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Brief Report

Gender and engineering aptitude: Is the color of science, technology, engineering, and math materials related to children's performance?



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ABSTRACT

To investigate gender stereotypes, demonstrated engineering aptitude, and attitudes, children ($N = 105$) solved an engineering problem using either pastel-colored or primary-colored materials. Participants also evaluated the acceptability of denial of access to engineering materials based on gender and counter-stereotypic preferences (i.e., a boy who prefers pastel-colored materials). Whereas material color was not related to differences in female participants' performance, younger boys assigned to pastel materials demonstrated lower engineering aptitude than did other participants. In addition, results documented age- and gender-related differences; younger participants, and sometimes boys, exhibited less flexibility regarding gender stereotypes than did older and female participants. The findings suggest that attempts to enhance STEM (science, technology, engineering, and math) engagement or performance through the color of STEM materials may have unintended consequences.

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Introduction

Young children naturally seek to understand how the world works. Children, however, often lose interest in STEM (science, technology, engineering, and math) disciplines over time ([National](#)

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Science Board, 2014). New research is needed to provide insight into how to maintain strong STEM interest across childhood to create a pipeline for futures in STEM careers. The goal of the current research were to examine whether the color of STEM toys (engineering and building materials) is related to children's demonstrated engineering aptitude. Little is known about the impact of varying the color of engineering materials on demonstrations of engineering aptitude or skill in solving engineering problems. Research is also needed to identify how children perceive materials that vary in color and to clarify whether they hold stereotypic attitudes related to access to and preference for materials that are stereotypic consistent (pastel for girls and primary for boys) or stereotype inconsistent (primary for girls and pastel for boys). This will provide insight into whether attempts by toy manufacturers to attract female interest in STEM toys through color (marketing pastel-colored materials to girls) is an apt pathway to enhance STEM interest and skills.

A focus on building the STEM skills of youths is important given the troubling patterns regarding the STEM workforce. Students' interest in STEM declines beginning in fifth grade (Guzey, Moore, & Harwell, 2016). Because many STEM programs focus on older students, the need to build interest from early ages is imperative. In addition, disparities in the representation of women in the STEM workforce are pervasive (National Science Board, 2014). One barrier that may prevent women from pursuing STEM interests is stereotypes. For instance, stereotype threat, or group performance anxiety, may be a reason why women and ethnic minorities choose to leave STEM fields (Beasley & Fischer, 2012). Even young children hold stereotypes associating boys with science-oriented careers (Liben & Bigler, 2002), and younger children and boys may hold more gender stereotypes about occupations than do older children or girls (Miller & Budd, 1999).

The reasons why girls do not pursue STEM interests may be complex and multifaceted (Eccles & Wang, 2016). Attempts to engage girls with STEM activities often simplify the issue or turn to stereotypes. For instance, marketers target girls with pastel-colored (predominantly pink and purple) STEM toys (Fenn, 2015; Wieners, 2011), often with the explicit goal of trying to increase girls' STEM interest and skills (Weiss, 2013). Developing pastel toys may be driven by findings suggesting that stereotypes about color are ingrained early in childhood and are pervasive (Chiu et al., 2006; Picariello, Greenberg, & Pillemer, 1990). Toy colors can communicate messages about whether it is acceptable to play with a toy (Weisgram, Fulcher, & Dinella, 2014), and young children prefer to play with toys that align with gender stereotypes about colors (Wong & Hines, 2015a). Children are more willing to play with counter-stereotypic toys if they are gender stereotypic colors (e.g., a girl is more likely to play with a pink train; Wong & Hines, 2015a). Thus, color is gendered (Wong & Hines, 2015b), messages surrounding color and gender are ubiquitous (Cunningham & Macrae, 2011), and color can guide gendered behaviors (Weisgram et al., 2014). However, no past research has focused on whether girls and boys respond differently to engineering toys that vary in color (pastel colored [pink, purple, and white] vs. primary colored [red, blue, and yellow]). Despite increased marketing of pastel STEM toys, no research has examined whether these pastel-colored STEM toys increase girls' demonstrations of engineering aptitude.

Toys and games can influence children's cognition surrounding STEM. Gender schema theory (GST) suggests that children use contextual information to determine whether an activity is appropriate for their gender and that this guides their preferences and decisions (Bem, 1981). Children approach toys and activities that are culturally coded as acceptable for their gender (Martin et al., 2012; Miller, Trautner, & Ruble, 2006) and use gendered contextual information when making novel decisions (Cherney & Dempsey, 2010; Weisgram et al., 2014). Furthermore, children who are more likely to attend to gender showed greater interest in feminine activities after playing a game about occupations with a hyper-feminine character (Barbie Doll) than when playing with a less feminized character (female Playmobil character), but the game manipulation did not affect girls' career interests (Coyle & Liben, 2016). Thus, even short-term exposure to play materials with gendered messages can affect girls' interests. Furthermore, there has been less attention given to messages about gender for boys; however, moving down the status hierarchy by engaging in feminine activities can prove to be difficult for boys (Biernat & Manis, 1994). Research is needed, then, that examines both boys and girls and that empirically tests how color affects behavior when completing a STEM task.

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