

## Science Self-Concept and Self-Efficacy: Their Structure and Relation to 3<sup>rd</sup> Grade Academic Achievement

Kristin M. Gagnier<sup>1</sup>, Steven Holochwost<sup>2</sup>, Kelly R. Fisher<sup>1</sup>, & Akilah S. Nelson<sup>3</sup>

Johns Hopkins University<sup>1</sup>, WolfBrown<sup>2</sup>, Prince Georges County Public Schools<sup>3</sup>

Students' self-perceptions, including academic self-concept and self-efficacy, influence academic achievement, even in young children (Guay et al. 2003). Academic self-concept refers to a student's knowledge and perceptions about his/her academic competencies (Ferla, et al., 2009; Wigfield & Karpathian, 1991), whereas academic self-efficacy refers to a student's beliefs that s/he can master knowledge and skills necessary to succeed in an academic discipline (Ferla et al 2009.; Schunk, 1991). A growing body of work suggests that young children hold differentiated self-perceptions (Jacobs et al. 2002; Marsh et al., 1991), for example, perceiving themselves as capable at math but not sports. While work has examined self-perceptions for a variety of domains including verbal and mathematics skill, physical ability, and physical appearance, this work has not been extended to the domain of science. The purpose of our work was to (1) adapt domain-general academic self-concept and self-efficacy measures to domain-specific measures for science, (2) examine how they perform in a sample of 3<sup>rd</sup> graders who are traditionally underrepresented in science, and (3) explore their relation to academic performance at the end of third grade. Probing children's science self-perceptions will advance our understanding of the relation between these perceptions and achievement, and potentially inform interventions aimed at developing underrepresented students' motivation and confidence in science.

To investigate children's science self-perceptions and their connection to academic achievement, we administered three measures to 204 third-grade students: (1) general academic self-concept (e.g. I am good at school; Marsh, 1990), (2) science self-concept (e.g. I am good at science; adapted from Marsh, 1990), and (3) science self-efficacy (e.g. I can do even the hardest work in science if I try, adapted from Midgley et al., 2000). All statements were rated on a 5-point scale from strongly disagree (1) to strongly agree (5). We explored the structure of these measures and examined how they predicted end-of-year grades in science, math, reading, and performance on two standardized tests; the Partnership for Assessment of Readiness for College (PARCC), which assess grade-level skill in math and reading and the Otis-Lennon School Ability Test (OLSAT) which assesses verbal, nonverbal, and quantitative skill. Preliminary analyses focused on establishing internal consistency of each measure and examining convergent validity and predictive validity.

As seen in Table 1, 94% of our sample was African American and Hispanic, two traditionally underrepresented populations in science (Hurtado et al., 2010). As shown in Table 2, science self-concept and self-efficacy measures were internally consistent, ranging from  $\alpha=.80$  to  $\alpha=.86$ . The correlation matrixes shown in Table 1b indicate that all three measures were related to each other. Science self-concept is differentiated from general academic self-concept, and science self-concept and science self-efficacy were collinear. These findings indicate that 3<sup>rd</sup> graders views of their science competency (science self-concept) and their confidence that they can master science (science self-efficacy) are overlapping, but not the same.

We also sought to examine the measures' predictive capacity. Academic general self-concept was modestly correlated with final grades in science, math, and reading ( $r = [.21-.23]$ ) and PARCC math scores ( $r = .18$ ). Science self-concept was associated with final grades in reading ( $r = .13, p < .10$ ) after controlling for school, gender, and race/ethnicity, but not final grades in math or science ( $r = n.s$ ). Science self-efficacy was modestly correlated with final grades in science ( $r = .12, p < .10$ ) and PARCC Math scores ( $r = .15, p < .05$ ), after controlling for school, gender, and race/ethnicity.

This work makes two contributions to the literature. First, it offers two measures of children's self-perceptions of science, which perform well in a sample of traditionally underrepresented students. Second, it extends the growing body of work on children's differentiated self-perceptions in science. Implications for understanding factors that contribute to academic achievement in traditionally underserved populations will be discussed and situated within the broader conversation regarding avenues for promoting motivation and confidence in science.

Table 1

Demographic Makeup	Percentage
<b>Gender</b>	
Female	54.9%
Male	45.1%
<b>Race/Ethnicity</b>	
African American	73.5%
American Indian	0.5%
Asian	1.0%
Caucasian	3.9%
Hispanic	20.6%
Multi-Racial	0.5%

Table 2a

Measure	Central Tendency		Skew		Internal Consistency <sup>1</sup>
	M	SD	G <sub>1</sub>	SE	
General Academic Self-Concept (Marsh 1990)	2.62	0.72	-.55	.17	.80
Science Self-Concept (Adapted; Marsh 1990)	2.77	0.74	-.69	.17	.86
Science Self-Efficacy (Adapted; Midgley et al., 2000)	2.80	0.71	-.59	.17	.81

Table 2b

	1.	2.	3.
1. General Academic Self-Concept (Marsh 1990)		.49**	.50**
2. Science Self-Concept (Adapted; Marsh 1990)			.70**
3. Science Self-Efficacy (Adapted; Midgley et al., 2000)			

<sup>1</sup> Cronbach's Alpha;  $N = [203, 204]$ , depending on the measure in question

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 $p < .01$

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