Science Self-Concept and Self-Efficacy: Their Structure and Relation to 3rd Grade Academic Achievement

Kristin M. Gagnier[1], Steven Holochwost[2], Kelly R. Fisher[1], & Akilah S. Nelson[3]
Johns Hopkins University[1], WolfBrown[2], Prince Georges County Public Schools[3]

BACKGROUND

Students' self-perceptions influence academic achievement (Guay et al. 2003).

- *Academic self-concept*: Knowledge and perceptions about academic competencies (Ferla, et al., 2009; Wigfield & Karpathian, 1991)
- *Academic self-efficacy*: Belief that you can master knowledge and skills necessary to succeed (Ferla et al 2009.; Schunk, 1991).

Young children hold differentiated self-perceptions regarding their mathematical, verbal, and physical skills and physical appearance (Jacobs et al. 2002; Marsh et al., 1991). Yet, their scientific self-perceptions are unknown.

Our Goal: Explore science self-perceptions and their connection to academic achievement

- Adapt domain-general academic self-concept and self-efficacy measures for science
- Examine how they perform in a sample of 3rd graders who are traditionally underrepresented in science
- Explore their relation to academic performance

Potential Impact:

- Advance understanding of the relation between scientific self-perceptions and achievement
- Inform interventions to support underrepresented students' motivation and confidence in science

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METHOD

Administered 3 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)
(3) Science self-efficacy (e.g. I can do even the hardest work in science if I try, adapted from Midgley et al., 2000)

- Rated on 5-point scale (strongly disagree = 1 to strongly agree = 5)

Explored measure structure and how they predicted end-of-year grades in science, math, reading, and two standardized tests:

- Partnership for Assessment of Readiness for College (PARCC, grade-level math and reading)
- Otis–Lennon School Ability Test (OLSAT; verbal, nonverbal, and quantitative skill)

RESULTS

- Sample was 94% African American and Hispanic

TABLE 1: Demographic Makeup	Percentage
Gender	
Female	54.9%
Male	45.1%
Race/Ethnicity	
African American	73.5%
American Indian	0.5%
Asian	1.0%
Caucasian	3.9%
Hispanic	20.6%
Multi-Racial	0.5%

Internal consistency & convergent validity

- Measures were internally consistent (Table 2A)
- Science self-concept is differentiated from general academic self-concept (Table 2B)
- Self-concept and self-efficacy are collinear (Table 2B)

TABLE 2A: Measure	Central Tendency		Skew		Internal Consistency
	M	SD	G_1	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

Cronbach's Alpha; N = [203, 204], depending on the measure in question

TABLE 2B: Measure	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)			

Predictive validity

- Academic self-concept & grades in science, math, and reading (r = [.21 to .23])
- Academic general self-concept & PARCC math (r = .18)
- Science self-concept & grades in reading* (r = .13, p < .10)
- Science self-concept & math and science grades* (r = *n.s*)
- Science self-efficacy & grades in science* (r = .12, p < .10)
- Science self-efficacy & PARCC math* (r = .15, p < .05)

* After controlling for school, gender, and race/ethnicity

CONCLUSIONS

- Offer two measures of children's self-perceptions of science, which perform well in a sample of traditionally underrepresented students
- Extends work on differentiated self-perceptions in science.

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