

Attributional style, positive illusory bias, and self-concept of children with and without attention deficit hyperactivity disorder

Angela F. Y. SIU^a, Z. YAN^b and F. C. HO^c

^a *Associate Professor, Department of Educational Psychology, The Chinese University of Hong Kong*

^b *Assistant Professor, Department of Curriculum and Instruction, The Education University of Hong Kong*

^c *Adjunct Assistant Professor, Department of Special Education and Counseling, The Education University of Hong Kong*

(Received 20 July 2015, Final revised version received 06 April 2016)

This study investigated the positive illusory bias, attribution of success and failure, and self-concept of children with attention deficit hyperactivity disorder (ADHD). The participants were 85 primary-school children, 45 of whom had been diagnosed with ADHD. The remaining 40 children made up the matched sample. The children in both groups were asked to work on two problem-solving tasks, one designated as “easy” and the other as “difficult,” and then to explain their success or failure in each task. A questionnaire was used to gather data on the children’s self-concept. Analysis of the children’s attributions of success and failure revealed no significant interaction between the groups (with ADHD vs. without ADHD) and locus of control (internal vs. external). However, children with ADHD tended to use external factors to explain their success, whereas those who did not have ADHD more frequently attributed their success to internal factors. Compared with children who did not have ADHD, children with ADHD scored much higher on various domains of self-concept, supporting recent findings on positive illusory bias. A Rasch analysis of the psychometric properties of the self-concept scale confirmed its suitability for use with the sample under study. Future research directions and practical implications are discussed.

Keywords: attributional style, positive illusory bias, self-concept, Rasch measurement, ADHD

Corresponding author: Angela F.Y. Siu, E-mail: afysiu@cuhk.edu.hk

Introduction

The Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder manifested behaviorally across multiple settings, such as work, school, and home. The pattern of behavior that characterizes ADHD can negatively affect individuals' social, educational, and professional performance. The symptoms of ADHD have been divided into three categories: (1) inattention, (2) hyperactivity and impulsivity, and (3) all of the above (American Psychiatric Association, 2011, DSM-V). The percentage of children between 4 and 17 years old diagnosed with ADHD increased throughout the last decade in the States, from 7.8% in 2003 to 9.5% in 2007 and 11.0% in 2011 (Centre for Disease Control and Prevention, 2013). The global increase of ADHD is also supported by the fact that the amount of ADHD medications had raised. For instance, prescription of methylphenidate in the U.K. has increased 9% from 2013 to 2014, reflecting the steady increase of diagnosis in ADHD (Care Quality Commission, 2015). Furthermore, diagnosis of ADHD is also not limited to Western countries. A meta-analysis that reviewed relevant studies world-wide, including regions such as North America, Europe, Asia and Middle East, found that ADHD has a global prevalence of 5.29% (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). As a result, the number of children with a history of ADHD increased by 42% in less than a decade. However, it is worth noting that there has been substantial controversy exists concerning its correct diagnosis (Ford-Jones, 2015; Kube, Petersen, & Palmer, 2002). Even so, insights into the experiences of children with ADHD are needed to assist in the development of effective interventions for this group.

Positive illusory bias

Despite their social and academic difficulties, children with ADHD often overestimate their own performance (see review in Owens et al., 2007). Hoza et al. (2002) referred to this phenomenon as the "positive illusory bias" (PIB), which is operationally defined as "a disparity between self-report of competence and actual competence such that the self-reported competence is substantially higher than actual competence" (Owens et al., 2007, p. 336). Taylor and Brown (1988) argued that positive self-evaluation is characteristic of normal human thought, and that people without disorders often overestimate their performance under circumstances that might be expected to cause depression or reduce motivation. According to Ohan and Johnston (2002), inflated self-perception is a self-protective mechanism that may form part of an individual's coping response. Positive illusions may encourage individuals to

persevere after failure, help them to cope with setbacks, and enhance their motivation, tenacity, and performance (Taylor & Brown, 1988). However, inflated self-assessment does not have positive outcomes for children with ADHD, who perform less well on tasks and give up more quickly than their non-ADHD peers (Hoza et al., 2001; Owens et al., 2007). The magnitude of PIB differs between children with and without ADHD. The discrepancy between perceived and actual competence is typically greater in samples of children with ADHD (Hoza et al., 2002; Owens and Hoza, 2003). In other words, children with ADHD exhibit greater PIB regarding their own competence than non-diagnosed children of similar ages. In this study, two variables were used to measure the differences in PIB between children with and without ADHD: attributional style and self-concept.

Attributional style

“Attributional style” is defined as the way in which an individual explains his/her success or failure. Weiner (1985, 2010) modeled the perceived causes of success and failure in three dimensions: locus of control, controllability, and stability. Success and failure are most commonly attributed to four factors: effort, ability, task difficulty, and luck. Ability and effort are internal factors, whereas task difficulty and luck are external factors. Ability and task difficulty are stable factors, but effort and luck are unstable; they may vary from moment to moment. Effort and task difficulty are regarded as controllable, and disability and luck as uncontrollable. Children with lower scores for self-concept usually attribute their failures to internal causes (e.g., ability and effort) and their successes to external factors (e.g., luck and task difficulty). McInerney (1999) suggested that children with high scores for self-concept tend to attribute their success to internal, stable factors. This attributional style increases children’s satisfaction with their performance, which in turn improves their self-concept and increases their motivation to perform well, whether academically or socially (e.g., King & McInerney, 2014; King, McInerney, & Watkins, 2012). In contrast, children with poor self-concept usually attribute their successes to external, unstable factors. Children who use this attributional style are unlikely to experience pride in their performance.

Compared with their non-ADHD peers, children with ADHD are more likely to view their own behavior as uncontrollable, less likely to attribute positive outcomes to internal causes such as ability and effort, and are more inclined to attribute positive outcomes to luck. On the other hand, children without ADHD attribute negative outcomes to similar causes (Collett & Gimpel, 2004; Johnson & Lee, 2005). However, findings regarding the

attributional style of children with ADHD have been inconclusive, whereby others indicate that compared with their non-diagnosed peers, children with ADHD are more likely to attribute academic success to luck and deny that failure was due to a lack of effort (e.g., Hoza et al., 2001). A review of attribution-based research on children with ADHD suggests that researchers' choice of methodology (e.g., questionnaires or experimental tasks) may significantly affect the interpretation of their results (Wiener et al., 2012). The aim of the current study was to experimentally investigate the differences between children with ADHD and those without in their attribution of success and failure, and to provide further insight on educational implications when working with children with ADHD.

Children with ADHD who exhibit PIB can expectedly be assumed to attribute their successes to internal, stable factors such as ability, and their failures to external, unstable factors such as luck. We also hypothesized that children with ADHD, but without PIB, to follow the opposite pattern of attribution. As well as contributing to the study of PIB by examining the attributional styles of children with ADHD, we used a standardized self-concept measure, the Piers-Harris Children's Self-Concept Scale (PHS) (Piers & Herzberg, 2002), to obtain concrete data on PIB.

Self-concept

The term "self-concept" refers to the perceptions of self that are formed through experiencing and interpreting one's environment (Shavelson, Hubner, & Stanton, 1976). Once regarded as unidimensional, self-concept is considered by most researchers today to possess multiple dimensions (Marsh, 2007; Cole et al. 2001; McConnell, 2011; Martin, 2014). Marsh and Martin (2011) confirmed that self-concept is not only an important outcome variable, but also affects other key educational, psychological, and behavioral outcomes. McInerney, Dowson, and Yeung (2005) showed that (academic) self-concept is affected by both internally referenced factors, such as self-processes (e.g., sense of competence), and externally referenced factors (the opinions of significant others, such as parents and peers). All positive external factors have been found to positively affect children's self-processes (Yeung, McInerney, & Ali, 2014).

Several measures have been developed to evaluate children's self-concept. Donnellan, Trzesniewski, and Robbins (2014) described in great detail the psychometric properties of measures such as self-liking and self-competence questionnaires (e.g., Tafarodi & Swann, 1995), Harter's series of

Self-Perception Profiles (e.g., Harter & Pikes, 1984), and several self-description questionnaires (e.g., Marsh, 1992). The Piers-Harris 2 Children's Self Concept Scale (PHS-2; Piers & Herzberg, 2002) is a multidimensional construct with six subscales in domains such as "freedom from anxiety," "behavioral adjustment," and "popularity." According to Kelley (2004), the PHS-2 is one of the best if not the best questionnaire of its type, and has been used to assess children with various types of disorder, including those with complex needs. It is often used in classroom settings to routinely screen for children who might benefit from further evaluation, and in clinical settings to determine specific areas of conflict, coping responses, defense mechanisms, and appropriate intervention techniques (Laugeson, Ellingsen, Sanderson, Tucci, & Bates, 2014). The PHS-2 test items are simple descriptive statements at a second-grade reading level. Children indicate whether each item applies to them by selecting a "yes" or "no" response. In fact, the PHS-2 has achieved high scores for reliability and validity with numerous ethnic groups in the U.S., Europe, and Africa (Gang, 2005; Piers & Herzberg, 2002). Su, Lou, Zhang, Xie, and Liu (2002) tested the suitability of the PHS for use with populations from mainland China, using a sample of 1,698 participants from 20 Chinese cities. They found strong evidence for the reliability of the Chinese version of the PHS. PHS scores were also found to be consistent with scores obtained on the Chinese version of the Conners Parent Symptom Questionnaire (Su, Li, Huang, Lou & Zhang, 2001) and the Conners Teacher Rating Scale (Su, Xie, Lou, Zhang, & Li, 2001). Flahive, Chuang, and Li (2011) also provided preliminary evidence of the applicability of the hierarchical structure and multidimensionality of the Chinese PHS-2 to samples of Taiwanese children.

The second edition of the PHS-2 (Piers & Herzberg, 2002) is also suitable for use with children with special educational needs, such as those with ADHD (Banks, Shevlin, & McCoy, 2012). Many of the items in the PHS-2 correlate with official definitions of emotional and behavioral difficulties. According to the Scottish Executive Educational Department (2001), for example, children with emotional and behavioral difficulties may be unhappy, emotionally volatile, and/or easily hurt; they are also likely to have learning difficulties, poor social skills, few friends, and low self-esteem, and to experience few positive child/adult interactions.

There is also evidence of a close relationship between self-concept and the attribution of success and failure (e.g., Erten & Burden, 2014). However, previous findings on the self-concept of children with ADHD are mixed. Some researchers report that children with ADHD score more highly than their non-

diagnosed peers on self-concept scales (Treuting & Hinshaw, 2001; Martin, 2012); others suggest that children with ADHD achieve lower scores for self-concept (Barber, Grubbs, & Cottrell, 2005); and still others report that self-concept does not differ significantly between children with and without ADHD (Bussing, Zima, & Perwien, 2000). In the current study, we measure the differences in self-concept between children with and without ADHD. It was expected children with ADHD would score higher than those children without ADHD in their self-concept scores. Further, it was expected that children with ADHD and PIB would have higher scores in self-concepts compared to their counterparts without PIB.

The present study

To measure the PIB exhibited by children with ADHD, we experimentally evaluated their attribution styles in response to success and failure scenarios. The following research hypotheses were proposed. (i) children with ADHD and those without differ significantly in their attribution of success and failure in tasks of varying difficulty; and (ii) the self-concept exhibited by children with ADHD differs significantly from those that do not have ADHD. We used multidimensional Rasch analysis to examine the psychometric properties of the six-domain PHS. The insights gained into the self-concept of ADHD children may help educators to plan effective intervention programs for this group of children.

Method

Participants

The participants comprised 85 elementary-school children from three “regular” (or “normal”) schools in major urban districts in Hong Kong.

Sample from children with ADHD

The ADHD sample consisted of 45 elementary-school children, of whom 26 were in lower grades (Grade One to Three) and 19 were in higher grades (Grade Four to Six). All these children were diagnosed by psychiatrists as having ADHD. However, the nature of the diagnostic process made it impossible to identify the children as predominantly inattentive, predominantly hyperactive, or both inattentive and hyperactive. Therefore, a broad ADHD designation was used. Among them, five were also reported to have learning disabilities; and eight out of these 45 indicated in the questionnaire that they were on medication. Judging from previous comparisons of samples of

children with ADHD and those without, our sample size of 45 was reasonable. Purdie, Hattie, and Carroll (2002) conducted a meta-analysis of 74 studies relating to the ADHD population, and found that sample sizes ranged from 1 to 161, with an average of 29 participants. All of the children with ADHD in the sample were from a Chinese-speaking background.

Sample from children without ADHD

The matched sample consisted of 40 normal healthy children, (i.e. those without ADHD) from the same schools and in the same grades as the children with ADHD. Twenty-one of the normal healthy group of children were in lower grades (Grade One to Three), and 19 were in higher grades (Grades Four to Six). The children with ADHD and those without were matched in terms of both grade level and academic achievement (defined as a child's average score in the three core subjects: English Language, Chinese Language, and Mathematics).

Measures

Piers-Harris 2 Children's Self Concept Scale (PHS-2; Piers & Herzberg, 2002). The PHS-2 is a 60-item self-reported measure used to assess children's self-concept. Participants choose either a "yes" or a "no" response for each item. Self-perception is assessed in six domains: behavioral adjustment, intellectual and school status, physical appearance and attributes, freedom from anxiety, popularity, and happiness and satisfaction. According to Piers and Herzberg (2002), the internal consistency reliability coefficients for the six domains range from 0.74 to 0.81. The inter-scale correlations between the total scores for the scale and the scores for the six subscales range from 0.73 to 0.84. Using a sample of Taiwanese children, Flahive, Chuang, and Li (2011) found that the six-part Chinese version of the PHS-2 yields results consistent with those reported by Piers and Herzberg.

Problem-solving task: Seven-piece puzzle. A two-item problem-solving task was given to each child. Task 1 was considered an easy task (in which the children were likely to succeed), and Task 2 was considered a difficult task (in which the children were likely to fail). The responses of 10 children of average intelligence were used to calibrate these levels of difficulty. To complete Task 1 (the success scenario), the participants were asked to assemble seven pieces of a puzzle into the shape of a bowl, with a time limit of 5 minutes. To complete Task 2 (the failure scenario), the participants were asked to create a square from the seven puzzle pieces, with the same time limit. After each task, the participants were asked to choose one of four explanations for their ability

(or inability) to correctly assemble the pieces. Those who succeeded in assembling the puzzle pieces were given the following response options: “I am lucky,” “I made a lot of effort,” “I am smart,” and “The task was too simple.” Those who failed to complete the task within the time limit were asked to choose one of the following four explanations: “I am unlucky,” “I didn’t make enough effort,” “I am stupid,” and “The task was too difficult.”

Procedure

First, children with ADHD were invited to participate in the study. The children in the matched sample were recruited after confirming the participation of the children with ADHD. The parents of both sets of children received letters from their children’s schools inviting their children to complete a questionnaire and to carry out two problem-solving tasks. Only children with signed consent from their parents were allowed to participate in the study. The test was administered in individual sessions lasting approximately 20 minutes each. The children were first asked to complete the questionnaire, and then to carry out the problem-solving tasks as described above. The simple task was attempted first. After completing the task, they were asked to choose one of four possible explanations for their success/failure in this task. The same procedure was followed for the more difficult task. Next, each child was asked to complete the self-administered test of self-concept.

Data analysis

Although traditional methods of analysis based on classical test theory suggest that the PHS (Piers, 1969) is a reliable instrument (e.g., Flahive et al., 2011), the Rasch model (Rasch, 1960) can provide a more rigorous assessment of its psychometric properties. The most significant drawback of traditional analytical methods concerns the untested assumption that the data input for analysis are in interval form. In fact, the raw data collected from Likert-type scales are usually ordinal data, which indicate only order, not relative meaning. Therefore, applying conventional analysis to raw ordinal data may yield misleading results (Bond & Fox, 2015; Wright, 1997). However, Rasch analysis can be used to transform raw ordinal scores into logit-scale measures with constant interval meaning. These measures can then be analyzed further (Linacre, 2000, 2006). In some studies of the psychometric properties of traditional instruments, Rasch analysis has revealed important empirical problems inaccessible by traditional means (e.g., Muís, Winne, & Edwards, 2009). Rasch analysis is widely used in educational research, both in the field of general education (e.g., Schulz & Fraillon, 2011; Wendt, Bos, & Goy, 2011; Yan & Cheng, 2015) and in studies of children with special educational needs

(e.g., Ho & Yan, 2014; Randall & Engelhard, 2010; Rawls, 2009). Rasch analysis increases both the accuracy of latent-trait assessment and the quality of measurement instruments (Bos, Goy, Howie, Kupari, & Wendt, 2011).

In this study, Rasch analysis was first used to examine the psychometric properties of the PHS-2. Standard Rasch analysis is typically used with unidimensional data. However, as the PHS-2 is a multidimensional scale with six unidimensional subscales, a multidimensional Rasch model (Adams, Wilson, & Wang, 1997) was required. The multidimensional Rasch analysis was carried out using ConQuest version 2.0 software (Wu, Adams, Wilson, & Haldane, 2007). Several criteria, such as item-fit statistics (outfit and infit mean square; MNSQ) and Rasch reliability, were used to measure the quality of the items and the scale. After checking the psychometric properties of the scale, the Rasch-calibrated person measures (in this case, children's self-concept levels) were subjected to further analysis, such as t-tests, to investigate the differences in self-concept between children with and without ADHD. Chi-square tests were conducted to determine whether significant interaction effects existed between the groups (those with ADHD vs those without ADHD) and attribution styles (internal locus of control vs external locus of control; stable vs unstable).

Results

Interaction effects between groups (children with ADHD vs children without ADHD) and attribution styles

The causes to which children with ADHD and those without ADHD ascribed their success in Task 1 and their failure in Task 2 were compared to determine whether significant interaction effects existed between the groups (with ADHD vs. without ADHD) and locus of control (internal vs external), or between group (with ADHD vs without ADHD) and stability (stable vs unstable). The results for the success scenario (Task 1), shown in Table 1, indicate that no significant interaction occurred between group (with ADHD vs without ADHD) and locus of control (internal vs external) ($\chi^2 = 3.236$, $p = 0.072$), but that the children with ADHD were more likely to use external factors to explain their successful performance, whereas the normal, healthy children (i.e. those without ADHD) were more likely to attribute their success to internal factors. The children in both groups tended to ascribe their success to unstable factors. No interaction was detected between group (with ADHD vs without ADHD) and stability (stable vs unstable) ($\chi^2 = 0.229$, $p = .633$).

The members of both groups tended to ascribe their failure in Task 2 (the failure scenario) to external factors. No interaction was detected between group (with ADHD vs without ADHD) and locus of control (internal vs external) ($\chi^2 = 3.207, p = .073$). The children in both groups were found to be more likely to attribute their failure to stable factors. The interaction effect between group (with ADHD vs without ADHD) and stability (stable vs unstable) was not statistically significant ($\chi^2 = 0.680, p = .410$).

Table 1. *Chi-Square tests of conditions and attribution type*

			Internal-External		Stable-Unstable	
			Internal	External	Stable	Unstable
Success scenario	ADHD	Count	13	22	8	27
		Expected Count	16.3	18.8	8.8	26.3
	Non-ADHD	Count	13	8	6	15
		Expected Count	9.8	11.3	5.3	15.8
		Chi-Square test	$\chi^2=3.236, p=.072$		$\chi^2=0.229, p=.633$	
Failure scenario	ADHD	Count	11	27	22	16
		Expected Count	8.1	29.9	23.6	14.4
	Non-ADHD	Count	3	25	19	9
		Expected Count	5.9	22.1	17.4	10.6
		Chi-Square test	$\chi^2=3.207, p=.073$		$\chi^2=0.680, p=.410$	

Comparison of self-concept of children with and without ADHD

First, the Rasch model was used to evaluate the psychometric properties of the PHS-2. Of the 77 items in the PHS-2, eight failed to fit the Rasch model; i.e., their infit or outfit MNSQ values were outside the 0.5 to 1.5, which is usually regarded as an acceptable range (Linacre, 2006). These non-fitting items comprised two items each from the freedom from anxiety scale (SCO10, SCQ35), the popularity scale (SCQ39, SCQ54), and the behavioral-adjustment scale (SCQ30, SCQ60), and one item each from the happiness and satisfaction scale (SCQ60) and the intellectual and school status scale (SCQ39). These items were removed from the scale one by one. After each item was removed, the Rasch analysis was re-run to check whether the remaining items fitted the

Rasch model. After removing all of the above-mentioned items, another six items no longer fitted the Rasch model: two items from the freedom from anxiety scale (SCQ7, SCQ56) and one item each from the popularity scale (SCQ51), the happiness and satisfaction scale (SCQ35), the behavioral-adjustment scale (SCQ13), and the physical appearance and attributes scale (SCQ50). These items were removed from the scale, and the Rasch analysis was repeated. The process was repeated until all of the remaining items fitted the Rasch model.

A total of 14 items failed to fit the Rasch model and were thus removed from the scale. The remaining items were used to calculate the Rasch reliability of each subscale. Table 2 presents the number of items in each subscale of the PHS-2 and the Rasch EAP/PV reliability for each subscale. Both these results and the values calculated for Cronbach's alpha indicate that the subscales were all satisfactorily reliable, with the exception of the physical appearance and attributes subscale.

Table 2. *Reliabilities and number of items of subscales*

Subscale	Number of items in original scale	Number of items in revised scale	EAP/PV reliability	Cronbach alphas
Freedom from Anxiety	14	10	0.90	.853
Popularity	12	9	0.92	.779
Happiness & Satisfaction	10	8	0.89	.764
Behavioral Adjustment	14	11	0.92	.870
Intellectual & School Status	15	14	0.84	.743
Physical Appearance & Attributes	12	11	0.61	.452

As Rasch-calibrated person measures are interval data, they can be analyzed further. An independent t-test was conducted to compare the person

measures estimated for the children with and without ADHD. Compared with their peers whom do not have ADHD, the children with ADHD received significantly ($p < .01$) higher self-concept scores for all of the subscales except the physical appearance and attributes subscale. On the latter subscale, the children without ADHD received higher (but not significantly higher) scores than the children with ADHD. Table 3 presents the means of the person measures for the six dimensions of self-concept, organized by student group.

Table 3. *Comparisons of self-concept between children with ADHD and those without*

	Children with ADHD		Children without ADHD		Mean difference	<i>t</i>	<i>p</i>
	Mean ^a	S.D.	Mean ^a	S.D.			
Freedom from Anxiety	0.56	1.20	-1.18	1.01	1.74	7.179	.00**
Popularity	0.37	0.88	-1.18	0.90	1.55	8.054	.00**
Happiness & Satisfaction	0.56	0.78	-0.60	0.57	1.16	7.696	.00**
Behavioral Adjustment	0.37	0.97	-0.88	0.72	1.24	6.778	.00**
Intellectual & School Status	0.34	0.77	-0.46	0.96	0.80	4.253	.00**
Physical Appearance & Attributes	0.21	0.89	0.26	0.65	-0.05	-0.306	.76

Note: ^a All measures are in Rasch logits.
** $p < .01$

Discussion

This study investigated the self-concept and attribution styles of children with ADHD and those without. In the success scenario (Task 1), the attributional styles of the two groups differed only in terms of locus of control. The members of the normal, healthy group (i.e. those without ADHD) tended to ascribe their success to internal factors, whereas most of the children with ADHD attributed their success to external factors. However, this difference was not statistically significant. Research has shown that children with ADHD are less likely than those without ADHD to attribute positive outcomes to internal causes such as ability and effort, and more inclined to attribute positive outcomes to luck. The members of both groups tended to use external factors to explain their failure in Test 2 (the failure scenario). Both groups ascribed their successes to unstable factors and their failures to stable factors.

In normal circumstances, children with high scores for self-concept are expected to attribute their successes to internal, stable factors and their failures to external, unstable factors. The results of this study showed that the children with ADHD and those without exhibited similar attributional styles, although the children with ADHD were more likely to ascribe their successes to external factors.

Multidimensional Rasch analysis confirmed the validity of the six-domain structure of the PHS. However, further improvements could be made to enhance the quality of the instrument. Fourteen items failed to fit the Rasch model: four items from the freedom from anxiety scale, three items from the popularity scale, three items from the behavioral-adjustment scale, two items from the happiness and satisfaction scale, and one item each from the intellectual and school status scale and the physical appearance and attributes scale. These non-fitting items were removed from the scale, and the remaining 63 items were used to calculate the Rasch reliability of each subscale. With the exception of the physical appearance and attributes scale, all of the subscales received good Rasch-reliability scores (ranging from .84 to .92). The reliability of the physical appearance and attributes scale was calculated at 0.61. The results also showed that the average difficulty of the remaining items in each subscale closely matched the children's mean level of self-concept in each respective subscale. In summary, the revised PHS questionnaire was found to be an appropriate tool to assess the self-concept of the sampled participants. However, future researchers should take care when removing items from the scale. Some items that are relevant and conceptually valid may be flagged as

failing to fit the Rasch model due to certain characteristics of the sample, e.g., sample size and participant demographics. Future researchers should carefully check the properties of each item with reference to the empirical data set, and more closely examine context to identify the potential underlying reasons for items' lack of fit; as noted by Messick (1995, p. 6.), "validity is an evolving property and validation is a continuing process." The children's self-concept levels were distributed across a wider range of the latent-trait scale than the item-difficulty values. This discrepancy was particularly prominent in the happiness and satisfaction scale and the physical appearance and attributes scale. Several more items—some more difficult and some easier—could be added to these two subscales to tap a wider range of latent-trait levels. In addition, items could be added to the freedom from anxiety scale to bridge the .85 logit gap between items 10 and 12. The inclusion of more items may improve the reliability of these subscales, and in turn the reliability of the whole scale.

Our second hypothesis, that children with and without ADHD differ significantly in their levels of self-concept, was supported. This is consistent with previous findings on PIB and other themes (Hoza et al., 2002; 2004; Nigg, 2006). As theorized by Barkley (1997; 2006), the deficits in inhibition and executive functioning exhibited by children with ADHD may affect their ability to accurately judge their competence and performance using feedback from their surroundings. The sample used in the current study offered no conclusive explanations of the significant difference in self-evaluation between the children with ADHD and those without. However, positively biased self-views may serve as a coping strategy for children with ADHD, helping to minimize the stress they experience in dealing with daily challenges. Further work is needed to conclusively explain the difference in self-concept between these two groups of children.

Limitations of the study

The limitations of the study, and their implications for the interpretation of the findings, should be acknowledged. First, the sample used in the study was small, because it is fairly difficult to recruit participants with ADHD. Therefore, our findings may not be generalizable to larger populations of children with ADHD, especially as we did not distinguish between the characteristics of ADHD subgroups (such as inattention and hyperactivity) in our small sample. Along the line of diagnosis, given that the prevalence of misdiagnosis as described in the literature, it is possible that some of the ADHD sample in this study were misdiagnosed; hence their results may not be

generalizable. Second, children's self-concept changes as they develop. Although the participants were all elementary-school children, they were drawn from a fairly wide age range. Further research should be limited to a single age group to enable researchers to control for the stage of development of children's self-concept. Third, in terms of measurement selection, we relied on self-report, which may create social desirability. The use of a parallel other-informant report may enable us to make direct comparisons between potential discrepancy scores (Mikami, Calhoun, & Abikoff, 2010). With particular reference to the validity of PHS, its psychometric properties should be further analyzed by correlating its subscales with those of other questionnaires on self-concept, such as Marsh's (1988) Self-Description Questionnaire and Harter's (1982) Self-Perception Profile for Children. Fourth, the use of a separate set of matched children in doing discrepancy analysis may be less valid. In fact, the criterion should be convergent assessment of the same child's self-perceptions. That is, differences in scores can be calculated by subtracting a criterion (e.g., teacher report) from the child's report of self-competence, with higher scores indicating over-estimations by the child.

Implications of this study

Despite limitations, the findings from this study showed that children with ADHD scored much higher on various domains of self-concept when compared to children without ADHD. This result also supported recent findings on positive illusory bias for children with ADHD. Our study extends this research and raises the possibility that PIB plays a role in the self-concept of children with ADHD as these children tended to use external factors to attribute their success. Although speculative, we believe that it is this PIB that leads to positive self-concept. Another educational implication is that when working with children with ADHD, it may be helpful to conduct an attribution interview so teachers may know more about how these children see controllability and locus of causality. If children with ADHD view their behaviors as uncontrollable (i.e. "success" is attributed to external factors and not by themselves), this may suggest that they are aware of their difficulties but they do not have strategies to work on them. Such information on attributions among these children should be taken into account when planning for intervention. Strategies that are designed with a focus on reducing subjectivity with which these children with ADHD assess their own abilities may be helpful.

References

- Adam, R.J., Wilson, M., & Wang, W.C. (1997). The multidimensional random coefficients multinomial logit model. *Applied Psychological Measurement, 21*, 1-23.
- American Psychiatric Association. (2011). *Diagnostic and statistical manual of mental disorders* (5th ed.) (DSM-V). American Psychiatric Association, Arlington, VA.
- Banks, J., Shevlin, M., & McCoy, S. (2012). Disproportionality in special education: Identifying children with emotional behavioral difficulties in Irish primary schools. *European Journal of Special Needs Education, 27*, 219-235.
- Barber, S., Grubbs, L., Cottrell, B. (2005). Self-perception in children with attention deficit/hyperactivity disorder. *Journal of Pediatric Nursing, 20*, 235-245
- Barkley, R.A. (1997). Behavioral inhibition, sustained attention and executive functions: constructing a unifying theory of ADHD. *Psychological Bulletin, 121*, 65-94.
- Barkley, R.A. (2006). (ed). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment*. New York, NY: Guilford Press.
- Bond, T. G., & Fox, C. M. (2015). *Applying the Rasch model: Fundamental measurement in the human sciences* (3rd ed.). New York, NY: Routledge.
- Bos, W., Goy, M., Howie, S.J., Kupari, P., & Wendt, H. (2011). Rasch measurement in educational contexts Special issue 2: Applications of Rasch measurement in large-scale assessments. *Educational Research and Evaluation, 17*, 413-417.
- Buckroyd, J., and B. Flitton. (2004). The measurement of self-concept in children with complex needs. *Emotional and Behavioral Difficulties, 9*, 131-9.
- Bussing, R., Zima, B.T., Perwien, A.R. (2000). Self-esteem in special education children with ADHD: Relationship to disorder characteristics and medication use. *Journal of the American Academy of Child & Adolescent Psychiatry, 39*, 1260-1269
- Care Quality Commission (2014). *The Safer Management of Controlled Drugs Annual Report 2013*. Retrieved from http://www.cqc.org.uk/sites/default/files/20150716_safer_management_controlled_drugs_annual_report_2014.pdf

- Centers for Disease Control and Prevention.(2013). Mental health surveillance among children — United States 2005–2011.*MMWR Survey Summary* 62, 1-35.
- Collett, B.R., & Gimpel, G.A. (2004).Maternal and child attributions in ADHD vs non-ADHD populations. *Journal of Attention Disorders*, 7, 187-196.
- Cole, D.A., Maxwell, S. E., Martin, J. M., Peeke, L.G., Seroczynski, A.D., Tram, J. M., & Maschman, T. (2001). The development of multiple domains of child and adolescent self-concept: A cohort sequential longitudinal design. *Child Development*, 72(6), 1723-1746.
- Donnellan, M.B., Trzeniewski, K.H., & Robins, R.W. (2014).Measures of self-esteem. In G. Boyle, D. Saklofske, & G. Matthews (Eds).*Measures of Personality and Social Psychological Constructs*. (pp.131-157). New York: NY: Academic Press.
- Erten, I.H., & Burden, R.L. (2014).The relationship between academic self-concept, attributions and L2 achievement. *System*, 42, 391-401.
- Flahive, M. W., Chuang, Y. C. & Li, C. M. (2011).Reliability and validity evidence of the Chinese Piers–Harris Children’s Self-Concept Scale Scores among Taiwanese children. *Journal of Psychoeducational Assessment*, 29, 273-285.
- Gang, S. (2005). *The use of Piers-Harris Children’s Self-Concept Scale to measure the multidimensional structural model of self-concept for children in second grade* (Unpublished doctoral dissertation).University of Iowa, Iowa City.
- Harter, S. (1982).The perceived competence scale for children. *Child Development*, 53, 87-97.
- Harter, S., & Pike, R. (1984).The pictorial scale of perceived competence and social acceptance for young children. *Child Development*, 55, 1969-1982.
- Ho, F. C., & Yan, Z. (2014). Reading patterns of students with learning disabilities in Chinese: A Rasch analysis. *Educational Psychology*, 34, 305-322.
- Hoza, B., Gerdes, A. C., Hinshaw, S. P., Arnold, E. L., Pelham, W. E., Molina, B. S. G. et al. (2004). Self-perceptions of competence in children with ADHD and comparison children. *Journal of Consulting and Clinical Psychology*, 72, 382–391.
- Hoza, B., Pelham, W. E., Dobbs, J., Owens, J. S., & Pillow, D. R. (2002). Do boys with Attention-Deficit/Hyperactivity Disorder have positive illusory self-concepts? *Journal of Abnormal Psychology*, 111, 268–278.

- Hoza, B., Pelham, W. E., Waschbusch, D. A., Kipp, H., & Owens, J. S. (2001). Academic task persistence of normally achieving ADHD and control boys: performance, self-evaluations, and attributions. *Journal of Consulting and Clinical Psychology, 69*, 271–283.
- Johnson, C., & Lee, C.M. (2005). Children's attributions for their own versus others' behaviors: Influence of actor vs observer differences. *Journal of Applied Developmental Psychology, 26*, 314-328.
- Kelley, M.L. (2004). Review of the Piers-Harris Children's Self-Concept Scale: The way I feel about myself. *Mental Measurements Yearbook Database, 16*, London: Ohio University.
- King, R.B., &McInerney, D.M. (2014). Mapping changes in students' English and math self-concepts: a latent growth model study. *Educational Psychology, 34*, 581-597.
- King, R.B., McInerney, D.M., & Watkins, D.A. (2012). Studying for the sake of others: the role of social goals on academic engagement. *Educational Psychology, 32*, 749-776.
- Kube D, Petersen M, Palmer F. (2002). Attention deficit hyperactivity disorder: Comorbidity and medication use. *Clinical Pediatric, 41*, 461-469.
- Laugeson, E.A., Ellingsen, R., Sanderson, J., Tucci, L., & Bates, S. (2014). The ABC's of teaching social skills to adolescents with autism spectrum disorder in the classroom. *Journal of Autism and Developmental Disorders, 44*, 2244-2256.
- Linacre, J.M. (2000). New approaches to determining reliability and validity. *Research Quarterly for Exercise and Sport, 71*, 129–136.
- Linacre, J. M. (2006). *A user's guide to WINSTEPS/MINISTEPS: Rasch-model computer programs*. Chicago, IL: Winsteps.com.
- Marsh, H.W. (1988). *The Self-Description Questionnaire (SDQ-1): A theoretical References and empirical basis for the measurement of multiple dimensions of preadolescent self-concept: A test manual and research monograph*. San Antonio, TX: Psychological Corporation.
- Marsh, H.W. (1992). *The Self-Description Questionnaire (SDQ-II): A theoretical References and empirical basis for the measurement of multiple dimensions of preadolescent self-concept: A test manual and research monograph*. Macarthur, New South Wales, Australia: University of Western Sydney.
- Marsh, H.W. (2007). *Self-concept theory, measurement and research into practice: The role of self-concept in educational psychology*. Leicester: British Psychological Society.

- Martin, A.J. (2012). *Attention Deficit Hyperactivity Disorder (ADHD), perceived competence, and self-worth: Evidence and implications for students and practitioners*. In D.Hollar (Ed.). *Handbook on children with special health care needs*. Springer: New York.
- Martin, A.J. (2014). Academic buoyancy and academic outcomes: Towards a further understanding of students with ADHD, students without ADHD, and academic buoyancy itself. *British Journal of Educational Psychology*, 84, 86-107.
- McConnell, A. R. (2011). The multiple self-aspects framework: Self-concept representation and its implications. *Personality and Social Psychology Review*, 15(1), 3-27.
- Marsh, H.W., & Martin, A.J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology*, 81, 59-77.
- McInerney, D. M. (1999). What should teachers do to get children to want to read and write? Motivation for literacy acquisition. In A. J. Watson & L. R. Giorcelli (Eds.), *Accepting the literacy challenge* (pp. 95-115). Sydney, Australia: Scholastic.
- McInerney, D.M., Dowson, M., & Yeung, A.S. (2005). Facilitating conditions for school motivation: construct validity and applicability. *Educational and Psychological Measurement*, 65, 1-21.
- Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist*, 50, 741 - 749.
- Mikami, A. Y., Calhoun, C. D., & Abikoff, H. B. (2010). Positive illusory bias and response to behavioral treatment among children with attention-deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 39, 373-385.
- Muís, K.R., Winne, P.H., & Edwards, O.V. (2009). Modern psychometrics for assessing achievement goal orientation: A Rasch analysis. *British Journal of Educational Psychology*, 79, 547-576.
- Nigg, J.T. (2006). *What causes ADHD? Understanding what goes wrong and why*. New York: Guilford.
- Ohan, J. L., & Johnston, C. (2002). Are the performance overestimates given by boys with ADHD self-protective? *Journal of Clinical Child Psychology*, 31, 230-241.
- Owens, J.S., & Hoza, B. (2003). The role of inattention and hyperactivity/impulsivity in the positive illusory bias. *Journal of Consulting and Clinical Psychology*, 71, 680-691.

- Owens, J.S., Goldfine, M.E., Evangelista, N.M., Hoza, B., & Kaiser, N.M. (2007). A critical review of self-perceptions and the positive illusory bias in children with ADHD. *Clinical Child and Family Psychological Review, 10*, 335-351.
- Piers, E.V. (1969). *Manual for the Piers-Harris Children's Self-Concept Scale*. Nashville, TN: Counselor Recordings and Tests.
- Piers, E.V., & Herzberg, D.S. (2002). *Piers-Harris 2 Children's Self-Concept Scale*. Los Angeles, CA: Western Psychological Services.
- Polanczyk G, de Lima M.S., Horta B.L., Biederman, J, Rohde, L.A. (2007). The worldwide prevalence of ADHD: a systematic review and meta-regression analysis. *American Journal of Psychiatry, 164*(9) 42-8.
- Randall, J., & Engelhard, G. (2010). Using confirmatory factor analysis and the Rasch model to assess measurement invariance in a high stakes reading assessment. *Applied Measurement in Education, 23*(3), 286-306.
- Rasch, G. (1960/1980). *Probabilistic models for some intelligence and attainment tests*. (Copenhagen, Danish Institute for Educational Research), expanded edition (1980) with foreword and afterword by B.D. Wright. Chicago: University of Chicago Press.
- Rawls, A. M. W. (2009). *The importance of test validity: An examination of measurement invariance across subgroups on a reading test*. Unpublished PhD Dissertation, University of South Carolina.
- Schulz, W., & Fraillon, J. (2011). The analysis of measurement equivalence in international studies using the Rasch model. *Educational Research and Evaluation, 17*(6), 447-464.
- Scottish Executive Educational Department. (2001). *Better behavior – better learning*, Edinburgh: Scottish Executive.
- Shavelson, R. J., Hubner, J. J. & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research, 46*, 407-441.
- Su, L., Li, X., Huang, C., Lou, X., & Zhang, J. (2001). Norms of the Conners Parent Symptom Questionnaire in Chinese urban children. *Chinese Journal of Clinical Psychology, 9*, 241-243.
- Su, L., Lou, X., Zhang, J. Xie, G., & Liu, Y. (2002). Norms of the Piers-Harris Children's Self-Concept Scale of Chinese urban children. *Chinese Mental Health Journal, 16*, 31-34.
- Su, L., Xie, G., Lou, X., Zhang, J., & Li, X. (2001). Norms of the Conners Teacher Rating Scale of Chinese urban children. *Chinese Journal of Practical Pediatrics, 12*, 29-33

- Tafarodi, R.W., & Swann, W.B. Jr. (1995). Self-liking and self-competence as dimensions of global self-esteem. *Journal of Personality Assessment*, 65, 322-342.
- Taylor, S.E., & Brown, J.D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, 103, 193-210.
- Treuting, J., & Hinshaw, S. (2001). Depression and self-esteem in boys with ADHD:
Associations with comorbid aggression and explanatory attributional mechanism. *Journal of Abnormal Psychology*, 29, 23-29.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92, 548-573.
- Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist*, 45, 28-36.
- Wiener, J., Malone, M., Varma, A., Markel, C., Biondic, D., Tannock, R., & Humphries, T. (2012). Children's perceptions of their ADHD symptoms: Positive illusions, attributions, and stigma. *Canadian Journal of School Psychology*, 27(3), 217-242.
- Wendt, H., Bos, W., & Goy, M. (2011). On applications of Rasch models in international comparative large-scale assessments: a historical review. *Educational Research and Evaluation*, 17(6), 419-446.
- Wright, B.D. (1997). A history of social science measurement. *Educational Measurement: Issues and Practice*, 16, 33-45.
- Wu, M. L., Adams, R. J., Wilson, M. R., & Haldane, S. A. (2007). *ACERConQuest, Version 2.0: generalized item response modelling software*. Camberwell, Victoria: Australian council for Educational Research.
- Yan, Z., & Cheng, E. C. K. (2015). Primary teachers' attitudes, intentions and practices regarding formative assessment. *Teaching and Teacher Education*, 45, 128-136.
- Yeung, A.S., McInerney, D.M., & Ali, J. (2014). Asian students in Australia: sources of the academic self. *Educational Psychology*, 14, 598-618.