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Being Narrow While Being Broad: The Importance of Construct Specificity and Theoretical Generality

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Abstract This article considers Gunderson et al.'s (2011) analysis of the intergenerational transmission of mathematics attitudes in light of broader knowledge about the nature of attitudes. It makes two primary points. First, many of the constructs that Gunderson et al. include under the umbrella of "attitude" are theoretically and psychometrically distinct. Researchers who follow the agenda laid out by Gunderson et al. should take care to carefully define their constructs. Second, using the literature on the intergenerational transmission of implicit attitudes as a starting point, this commentary explores specific ways in which children's mathematics attitudes may arise as a function of their parents' and teachers' attitudes.

Keywords Mathematics attitudes · Gender · Stereotypes · Attitudes

Introduction

Men pursue mathematics more than women at almost all stages of education and achievement (Snyder et al. 2008; National Science Foundation 2008). At the same time, the gap in performance between men and women on standardized measures of mathematics in the United States has narrowed in the past several decades (Hyde et al. 2008). Efforts to understand the disconnect between the relative gender parity on measures of mathematics and science achievement on one hand, and the gender gap in mathematics and science engagement on the other, have been robust. Explanations range from sex differences in brain morphology (Gur et al. 1999) to gender differences in expectations for success in mathematics and science, and value placed on these fields (Simpkins et al. 2006).

In the target article, Gunderson et al. (2011) focus on young children's mathematics attitudes, beliefs, and identities, starting with the assumption that early formation of these dispositions toward mathematics "sets the stage for lifelong behavioral and attitudinal patterns" (this issue). Their primary interest is in the role of parents and teachers on children's mathematics-related orientations. Their goal of establishing directions for future research that build on the extant literature is important—as they note, such work will not only add to the academic literature, but may "lead to the development of practical interventions … that ensure that all students are provided with opportunities to excel in math" (this issue). Inspired by Lewin's (1952) often-repeated reminder that "there is nothing more practical than a good theory" (p. 169), this commentary considers how the broader attitudinal literature can inform Gunderson et al.'s analysis.

When I gave my job talk at my current institution, I noted in passing that I am a fan of the baseball team the New York Mets, and also mentioned that I am from the Bronx, New York. At dinner, a search committee member asked a pressing question: How had I grown up in the Bronx, which serves as the home of the New York Yankees baseball team, and become a fan of their rival team? The answer was simple: My father was an ardent Mets fan, and his mother had rooted for the often-hapless team before that. In short, both my father and I learned to be Mets fans from the adults around us.

While the target article (Gunderson et al. 2011) takes a singular focus on mathematics-related cognitions and feelings, this anecdote illustrates that attitudes and beliefs about

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mathematics are not the only ones that may be transmitted from adults to children. Children may learn from the adults around them to root for one baseball team over another, to like broccoli, or to believe that little girls are made of sugar and spice. Mathematics attitudes and beliefs are not immune to the processes that underlie development of a wide range of preferences and beliefs (e.g., Greenwald et al. 2002; Nosek et al. 2002). Drawing primarily on research with American samples, the current commentary explores how considering the intergenerational transmission of mathematics attitudes and beliefs as a specific case of this more general process can inform and enhance the understanding of adults' role in the development of children's mathematics-related feelings and beliefs. In so doing, it highlights the need to ground research on the applied issue of gender and mathematics within broader theoretical literatures.

The first focus is on the importance of specificity in construct definition. Gunderson et al. (2011) begin with an expansive definition of attitudes that encompasses not only a person's degree of favor or disfavor for mathematics, but also stereotypes about whether boys or girls are better at mathematics, as well as mathematics identity, anxiety, and self-efficacy. These components are at times treated as distinct entities throughout the article. Often, however, the target article treats several distinct constructs as a single variable, noting, for example, that "[a]lthough anxiety, self-concept, and self-efficacy are distinct constructs (e.g., Pajares and Miller 1994)" (this issue), it "treat[s] them as a class that reflects adults' personal attitudes toward math" (this issue). The clumping of discrete constructs into a unitary concept certainly facilitates the description of several bodies of work, but may inadvertently obscure important differences in how these distinct constructs are transmitted from adults to children, miss important interactions among them, or lead to the development of interventions that do not target the most relevant or important features of mathematical thought or sentiment. This commentary reviews evidence that attitudes and stereotypes—two of the constructs most central to Gunderson et al.'s analysis—are distinct psychological constructs with unique consequences for behavior. Consequently, researchers who pursue the agenda laid out by Gunderson et al. would do well to be as specific as possible when defining and operationalizing their constructs. The directions for future research that Gunderson et al. propose would be well-served by thoughtful and precise identification of which aspects of mathematics-related thought and feeling are relevant for a particular research question.

The second main point also centers on the importance of attending to broader theoretical concepts. Gunderson et al. (2011) urge researchers to provide a careful examination of the mechanisms underlying the relationship between adults' and children's mathematics attitudes. This is a noble and important goal, and a focus on process rather than description will indeed advance the field. However, taking a single-minded focus on mathematics attitudes risks the reinvention of the knowledge wheel, or "discovery" of truths already known. To be sure, mathematics attitudes may have domain-specific features that distinguish them from attitudes toward cats, African-Americans, or the color blue. At their core, though, attitudes toward each of these target objects represent an evaluation of an object's positivity (e.g., Crano and Prislin 2006; Eagly and Chaiken 1993; Fazio et al. 1982; Petty et al. 1997), are governed by a common set of rules, and share overlapping properties. This commentary provides a summary of work on the intergenerational transmission of implicit attitudes with the goal of highlighting the importance of grounding work on mathematics attitudes, identities, and beliefs within their broader literatures. Rather than beginning at the starting line when deciding what potential mechanisms to investigate, researchers interested in the transmission of mathematics attitudes can generate hypotheses that are guided by what is already known about how attitudes in general (as opposed to just mathematics attitudes) are transmitted across generations.

The Importance of Construct Specificity

Example: The Distinction Between Attitudes and Stereotypes

Gunderson et al. (2011) offer a broad definition of mathematics attitudes: "[A] cluster of beliefs and affective orientations related to mathematics, such as math anxiety, math-gender stereotypes, math self-concepts, and attributions and expectations for success and failure in math" (this issue). While these different aspects of feelings and beliefs with regard to mathematics to some extent all reflect a person's degree of favor or disfavor toward mathematics, this definition departs from the traditional social psychological concept of an attitude, which focuses primarily on evaluation of an object (e.g. Eagly and Chaiken 1993). For example, Eagly and Chaiken offered the straightforward definition of an attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p. 1). Mathematics anxieties, stereotypes, and identities, while certainly related to mathematics attitudes (e.g., Meece et al. 1990; Nosek et al. 2002), are, at the same time, semantically and psychometrically distinct from one another (e.g., Ferla et al. 2009). In this section, I draw from the literature on intergroup relations in order to demonstrate how one of these constructs—stereotypes—is distinct from attitudes, and then explore how this distinction is important for understanding the development of a constellation of psychological constructs related to mathematics.

Whereas attitudes reflect the affective evaluation of an object (e.g., Eagly and Chaiken 1993), stereotypes are generally taken to capture a more cognitive orientation (Hamilton and Trolier 1986) reflecting culturally prevalent beliefs about the link between a category and a particular trait. For example, the beliefs that men are tall, cats are standoffish, or women are bad at mathematics all represent stereotypes. Critically, attitudes and stereotypes are distinct. Drawing on neuroscientific evidence showing that separate neural substrates underlie affective and semantic learning, Amodio and Devine (2006) explored the distinction between implicit evaluations and stereotypes. Their research revealed that people exhibited negative implicit attitudes toward African Americans (compared to White Americans) and also showed the implicit stereotype that African Americans are associated with the concept *physical* (compared to White Americans and the concept *mental*). However, attitudes and stereotypes were uncorrelated with one another, $r=.06$.

Consistent with the idea that stereotypes are relatively more cognitive and attitudes are relatively more affective, implicit attitudes and stereotypes in this study predicted distinct behaviors (Amodio and Devine 2006). Whereas implicit stereotypes predicted relatively "cold" behaviors related to information processing and beliefs, implicit attitudes predicted relatively "warm" behaviors related to approach or avoidance. Although participants with stronger stereotypical associations between the concepts *African American* and *physical* were more likely to rate an ostensible African American essay writer more stereotypically and expected lower performance from an African American partner on a joint task, implicit attitudes were unrelated to these behaviors. In contrast, implicit attitudes—but not stereotypes—predicted participants' expectations that they would get along with an African American essay writer and also predicted how far participants sat from the personal belongings of an African American partner.

Data showing that affect and cognition are differentially influenced by interventions designed to create more intergroup positivity offer further reason to draw a distinction between attitudes and stereotypes. In a meta-analytic review based on over 250,000 participants from 38 nations, intergroup contact was more strongly related to prejudice's affective dimensions than its cognitive aspects (Tropp and Pettigrew 2005). In a subsequent study, a confirmatory factor analysis revealed that affective and cognitive dimensions of prejudice toward Black people were distinct, but related ($r=.62$), constructs (Tropp & Pettigrew).

Although this analysis is drawn from the intergroup relations literature, the same basic principle extends to mathematics attitudes and stereotypes. Forbes and Schmader (2010) recently drew on Amodio and Devine's (2006) analysis to understand the mechanisms that contribute to women's tendency to underperform on mathematics tests under conditions of stereotype threat. If attitudes affect approach and avoidance behaviors, they reasoned, then creating more positive mathematics attitudes should increase motivation to pursue mathematics. If stereotypes affect cognitive processing, then changing stereotypes about mathematics and gender should decrease the amount of cognitive effort women spend while taking a mathematics test, thus increasing their available cognitive resources. Across four studies, participants completed training procedures designed to induce a. positive or negative mathematics attitudes; and/or b. stereotype-consistent (e.g., *Men are good at math*) or stereotype-inconsistent (e.g., *Women are good at math*) associations. Following the induction of positive mathematics attitudes, participants were more motivated on a mathematics test when threat was present or stereotypic associations were reinforced. However, attitude induction did not affect working memory. In contrast, counterstereotypic training improved women's working memory, and these changes in working memory mediated the effects of training on mathematics performance. In short, the effects of interventions designed to change mathematics stereotypes or attitudes had distinct effects consistent with those observed by Amodio and Devine—attitudes were more strongly related to "hot" processes such as motivation, and stereotypes were more strongly related to "cold" processes such as cognitive processing. These data suggest that, like their counterparts in the domain of intergroup relations, attitudes toward and stereotypes about mathematics are distinct constructs with unique effects on mathematics performance and behavior.

The Importance of Distinguishing Among Mathematics-Related Constructs

These observations are offered to enhance rather than undermine Gunderson et al.'s (2011) argument. While this analysis illustrates the distinction between two of the specific constructs discussed by Gunderson et al., the general point applies to disparate constructs that sit under their umbrella definition of attitudes. Clarity in which psychological variables are being investigated or discussed at any given time allows the complexity of development to reveal itself. For example, while Gunderson et al.'s definition of attitudes includes both mathematics self-concepts and stereotypes, these constructs may have unique developmental trajectories. For example, Cvencek et al. (2011) recently observed that implicit and explicit mathematics self-concept was "weaker, less stable, and may emerge later than" (p. 773) implicit stereotypes about gender and mathematics and gender identity. Stereotypes emerged early: Elementary school boys showed strong implicit and explicit associations between science and their own group than did girls at all grade levels (from first through fifth grades). In contrast, identity with mathematics showed a more complicated pattern. In early (first through third grades), but not late, elementary school, boys had stronger automatic associations between *math* and *me* than did girls. That is, gender differences in implicit identification with mathematics seemed to emerge early but then wane. Cveneck et al. hypothesized that mathematics self-concepts are a function of gender identity and gender stereotypes, and thus emerge later in development (see also Herbert and Stipek 2005, for evidence that mathematics identity develops in middle school). With unambiguous identification of the relevant constructs, researchers who follow the agenda laid out by Gunderson et al. will be better able to track the developmental time course in which they emerge, and better able to understand patterns of causality among them—and, ultimately, mathematics participation.

Gunderson et al. (2011) write that "[t]eachers' attitudes toward [mathematics] have been shown to influence their instructional techniques … and eventually, their students' attitudes toward the subject" (this issue). The study described in detail to support this contention (Relich 1996) is primarily about self-concept rather than attitudes. This conflating of different constructs leads to a misstatement of the evidence—researchers who were to pick up on the notion that attitudes (in the sense of preferences) affected teachers' instructional styles may wind up entering a blind alley studying attitudes when they really ought to be focused on self-concepts. Of the three references in the string cite provided to buttress this assertion, at least two do not deal with attitudes (in the sense of preferences) at all. Fennema et al. (1990) measured first-grade teachers' attributions for children's success in mathematics and examined which students were believed by their teachers to be the most promising budding mathematicians. Fennema and colleagues never use the words *attitude*, *like* (in the sense of a preference), *affect* (in its noun form), or *preference* in their article. Ironically, while Gunderson et al. cite Pajares (1992) as providing data that speak to the relationship between teachers' and children's attitudes, this aritlce's aim was to emphasize the importance of distinguishing among various constructs that fall under the rubric of *belief*. His observation that the utility of the notion of belief "will require clear conceptualizations … consistent understanding and adherence to precise meanings, and proper assessment and investigation of specific belief constructs" (p. 307) echoes the point of this analysis, and could easily be said of any of the constructs reviewed in the target article.

The Importance of Theoretical Generality

Gunderson et al. (2011) rightly call for researchers to "consider the mechanisms through which adults' gendered math attitudes are passed on to children" (this issue), noting that while a robust literature shows evidence for a relationship between adults' and children's mathematics attitudes, it "does not reveal how this process occurs" (this issue). Such research would provide not only a more nuanced understanding of the intergenerational transmission of these constructs, but, as Gunderson et al. point out, may also offer a foundation for effective interventions. A focus on the general mechanisms of attitude and stereotype transmission can inform the understanding of how mathematics-specific attitudes and stereotypes are passed from parents or teachers to children. Researchers who heed Gunderson et al. call to emphasize mechanisms in attitude and stereotype transfer may find plausible hypotheses or starting points within the broader attitudinal literature.

Although a full review of the vast literature on attitudes (see Banaji and Heiphetz 2010, for a review) is well beyond the scope of this commentary, a large body of work has identified a number of mechanisms by which attitudes pass from adults to children, ranging from social learning (e.g., Bandura 1997) to genetic transmission (Tesser 1993). This comment is centered around the nascent body of work that focuses on the intergenerational transmission of implicit (relatively less conscious) attitudes and stereotypes for several reasons. First, recent work highlights the importance of implicit attitudes and gender stereotypes about mathematics (e.g., Kiefer and Sekaquaptewa 2007; Nosek et al. 2002; Nosek and Smyth 2011). As Gunderson et al. (2011) note, young children are susceptible even to subtle cues about gender and mathematics (Ambady et al. 2001), stereotype endorsement and awareness are not synonymous (Martinot and Désert 2007), and endorsement of explicit stereotypes is not a prerequisite for such stereotypes to impair girls' and women's mathematics performance. Indeed, implicit and explicit attitudes are distinct constructs (e.g., Nosek and Smyth 2007), and in a sample of over 3,000 adults, implicit and explicit stereotypes predicted unique variance in plans to engage in mathematics (Nosek and Smyth 2011).

Second, an analysis of developmental sources of implicit attitudes serves as a case study that illustrates the importance of taking a broad theoretical perspective when considering issues of gender and mathematics attitudes. An understanding of the general properties of attitudes can, in conjunction with Gunderson et al.'s (2011) analysis, give rise to specific novel hypotheses about how parents and teachers influence children's mathematics attitudes. By examining how this process unfolds in the case of implicit attitudes, I hope to set the stage for similar analyses in the cases of the other constructs that Gunderson et al. discuss, such as identity, anxiety, explicit attitudes, and implicit and explicit stereotypes.

The Development of Implicit Attitudes

Children's early experiences are crucial for the development of implicit attitudes, and the effects of these early experiences persist even into adulthood (Rudman et al. 2007; Rudman and Goodwin 2004). For example, college students who reported that their childhood dreams were pleasant were more implicitly positive toward dreams in adulthood than those who did not report pleasant childhood dreams. Participants' weight during childhood predicted implicit attitudes toward slim people compared to heavy people, such that higher childhood weight was associated with less implicit bias toward heavy people in adulthood. In contrast, their present weight was uncorrelated with their implicit attitudes toward heavy and slim people (Rudman et al. 2007). These data are consistent with Gunderson et al. (2011) argument that a focus on children's mathematics attitudes is particularly important because these attitudes continue into adulthood.

Most centrally relevant to Gunderson et al. (2011) analysis is work showing that implicit attitudes are a function of the adults with whom children have contact. College students who were primarily raised by a maternal caretaker showed greater implicit preference for women over men than did students who were not raised by a maternal caretaker (Rudman and Goodwin 2004). Moreover, fifth graders with a close family member who smoked cigarettes exhibited lower levels of implicit negativity toward smoking than same-age peers who did not have a family member who smoked. Remarkably, this effect was more closely related to children's implicit attitudes than their own behavior: Implicit smoking attitudes did not differ among children who had tried cigarettes and those who had not (Andrews et al. 2010).

While these studies show the effects of adults on the development of children's implicit attitudes, all adults are not equal in intergenerational attitude transmission. Adults who are particularly well-liked by children, or with whom children strongly identify, have an especially large influence on children's implicit attitudes. The nature of parent–child relationships moderates the effects of parents on children's implicit attitudes. For example, among fourth and fifth grade students who reported relatively strong levels of identification with their parents, higher levels of parents' explicit racial bias predicted higher levels of children's implicit racial bias. In contrast, among children who reported relatively weak levels of identification with their parents, parents' explicit racial bias and children's implicit racial bias were unrelated (Sinclair et al. 2005). Additionally, feelings for one's mother moderated the extent to which adults implicitly preferred heavy or slim people, such that people with positive feelings for their mothers exhibited implicit preferences for heavy or slim people that were congruent with their childhood exposure to maternal weight (Rudman et al. 2007). That is, among people raised by heavy mothers, implicit attitudes toward heavy people became more positive as their liking for their mothers increased. Among people raised by slim mothers, implicit attitudes toward heavy people became more negative as their liking for their mothers increased. The weights of mothers who were not well-liked were unrelated to their adult children's implicit weight attitudes (Rudman et al. 2007).

Mothers, who typically serve as children's primary caretakers, may have an especially strong influence on children's implicit attitudes. Recent work (Castelli et al. 2009) with three- to six- year old children found that mothers with high levels of implicit (but not explicit) racial bias tended to have children who exhibited stronger preference for White people over Black people on unobtrusive measures of racial bias. In contrast, fathers' implicit and explicit racial attitudes were unrelated to children's levels of racial preferences. In the most comprehensive study examining the intergenerational transmission of implicit and explicit attitudes, Sherman and colleagues (2009) also found that mothers were particularly influential in the development of children's implicit attitudes. In a study that measured implicit smoking attitudes of over 700 children between 10 and 18 years old and their parents, fathers' implicit and explicit attitudes toward smoking were unrelated to their children's implicit or explicit smoking attitudes or smoking behavior. In contrast, mothers' and children's implicit smoking attitudes were positively correlated with one another, as were their explicit smoking attitudes. Moreover, mothers' implicit and explicit attitudes each exerted an indirect effect on children's smoking behavior. Not only did mothers with positive implicit or explicit smoking attitudes tend to have children with similar implicit smoking attitudes, but those children were more likely to start smoking within 18 months of completion of the attitudinal measures.

How do implicit attitudes pass from adults to children? Children may be attuned to adults' nonverbal behaviors, and "catch" their attitudes via cues that are not vocalized. In a correlational study, adults who reported watching television programs that featured more negative nonverbal behavior toward Black characters than White characters showed more implicit favoritism for White people over Black people. Additionally, participants who were randomly assigned to see brief television clips depicting positive nonverbal behaviors toward White characters showed stronger pro-White implicit attitudes than participants who saw clips with positive nonverbal behaviors toward Black characters (Weisbuch et al. 2009). Given that children are sensitive to adults' nonverbal behaviors in interracial situations (Castelli et al. 2008), it is plausible to think that children's implicit attitudes, like those of adult television viewers, may be shaped by these kinds of subtle behaviors that make them, as Dovidio (2009) aptly put it, "[u]nspoken but heard" (p. 1641).

How Can Basic Research on Implicit Attitude Development Inform the Study of the Transmission of Mathematics-Related Cognitions?

These findings from basic research on the development of implicit attitudes can inform and enhance the research agenda Gunderson et al. (2011) outline. This work generates several hypotheses about adults' effects on children's mathematics implicit attitudes.

First, the broader literature suggests that researchers interested in these questions ought to differentiate among different kinds of adults. Children's implicit attitudes are more likely to mimic those of adults who are well-liked, or with whom children strongly identify. Consequently, children's mathematics attitudes may be particularly well-aligned with adults with whom they have a close relationship or feel identified with. Inclusion of measures of relationship closeness or identification in future research can identify whether these variables moderate processes of mathematics attitude transmission.

In some ways, this literature complicates several of the findings Gunderson et al. (2011) describe. For example, Gunderson et al. point out that same-gender adults appear to have greater influence on children's mathematics stereotypes than adults of the opposite gender (Beilock et al. 2010; see also Bussey and Bandura 1984). Yet several studies (Castelli et al. 2009; Sherman et al. 2009) point to the ways in which mothers have a disproportionate effect on children's implicit attitudes. As Gunderson et al. note, there is a dearth of research on these issues as they relate to mathematics attitudes. However, the literature on implicit attitudes reviewed suggests that mothers may exert relatively strong effects on children's attitudes. This case may be one in which the unique properties of the attitude domain matter, and the importance of mothers on children's attitude development may not extend to the mathematical case. One intriguing possibility is that the nature of the attitude interacts with parents' and children's gender in shaping children's attitudes. In domains in which men and women do not generally differ in their preferences, such as smoking (Sherman et al. 2009), the influence of mothers' attitudes may be stronger than that of fathers' attitudes. However, in domains in which men and women do differ in their attitudes, such as mathematics, children may rely more on cues from same-gender adults when forming their evaluations of the object. These effects may also be mediated or moderated by the extent to which children like or identify strongly with same-gender adults (Rudman et al. 2007; Sinclair et al. 2005).

Finally, the literature on implicit attitude transmission suggests that nonverbal behavior is one plausible mechanism by which mathematics attitudes are transmitted from adults to children (Castelli et al. 2008; Weisbuch et al. 2009). Adults may explicitly encourage children in mathematics, voicing positive feelings about the subject, while at the same time telling a different story through their nonverbal behaviors. Moreover, adults may exhibit differential patterns of nonverbal behaviors to boys and girls when speaking about mathematics that are detected by young children.

Although the data reviewed speak to the relationship between adults' and children's attitudes, similar processes may underlie the intergenerational transmission of other constructs, such as stereotypes, identities, or anxieties. For example, Beilock et al. (2010) found that teachers' mathematics anxiety was related to first and second grade girls' (but not boys') mathematics performance at the end of the academic year. Moreover, this relationship was mediated by the extent to which girls exhibited traditional gender stereotypes about academics (boys are better at mathematics, and girls are better at reading). Little is known, however, about the process by which teachers' level of anxiety influenced girls' stereotypes. Anxiety is manifested in nonverbal behaviors such as frequent self-touching (Shreve et al. 1988), and children and adults can detect anxiety solely from nonverbal cues (Fluck et al. 2001). Thus, students may have picked up on their teachers' nonverbal demonstrations of mathematics anxiety. This speculation is bolstered by the finding that nonverbal anxiety mediated the relationship between being confronted with a stereotype about one's group and performance on a stereotype-relevant task (Bosson et al. 2004).

Conclusion

Given the substantial bodies of work on attitudes, stereotypes, identities, anxieties, and self-concepts, it is unlikely that any review could do them all justice, and Gunderson et al. (2011) instead narrowed their focus to work on these topics in the mathematics domain. This reasonable approach, however, misses the rich knowledge of the causes, consequences, contingencies, and developmental trajectories of each of these constructs. The current commentary has demonstrated several ways in which taking a more general view of each of these constructs elucidates the differences among them, and urges researchers to keep in mind these differences when following the research agenda laid out by Gunderson et al.

Of course, this commentary runs into the same challenge as the target article (Gunderson et al. 2011)—there is not enough space to engage fully with each of these ideas, and it is largely illustrative. For example, instead of considering the distinction between attitudes and stereotypes, it could have considered the differences between anxiety and self-efficacy. Similarly, the case study of implicit attitudes was very specific, and serves to illustrate how a broader theoretical perspective can shed light on an applied issue. It could just as easily have considered how emergent work in any number of areas, such as social cognitive development (e.g., Dunham and Olson 2008; Olson and Dweck 2008) speaks to the intergenerational transmission of mathematics attitudes, identities, and beliefs. These specific cases act in service of a more general point derived from the wider theoretical literatures. Just as environmental advocates urge people to attend to both the broad and narrow levels with the slogan "Think Global, Act Local," psychological researchers would do well to "Think Broad, Define Specific" even when considering a seemingly narrow applied problem.

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