially relevant sources of anxiety.

It is also possible that individual differences may partially explain the higher rates of social phobia reported for children with ASD in mainstream schools. Our mainstream sample comprised of higher proportions of youths diagnosed with Asperger's Syndrome (AS) based on DSM-IV-TR criteria. Higher-functioning youth with AS may possess greater levels of social awareness (Maddox and White 2015; Meyer et al. 2006), and may therefore experience more social worries compared to their specialist school peers with ASD. Moreover, youth with Asperger's Syndrome may have more interpersonal and social relating difficulties and discontented social relationships compared to typically developing peers (Bauminger and Kasari 2000; Russell and Sofronoff 2005) or peers with learning impairments (Burnette et al. 2005). Additionally, we found statistically significant differences in our participants with a diagnosis of ASD/Autism as compared to those with AS diagnoses in terms of overall anxiety and social phobia, despite no other differences in any of the other child characteristics examined.

However, there are also a number of reasons to be skeptical about the assertion that the differences found in parent-reported social anxiety symptoms can be fully explained by diagnostic subtype differences. Firstly, the literature strongly emphasizes that arguments relating to the distinction between AS and high-functioning Autism/ASD are circular (see Lord and Bishop 2015 for a review). Secondly, diagnoses across the varying diagnostic subtypes of Autism/ASD and Asperger's tend to not be reliable across clinicians (Lord et al. 2011) or time (Lord et al. 2006; Bennett et al. 2008; Howlin 2003). Post-hoc comparisons between the ASD/Autism and the Asperger diagnostic groups in the present study also showed no statistically significant differences in Autism related symptomatology or adaptive functioning, although it is possible that IQ, which was not measured directly in this study, or more complex verbal skills not captured by the limited number of SIB-R communication items, may to some extent explain the differences in endorsement of social phobia items. However, prerequisites for the 69 ASD/Autism diagnosed individuals to gain admission into the specialist school were a diagnosis of "mild" ASD and evidence of adequate cognitive and verbal ability appropriate for accessing the mainstream curriculum within a supporting school environment. Thus, despite some DSM-IV-TR diagnostic subgroup differences, the mainstream and specialist school groups in this study were generally comparable in the variables examined. The fact that the school group difference in social anxiety symptoms was only marginally significant when caregiver ratings of children's verbal skills were accounted for may suggest that social anxiety differences may to some extent be explained by possible differences in verbal abilities. However, the effect size of the difference remained medium and the difference continued to approach statistical significance. Therefore, it is likely that although verbal/communication ability may to some extent influence social anxiety reporting, it does not appear to fully explain the differences found in the present study.

We assert therefore that it is also possible that the mainstream school context itself may be more anxiety-provoking (Brook and Schmidt 2008), likely contributing to more social anxiety concerns. Specific stressors that are likely increased in mainstream, as compared to specialist schools, include frequent and more unpredictable changes in classroom settings and/or activities (Myles and Simpson 1998; Connor 1999), larger and more hectic classrooms (Moore 2007; Wing 2007), ambiguity and lack of environmental structure and order (Humphrey and Lewis 2008), and/or difficulties in understanding and responding to verbal and nonverbal cues from peers and teachers (Harrison 1998; Wainscot et al. 2008). Several studies have shown that students with ASD engage in fewer social interactions, report having fewer friends, are less physically active in comparison to students with no or other SEN in similar settings (Humphrey and Symes 2010a; b; 2011; Jordan 2005; Moore 2007; Wainscot et al. 2008; Wing 2007), and spend recess time and school breaks inside quieter school compounds with greater adult supervision (Humphrey and Symes 2013).

Limitations of our study include the relatively small sample size of children in mainstream schools and the absence of data from children with other SEN or no SENs in such settings as a comparison group (see Hebron and Humphrey 2014). No direct measures of how the two educational settings were actually different were collected, although based on existing literature (Ministry of Education 2004; 2010; Poon et al. 2014; Yeo and Choi 2011) and basic information collected from caregivers, it is reasonable to assume that the environmental and infrastructural support differences between specialist and mainstream settings were indeed present. Furthermore, our small sample of students with ASD in mainstream settings may not be representative of children with ASD in such settings, as we encountered considerable recruitment challenges and were not able to directly approach all mainstream schools with registered students with ASD to inform caregivers of children with ASD in these schools about our study. The mainstream subsample may therefore not be representative or powerful enough for our analyses to detect other potentially significant clinical differences, and to disentangle the contribution of school setting and other individual social-communication abilities in explaining anxiety and other emotional and behavioral problems.

Future studies would thus need to recruit larger sample sizes of children from different school settings to ascertain whether differences in anxiety levels were indeed driven by school environment influences, and to use more comprehensive and sensitive measures that could more accurately tap into the emotional and behavioral challenges of children and adolescents with ASD, including self-report measures. It is possible that self-reported differences may be even more attenuated than caregiver-reported emotional and behavioural difficulties. At the same time, the present study generally found few medium or large effect size differences in anxiety or other emotional/behavioural difficulties measured, also suggesting that there may be few differences in participants' mental health across the two educational settings, or that the informant-based measures used in the present study were not sensitive enough to detect other differences.

Nevertheless, our study highlights some potential implications for efforts to improve the school experience for students with ASD attending mainstream settings. Carefully considering social anxieties of youth with ASD in mainstream school settings and developing targeted support plans to reduce such worries is likely a helpful target of future support efforts. Future research would also do well to shift the attention away from examining solely whether individual child variables (such as age, IQ, gender, or adaptive functioning) are correlates of anxiety in ASD to explore family, school, social class, and other environmental and psychosocial factors influencing anxiety and broader psychopathology in children and youth with ASD (i.e., Rowley et al. 2012; Simonoff et al. 2013).

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Author Contributions HZ participated in the design of the study, carried out the data collection, performed the statistical analyses, participated in the interpretation of the data and drafted the manuscript. IM conceived the study, participated in its design, coordination and interpretation of the data and helped to draft the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of interest The authors report no conflicts of interest.

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