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The Role of Gender in Young Children’s Selective Trust of Familiar STEM Characters

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ABSTRACT

Female characters are less likely to engage with science, technology, engineering, and math (STEM) content than male characters on young children’s television shows. The current study examined how preschool-aged children’s selective trust of male and female characters to teach STEM differed by child gender, and how trust relates to children’s character identification. Forty-eight 3- to 6-year-old children’s selective trust of male and female characters to teach STEM content, gendered character identification, and personal interest in STEM activities was measured. Boys and girls had similar interest in STEM and had greater identification with same-gender characters. Although boys had significantly greater trust in male characters, girls had similar levels of trust in male and female characters. Overall, children had greater trust of male characters to teach STEM content, but this effect was driven by boys, indicating identification and selective trust are related, but not identical constructs. The discussion considers how representations of female and male characters on television may impact children’s trust of educational media characters to teach STEM.

Even with the increased presence of positive female characters on television during the last 40 years, women and girls are still underrepresented (Collins, 2011). Content analyses of United States television programming have reported female characters tend to be more passive and helpless, display less cleverness and independence, and speak less often than male characters (Baker & Raney, 2007; Biddle, 2016; Collins, 2011; Hentges & Case, 2013; Hetsroni & Lowenstein, 2014; Ryan, 2010; Steyer, 2014). In syndicated cartoons airing in the early 2000s in the United States, 30% of lead characters and 36% of minor characters were girls or women, and male characters were more likely to display cleverness and achieve goals than female characters (Aubrey & Harrison, 2004). Unpublished work has found that preschool television programs airing in 2015–2016 in the United States featuring male characters included significantly more school readiness skill

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curriculum, and male characters spoke more often than in shows with female main characters or ensemble casts (Biddle, 2016).

The underrepresentation of female characters is principally notable with television programs featuring STEM (science, technology, engineering, and mathematics) content. As of 2012, 31% of characters in U.S. television shows created for young children were female, and only 13% of female characters had careers in STEM fields (Smith, Choueiti, Prescott, & Pieper, 2012). Otherwise, although research on STEM media is growing, there is very little research on television programs for young children that teach STEM content (Richert & Schlesinger, 2016; Schlesinger, Flynn, & Richert, 2016; Schroeder & Kirkorian, 2016). Because recent research has demonstrated that the trust children have in familiar characters to teach STEM relates to children’s learning of STEM concepts from those characters (Schlesinger et al., 2016), and given the differences in gender representations in children’s programming, the current study examined how children’s trust in familiar characters to teach STEM related to identification with characters and differed by character gender.

A focus on characters featured in television and video programming is warranted because although interactive media use is increasing, television remains a huge part of preschoolers’ lives. By age 4, almost all children watch television shows daily and about 80% additionally watch shows on mobile devices (Kabali et al., 2015). With the increases in availability and variability in accessing television programming, media characters and their related messages about gender roles continue to be a dominant part of young children’s lives.

Children’s developing perceptions of gender roles and gender stereotypes are impacted by their exposure to messages about what is appropriate for their own gender and others (Bandura, & Bussey, 2004; Gerbner, Gross, Morgan, Signorielli, & Shanahan, 2002; Hentges & Case, 2013). Social cognitive theory postulates children are more likely to mimic behaviors of and engage in observational learning processes from same-gender models (Bandura, 1997; Bandura, & Bussey, 2004). Because under the umbrella of social cognitive theory, children are more likely to learn content from same-gender characters whether due to greater trust, identification, familiarity, or other social cognitive mechanisms, it is important to remember that female characters are less likely to achieve their goals, speak less, and are more passive than male characters (Aubrey & Harrison, 2004; Bandura, 1997; Bandura, & Bussey, 2004; Biddle, 2016; Keys, 2016). The current study considers how these portrayals relate to children’s selective trust of characters, and could impact children’s learning educational content and develop their concepts of gender roles. Overall, the theoretical importance of this study is situated in the recognition that preschool-aged children can learn both educational content and gender stereotypes from educational media characters, both of which impact children’s development. The implications of children having lower trust in female characters as sources of STEM information is evident in research about children’s selective trust.
Selective trust

Selective trust is the development of children’s recognition of characteristics and traits in others (Harris, 2012). Children depend on others to learn about their world; and much like adults, young children discriminate between who they can and cannot trust to provide accurate information. Although children refine their abilities to make accurate judgments of others’ trustworthiness throughout development, by age 4, children are sensitive to characteristics and traits of potential informants, and evaluate who they can trust to provide relevant and accurate information, also known as selective trust (Harris, 2012; Woolley & Ghossainy, 2013). The growing body of selective trust literature typically evaluates the traits that make an informant or character more “trustworthy,” with the goal of examining the social cognitive processes involved in young children’s evaluations of others and how trust relates to learning. Selective trust is typically evaluated by presenting two novel informants (or informants who the children have not encountered outside of a lab) or characters with distinct traits, and children are asked to choose which character they would ask if they wanted to learn more about a relevant domain. In the selective trust literature, the term “trust” refers to a preference or desire to learn from a particular character or informant.

This work has found 3- and 4-year-olds can identify reliable, unreliable, and ignorant informants at above chance levels (Corriveau & Harris, 2009; Corriveau, Pickard, & Harris, 2011; Jaswal, McKercher, & VanderBorgh, 2008; Koenig & Harris, 2005; Nurmsoo & Robinson, 2009). Studies that have presented children with two informants who are each experts in unique domains (or one expert and someone with an unknown expert status) have indicated young children overwhelmingly claim the informants described as experts as having greater knowledge about their expert domain than would be expected by chance (Koenig & Jaswal, 2011; Lutz & Keil, 2002). Overall, there is little evidence of a global or halo effect in young children’s trust (Koenig & Jaswal, 2011). The selective trust literature provides evidence that young children are adept at recognizing traits consistent with trustworthiness (e.g., reliability, expertise), and children are more likely to learn from a character or informant who displays positive or knowledgeable traits.

However, limited research has examined how gender relates to selective trust. A study addressing children’s gender-preferences and gender-stereotype awareness found that 4- to 6-year-old children were more likely to trust and learn from same-gender than other-gender informants about objects in a gender-neutral color (Ma & Woolley, 2013). Other research has revealed 4- to 7-year-old children had greater trust of a same-gender informant only when that informant was consistently reliable (Taylor, 2013). In a study focused on 4- to 8-year-old children’s trust of male and female child informants with gender counter-stereotyped interests and expertise, 4- and 5-year-olds had greater trust of same-gender informants regardless of the informants’ interest and expertise (Boseovski, Hughes, & Miller, 2016). When expertise was equal between same-gender and other-gender
informants, 3- to 4-year-old children learned more often from same-gender informants; however, when the other-gender informant had relevant expertise that the same-gender informants did not, children learned from the other-gender informants (Terrier, Bernard, Mercier, & Clément, 2016). Other research focusing on the impact of stereotypes indicated 3- to 5-year-old children have been more likely to associate male-stereotyped activities with male experts; the same association was not found for female-stereotyped activities with female experts (Shenouda & Danovitch, 2013). Overall, the existing literature has indicated that children initially gravitate toward same-gender informants when all other factors are held constant; however, children will guide their selective trust by other traits (e.g., expertise, reliability) over more salient similarities (e.g., gender).

In sum, the selective trust literature has provided evidence that young children have greater trust of knowledgeable and same gender characters. However, very little research has examined children’s trust of familiar media characters who are dynamic, have flexible personality traits, and whose knowledgeability differs depending on the episode narrative and curriculum. This lack of research is surprising given that children readily learn from familiar media characters (Schlesinger et al., 2016). To fill a gap in the literature about children’s trust of familiar media characters, from the perspective that there are limited competent female media characters teaching STEM, the current study examined if children’s trust in familiar television characters as sources of STEM information varied by child gender or character gender.

Two hypothesized patterns of relations could be derived from prior research. First, children could demonstrate a global same-gender preference, such that girls have significantly higher trust of female characters and boys have significantly higher trust of male characters. This pattern would suggest that children believe the presentations of male and female characters’ STEM knowledgeability and expertise are essentially “equal,” and therefore, children are basing character preference on gender-similarity (e.g., Boseovski, et al., 2016; Terrier et al., 2016) or other positive traits (e.g., identification). Second, children could demonstrate a male preference, such that children prefer male characters to teach them STEM content. The male preference would suggest that even at this young age children are sensitive to cultural messages that male characters are more likely to be experts in STEM than female characters (e.g., Boseovski et al., 2016), even in circumstances when both male and female characters are well matched in their time on screen and curriculum expertise. Both pathways have implications for the relations between trust and learning. Under the social cognitive theory framework, children are more likely to learn from models to whom they feel more similar; however, according to prior literature, children’s trust that a character will provide accurate and relevant information likely plays a large role. Therefore, it is important to focus on children’s selective trust of characters, as children may be more likely to learn from characters they trust. In order to examine potential
mechanisms through which children’s own gender relates to their trust in characters, the current study also examined children’s identification with characters.

**Identification**

In addition to gender-based expectations about expertise, identification (i.e., perception of similarity) is an integral social cognitive aspect of observational learning (Bandura, 1997); and it has been argued that identification with media characters may lead to greater attention to and therefore greater learning from those characters (Calvert, Strong, Jacobs, & Conger, 2007; Richert, Robb, & Smith, 2011; Schlesinger et al., 2016). Gender plays an important role in identification, especially for young children, as gender is one of the earliest salient features of identity (Kohlberg, 1996; Maccoby, 1998). Although the evidence is inconsistent, there is some evidence that preschool-aged children have greater attention to, learning from, and identification with members of the same-gender group, other traits can influence identification beyond gender similarity, including perceptions of intelligence or expertise (Bandura, & Bussey, 2004; Halim, Ruble, & Tamis-LeMonda, 2013; Hentges & Case, 2013; Hoffner, 1996; Lemish, 2010; Luecke-Aleska, Anderson, Collins, & Schmitt, 1995).

Perceptions of trust, expertise, or reliability may operate similarly to perceptions of intelligence during early childhood, therefore, it is hypothesized that there will be positive relations between identification and trust in the current study, such that children may have stronger identification with characters in the gender group that they believe to be more trustworthy sources of information, reflecting the desire to be like characters who have intelligence or knowledgableness, including those with STEM expertise. Therefore, the current study included measures of character identification to examine relations with selective trust.

**STEM**

The current study focused on STEM for several reasons. The United States is placing increased emphasis on STEM education by integrating STEM lessons into preschool curriculum and educational television curriculum (California Department of Education, 2013). STEM, by definition, is an interdisciplinary collective of scientific, technological, engineering, and mathematics concepts, activities, and perspectives (Ejiwale, 2013). A primary concern of this study was to capture STEM from a collectivist perspective, by both collapsing concepts that fall under discrete domains and by including concepts that fall under multiple STEM domains.

Although girls typically outperform boys in STEM domains, gender stereotypes implying girls are less interested and able to engage in STEM are still prevalent and impact decisions to pursue STEM throughout the lifespan, leading to continued gender imbalance in STEM fields (Aschbacher, Li, & Roth, 2010; Hyde, Lindberg,
In addition to focusing on characters, the current study also evaluated children’s interest in a variety of STEM activities to examine if boys and girls have different interests in STEM during the preschool years, prior to beginning formal schooling when gendered interests become more pervasive (Maccoby, 1998). With female characters still underrepresented in children’s media and female characters less likely to be involved in STEM activities, focusing on children’s trust of male and female familiar media characters to teach STEM curriculum is imperative for evaluating the impact media representation has on young children.

The current study

The current study had multiple hypotheses. First, in an exploratory analysis examining potential differences between children’s interest in STEM during the preschool years, it was hypothesized that boys and girls would have similar levels of interest in STEM. Second, examining how gender is involved in identification (or perceived similarity) to characters, it was hypothesized that children would have stronger identification with same gender characters, than other-gendered characters; that is, highly gendered identification. Third, based on the lack of competent female characters who teach STEM, it was hypothesized that children would have greater trust in male characters, even when both male and female characters are shown as having similar amounts of STEM knowledgeability and expertise. Finally, due to the conceptual overlap between identification and trust, it was hypothesized that identification and trust would be significantly related, and identification may be the mechanism that explains children’s patterns of trust in same- or other-gender characters.

Methods

Participants

Fifty-six children were interviewed (56.3% female), who ranged in age from 3 years, 9 months to 6 years, 11 months ($M = 5.35$, $SD = 0.85$). The race and ethnicity breakdown of the sample was diverse, representing the population of Southern California: 29.7% European American, 14.1% Hispanic or Latino American, 4.7% African American, 3.2% Asian American, and 48.4% multi-ethnic. Of those identifying multiple races or ethnicities, 17.2% identified as both Hispanic American and European American, 10.9% identified as both African American and European American, and remaining participants identified as African American/Asian American (4.7%), Asian American/European American (3.1%), African American/European American/Hispanic American (3.1%), African American/European American/Hispanic American (3.1%), African American/European American/Hispanic American (1.5%),
European American/Hispanic American/Native American (1.5%), African American/Asian American/Hispanic American (1.5%), Asian American/Hispanic American (1.5%), Asian American/European American (1.5%), and Hispanic American/Native American (1.5%). In terms of parents’ education level, 6.1% had a high school diploma or general education diploma; 46.9% had some college, a vocational degree, or associate’s degree; 28.6% had bachelor’s degrees; and 14.3% had advanced degrees. With regards to yearly income, 17.4% of families reported earning less than $29,999 per year, 23.9% of families earning between $30,000–49,999, 23.9% of families earning between $50,000–89,000, 23.9% of families earning between $90,000–149,000, 4.7% of families earning more than $150,000 yearly, and 6.5% not reporting.

Families were from Southern California, and were recruited through a laboratory database, community flyers, and community events to visit the on-campus laboratory for one 90-min session. To participate, English had to be the primary language spoken in the home, but parents and children did not have to be native English speakers. Children received a small toy for their time, and parents received $20 compensation for travel costs. Eight children were interviewed, but not included in the following analyses due to substantial missing data (four children asked to end the study early, four children displayed behavioral issues and could not complete the study). The final sample was 48 participants ($M_{age} = 5.40$, $SD = 0.82, 55\%$ female) in the following analyses. There were no significant demographic differences between children who were included or dropped from analyses.

**Materials**

Children watched four 90-s video clips, each featuring an animated educational media character. All four clips demonstrated the characters helping others by solving difficult engineering-related problems, as well as displaying critical thinking and highly-developed socioemotional skills. One clip featured Dora from *Dora the Explorer* helping a friend cross a windy river (Calvert et al., 2007; Richert & Schlesinger, 2016). One clip featured Diego from *Go Diego Go* rescuing flightless birds from the ocean (Richert & Schlesinger, 2016). One clip featured Sid from *Sid the Science Kid* getting a large stuffed animal onto a bed (Richert & Schlesinger, 2016). One clip featured Gabriela from *Sid the Science Kid* lifting a life-size truck off the ground. Canonically, both Dora and Diego are well matched; they both speak Spanish, have anthropomorphized animal friends, regularly rescue animals, teach a range of STEM, problem-solving, verbal, and socio-emotional content, and air on Nick Jr. Sid and Gabriela are similarly well matched, as inquisitive and prosocial scientists and problem solvers in their classroom and at home, and air on PBS-related channels. For the purposes of the analyses, Dora and Gabriela are grouped as female characters, and Sid and Diego are grouped as male characters.
**Measures**

**STEM interest**

Using a smiley face scale, children were asked how interested they were in learning about eight STEM concepts on a +2 (like a lot, big smiley face) to 0 (neutral, straight line smiley face) to –2 (dislike a lot, big frowning face) smiley face scale. Children’s responses to each question were transformed to +1 (like a lot or like a little) and 0 (neutral, dislike a little, dislike a lot), to capture positive responses. There were two at least two questions representing each STEM domain; however, some questions represented multiple categories. Concepts were drawn from a combination of educational television curriculum and state curriculum guidelines (California Department of Education, 2013). Participants were asked about how much they were interested in learning about animals, health, computers, phones, bicycles, counting, addition, and types of experimenting. Children’s positive responses to these eight questions were summed, creating a STEM interest score ranging from 0 to 8 (Crohnbach’s α = .72), with higher scores indicating greater interest in STEM concepts and STEM learning.

**Gendered identification.** Identification with characters was evaluated using Schlesinger et al.’s (2016) measure; children were verbally asked how much they (a) like, (b) were like, and (c) wanted to be like each character. Participants could respond a lot (2), a little (1), or not at all (0) to each question. The responses to all three questions were averaged for both female characters (α = .81) and both male characters (α = .72), creating two identification scores, ranging from 0 (weak identification) to 1 (moderate identification) to 2 (strong identification). An identification difference score was created by subtracting the female character identification score from the male identification score. This resulted in a final gendered identification score ranging from +2 (indicating stronger identification with male characters) to –2 (indicating stronger identification with female characters). Means closer to 0 indicate either weak identification generally or equally strong identification with both genders.

**Gendered selective trust.** The measure of children’s selective trust in different characters was adapted from and administered consistent with previous measures of children’s selective trust of familiar characters, which typically evaluate who young children would prefer to learn from or would ask to learn something new (Boseovski et al., 2016; Schlesinger et al., 2016). Participants were shown images the characters from the video clips and were told, “I am going to tell you about different things these characters know about, and you tell me who you would watch on TV to learn about those things.” Participants were then asked to pick which character they would watch to help them learn about the eight STEM concepts from the STEM interest measure first, second, third, and last, or not at all. How many times both male characters were selected first were summed for a
male character trust score, and how many times both female characters were selected first were summed for a female character trust score, ranging from 0 to 8, with higher scores indicating greater trust. A trust difference score was created by subtracting the female character trust score from the male trust score. This resulted in a final gendered trust score ranging from +8 (indicating stronger trust with male characters) to −8 (indicating stronger trust with female characters). Means closer to 0 indicate similar levels of trust with both male and female characters.

**Exposure.** Because the clips were chosen from readily available children’s programs, parents reported their children’s exposure to the television series from which the clips were drawn. Parents indicated how often their child watched each of the characters (0 = never, 1 = once a month, 2 = 2–3 times a month, 3 = once a week, 4 = 2–3 times a week, 5 = once a day, 6 = more than once a day). An exposure difference score was created by subtracting the female character exposure from the male exposure (\(\alpha = .77\)). This resulted in a final gendered exposure score ranging from +6 (indicating greater exposure to the male characters) to −6 (indicating greater exposure to the female characters). Means closer to 0 indicate either little exposure generally or equal exposure to characters of both genders. Additionally, parents indicated whether their children would (1) or would not (0) recognize each character.

**Procedure**
The study took place in a university laboratory testing room arranged like a living room. After obtaining parental consent and child assent, parents completed a survey with demographic and media exposure questions adjacent to the testing room, where children and parents could talk to each other, but parents were discouraged from disrupting the interview. Child participants provided ratings of their personal STEM interest, then watched short video clips in which they were reintroduced to the familiar media characters, and played games evaluating identification and trust of familiar characters. In each video clip, the main characters displayed knowledgeability and expertise for solving engineering problems, mathematics abilities, scientific knowledgeability, and technological tools. (Note: An analysis of children’s learning from these clips is presented elsewhere [Richert & Schlesinger, 2016]; however, the measures presented in this manuscript were designed to test the hypotheses related to character perceptions and are thus the focus of the analyses.)

**Results**
Preliminary analyses first tested relations of all variables with child age, race and ethnicity, character exposure, family income, and parent education. Analyses then examined if participants demonstrated gender-stereotyped STEM interests,
followed by examining gendered identification. The primary analyses tested the impact of selective trust by child gender, child age, and identification.

**Preliminary analyses**

There were no significant relations between exposure, STEM interest, character identification, and character trust with race and ethnicity, family income, and parent education. Therefore, race and ethnicity, family income, and parent education were excluded from further analyses. A correlation matrix for the variables can be found in Table 1. For the full sample, age was positively correlated with gendered trust, \( r = .32, p = .027 \); the older children were the greater their trust of male characters. Similarly, gendered identification and gendered trust were positively correlated, \( r = .40, p = .005 \); children with stronger identification with male characters and weaker identification with female characters had greater trust of male characters and weaker trust of female characters. For girls alone, there were no significant relations between age, exposure, STEM interest, gendered identification, and gendered trust (see Table 2). For boys in the sample, age was positively correlated with gendered trust, \( r = .51, p = .02 \), and STEM interest was negatively correlated with exposure, \( r = -.55, p = .02 \) (see Table 3). Therefore, age, identification, and gender will be considered in the final selective trust analyses.

**Gendered exposure**

Parents reported their children watched the television series a few times a month (female characters: \( M = 1.80, SD = 1.11 \); male characters: \( M = 1.58, SD = .95 \)). No variables were significantly correlated with exposure (see Table 1). Additionally, all parents noted their children would recognize both main characters from the clips. An independent samples \( t \) test examined how boys’ and girls’ character exposure differs. Boys and girls had similar amounts of exposure to the characters, \( t(47) = .57, p > .10 \), Cohen’s \( d = .21 \). Because there were no differences in

<table>
<thead>
<tr>
<th>Table 1. Correlation Matrix (With Means and Standard Deviations) for Child Age, Gender, STEM Interest, Character Exposure, Identification, and Trust for the Full Sample.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
</tr>
<tr>
<td>1. Age</td>
</tr>
<tr>
<td>2. STEM interest</td>
</tr>
<tr>
<td>3. Exposure</td>
</tr>
<tr>
<td>4. Identification</td>
</tr>
<tr>
<td>5. Trust</td>
</tr>
<tr>
<td>6. Gender</td>
</tr>
</tbody>
</table>

*Note: *\( p < .05 \), **\( p < .01 \), ***\( p < .001 \).
exposure by participant gender and exposure was unrelated to any other variables, exposure was not included in the following analyses.

**STEM interest**

Overall, children had relatively high personal interest in STEM ($M = 6.02$, $SD = 1.87$). Independent samples $t$ tests were run to examine differences in STEM interest by child gender, and indicated no significant gender differences in children’s STEM interest, $t(47) = 1.48$, $p = .15$, Cohen’s $d = .81$. In other words, there was no evidence that during this period in development (preschool and kindergarten) girls are less interested in engaging in STEM than boys. Because STEM interest was not significantly related to any other variables, STEM interest was not considered in further analyses.

**Gendered identification**

To examine if participants had similar identification with male and female characters, or if their identification was skewed towards their own gender, One-sample $t$ tests were run for boys and girls separately (see Figure 1). If identification scores do not differ from 0, children have similar levels of identification with male and female characters. A one sample $t$ test indicated girls’ identification scores were significantly different from 0, $t(27) = 2.126$, $p = .043$, Cohen’s $d = .82$, such
Table 4. Multiple Regression Predicting Trust by Participant Age, Participant Gender, Identification, and a Gender by Identification Interaction.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 (Constant)</th>
<th>Model 2 (Constant)</th>
<th>Model 3 (Constant)</th>
<th>Model 4 (Constant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B SE</td>
<td>β</td>
<td>t</td>
<td>p</td>
</tr>
<tr>
<td>Age</td>
<td>1.347</td>
<td>0.588</td>
<td>0.317*</td>
<td>2.292</td>
</tr>
<tr>
<td>Gender</td>
<td>3.218</td>
<td>0.854</td>
<td>0.464***</td>
<td>3.767</td>
</tr>
<tr>
<td>Identification</td>
<td>0.741</td>
<td>0.800</td>
<td>0.153</td>
<td>0.927</td>
</tr>
<tr>
<td>Gender × Identification</td>
<td>-1.218</td>
<td>1.620</td>
<td>-0.179</td>
<td>-0.752</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>95% CI for β</th>
<th>Lower</th>
<th>Upper</th>
<th>F change</th>
<th>Adjusted $R^2$</th>
<th>$R^2$ change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-12.631</td>
<td>0.285</td>
<td>5.25*</td>
<td>0.081</td>
<td>0.101</td>
</tr>
<tr>
<td>Gender</td>
<td>-11.980</td>
<td>-0.560</td>
<td>14.19***</td>
<td>0.283</td>
<td>0.212</td>
</tr>
<tr>
<td>Identification</td>
<td>-0.870</td>
<td>2.353</td>
<td>1.498</td>
<td>4.937</td>
<td></td>
</tr>
<tr>
<td>Gender × Identification</td>
<td>-0.895</td>
<td>3.468</td>
<td>2.353</td>
<td>4.937</td>
<td></td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01, ***p < .001.
that girls had significantly stronger identification with female characters than would be expected by chance. Boys’ identification scores also were significantly different from 0, \( t(21) = 6.40, p < .001 \), Cohen’s \( d = 2.79 \), such that boys had significantly stronger identification with male characters than would be expected by chance.

To fully examine differences between boys’ and girls’ identification scores, an Independent Samples \( t \)-test indicated boys and girls had significantly different identification scores from each other, \( t(47) = 6.16, p < .001 \), Cohen’s \( d = 1.78 \). Overall, boys’ identification scores (\( M = 0.74, SD = 0.54 \)) represent stronger identification with male characters, and girls’ identification scores (\( M = -0.22, SD = 0.54 \)) represent stronger identification with female characters (see Figure 1).

**Gendered trust**

To examine if participants had similar trust of male and female characters, or if their trust was skewed towards their gender or male characters, One-sample \( t \)-tests were run for boys and girls separately (see Figure 2). The one sample \( t \) test indicated girls’ trust scores did not significantly differ from 0, \( t(26) = .70, p = .49 \), Cohen’s \( d = .28 \); girls had similar levels of trust for male and female characters. Conversely, boys’ trust scores were significantly different from 0, \( t(21) = 5.13, p < .001 \), Cohen’s \( d = 2.24 \); boys had significantly stronger trust of male characters than would be expected by chance. An independent samples \( t \) test indicated boys and girls had significantly different trust scores, \( t(47) = \)
3.08, $p = .03$, Cohen’s $d = .43$; specifically, boys’ ($M = 2.52$, $SD = 3.53$) trust scores were significantly higher than girls’ ($M = -0.44$, $SD = 3.29$) trust scores (see Figure 2).

As noted above, both age and identification were significantly related to trust. To examine the significant relations between identification and trust with child gender, a hierarchical multiple regression was conducted. Model 1 added the effect of age, and was significant, $R^2_{\text{adjusted}} = .081$, $F(1, 47) = 5.25$, $p = .026$. Age was significantly positively predictive of gendered trust, the older children were, the greater their trust of male characters. Age accounted for 8.1% of the variance in selective gendered trust.

Model 2 added the effect of participant gender, and was significantly better than Model 1, $R^2_{\text{adjusted}} = .28$, $R^2_{\text{change}} = .212$, $F(1, 46) = 14.19$, $p < .001$. Gender was significantly positively predictive of gendered trust; boys’ selective trust was 0.464 points greater than girls’. Age was still significantly positively predictive. Model 2 accounted for an additional 21.2% of the variance in children’s gendered trust.

Model 3 added the effect of gendered identification, and was not significantly better than the previous models, $R^2_{\text{adjusted}} = .28$, $R^2_{\text{change}} = .013$, $F(1, 45) = .86$, $p > .10$. Both age and gender were still positively predictive of trust. Model 4 added the effect of a participant gender by identification interaction, and was not significantly better than the previous models, $R^2_{\text{adjusted}} = .27$, $R^2_{\text{change}} = .009$, $F(1, 44) = .57$, $p > .10$. Both age and gender were still positively predictive of trust.

Overall, all four models accounted for 31.4% of the variance in children’s gendered trust. Although identification and trust were significantly

**Figure 2.** Gendered trust by participant gender, with scores higher than 0 indicating greater trust with male characters and scores lower than 0 indicating greater trust with female characters.
correlated, age and child gender explain significantly more of the variance in children’s trust patterns than identification.

**Discussion**

The goal of the current study was to examine how participant and character gender relate to children’s identification with animated characters from popular television programs that include STEM curriculum, and children’s selective trust in those characters to teach STEM content. Findings suggested that identification and trust have different patterns of relations with gender, such that girls and boys both demonstrated a same-gender preference for character identification, and only boys had significantly higher trust of male characters, whereas girls had similar trust of male and female characters. Of note is that children’s interest in STEM activities did not differ by child gender and was unrelated to character perception variables. The current data do not allow us to determine a) if this lack of relation between children’s interests and character perceptions indicates that children’s character perceptions are unrelated to their own interests during the preschool years, b) if this lack of relation is true globally during the preschool years or is only true in regards to children’s STEM interests and perceptions about characters in STEM domains, or c) if preschoolers’ vary more broadly in their STEM interests than is represented in the sample in the current study. Thus, future research should continue to examine the role that media characters play in the development of children’s interest in STEM activities. To contribute to this line of inquiry, our discussion focuses on the relations between children’s trust in characters as sources of STEM information and their identification with those characters within a sample of children who had relatively similar and high degrees of interest in STEM themselves.

**Selective trust**

In regards to selective trust, we initially hypothesized two possible patterns based on prior research examining how gender relates to children’s trust: either children would display a same-gender preference, basing trust on gender similarity, or children would have stronger trust of male characters, reflecting cultural stereotypes that male characters are more likely to have STEM competence (Boseovski et al., 2016; Terrier et al., 2016). Overall, children had positive selective trust scores, indicating children generally had greater trust of male characters; but when character trust was further unpacked, we found this was driven by boys’ significantly greater trust of male characters, compared to girls having similar trust in male and female characters.

If we examined character trust in relation to gender alone, it would seem children recognized that male characters are more generally portrayed as STEM experts and that female characters are less often portrayed as competent
in STEM. These patterns suggest differences in how gender-stereotyped information in children’s programs becomes incorporated into children’s perspectives of characters depending on children’s identification with on screen characters. Importantly, all the characters in the clips displayed similar competency and knowledge for solving engineering problems, as well as other STEM content. Thus, children’s responses likely reflect a stereotype built from a mass media context in which female characters are less likely than male characters to be clever, successful, and have more positive engagements with STEM (Aubrey & Harrison, 2004).

**Identification**

An important pathway through which exposure to characters relates to children’s self-perceptions and learning is the extent to which children identify with the characters (Bandura, 1997). In the current study, children had somewhat stronger identification with same gender than other gender characters, consistent with social cognitive theory (Bandura, & Bussey, 2004). This finding somewhat contrasts results from previous studies suggesting no gender differences in children’s identification with male characters (Schlesinger et al., 2016), but some gender differences for female characters, such as girls having stronger identification with a female character than boys (Calvert et al., 2007). However, neither previous study explicitly compared characters of different genders. Our findings that children had greater identification with same-gender characters suggest that during early childhood, character identification may reflect ingroup biases constructed of easy to recognize, salient cues (e.g., gender), rather than other, less salient information additionally used to construct identification later in development (e.g., spoken language, interests, goals; Maccoby, 1988).

The possibility that identification was a proxy for ingroup bias is important for two reasons, one methodological and one theoretical. Methodologically, if the character identification variable used in the current study is a proxy for preschoolers’ ingroup biases, this may statistically account for ingroup biases in the analyses of selective trust. Given prior research on gender and trust, it is possible our identification variable reflected same-group favoritism (Taylor, 2013). Taylor (2013) noted that when children did not choose an other-gender reliable informant over a same-gender unreliable informant, it was not because they believed the other gender informants to be untrustworthy, but rather children likely had an ingroup bias toward same-gender reliable informants. Although in the hierarchical multiple regression, identification did not account for a significant amount of the variance in selective trust, identification was included in the character trust analyses to account for the impact of identification as well as possible ingroup biases. If identification is a proxy for same group favoritism, the current study statistically accounted for the contribution of same group favoritism in children’s trust perceptions.
On a theoretical level, character identification during early childhood may be a very different construct than later in development, and may not predict behavior beyond early childhood or short-term learning from characters. Research on children’s emotional relationships with media characters has indicated children engage in “break ups” with characters, which is likely caused by some of the same social cognitive processes that inform how much children like, are like, and want to be like particular characters (Bond & Calvert, 2014; Brunick, Putnam, McGarry, Richards, & Calvert, 2016). As such, children’s identification with characters may shift from being based on salient category membership like gender, to less salient similarity cues or categories throughout development. Future research should examine how children’s qualitative character identification differs at unique times in development and how the construct of character identification may include different factors at specific times in development.

In all likelihood, children’s character identification during the preschool years is driven by both an ingroup positivity bias (Taylor, 2013) and the desire to be like others of the same gender (Bandura, & Bussey, 2004). Thus, the evidence of the same-gender bias in identification operating differently than the gendered differences in children’s trust in the characters reveal some important psychological processes in how young children conceptualize educational media characters, particularly the unique relations between the constructs of identification and trust.

**Trust and Identification**

To summarize the patterns above, girls had high identification and selective trust in female characters and boys had high identification and selective trust in male characters. Thus, on the surface, the appropriate pieces seem to be in place for observational learning (Bandura, 1997; Bandura, & Bussey, 2004). When girls are presented with female characters who are teaching STEM content, girls identify with those characters and trust them as sources of STEM information, just as they would with male characters. Similarly, when boys are presented with male characters who are teaching STEM content, boys identify with those characters and trust them as sources of information. Especially with female characters, identification may further drive selective trust, in that children with stronger identification may develop greater character trust. We hypothesized selective trust and identification may demonstrate similar patterns within gender because previous literature has speculated relations between identification and trust, however, little empirical work has found consistent relations between identification and trust (Bond & Calvert, 2014; Richards & Calvert, 2016; Richert et al., 2011; Schlesinger et al., 2016).

The strongly positive relations between identification and selective trust between gender, and nonsignificant relations within genders points to the need for further study of how these constructs relate in early childhood and at different
developmental periods. Identification and trust clearly overlap in some circumstances. One possibility is that the two constructs overlap in their initial formation, but become differentiated over the course of development and through exposure to diverse media characters. In other words, children initially may be drawn to same-gender characters (e.g., through salient cues about same-gender groups), but unique aspects of individual characters (e.g., competency, reliability, or other less salient similarity cues) may impact children’s reevaluations of trust and identification upon repeated exposure.

The inconsistent correlations between character trust and identification when boys’ and girls’ variables are examined separately and together also demonstrate the necessity to continue to study how these processes relate to each other and to children’s learning from characters during early childhood. Based on cultivation theory (Gerbner et al., 2002; Hentges & Case, 2013), one primary concern and application of these findings is that they may be revealing the way children perceive female characters, female peers, and young women. The boys in this study had less positive views of female characters and were less likely to perceive those characters as STEM experts. The girls in the study did not demonstrate the same stereotyped expectations. Based on cultivation theory, both boys’ and girls’ beliefs about gender roles will develop through exposure to messages on television programs about appropriate behaviors for boys and girls, along with other influences in children’s lives. Overtime, children’s beliefs about gender roles will reflect the behaviors of the characters in their favorite shows, and children may embody the stereotypes and make assumptions about people in other-gender groups based on those media messages. These behaviors and beliefs can influence social, cognitive, and emotional development and decisions throughout the life-span, contributing to the lack of diversity in STEM fields (Aschbacher, et al., 2010; Gerbner et al., 2002; Hentges & Chase, 2013; National Science Foundation, 2014; Yazilitas et al., 2013).

**Exposure**

A related question is how do differences in exposure relate to children’s selective trust in characters. This study was not designed to examine the construct of exposure, but we can speculate as to the role exposure may play in children’s development of trust based on two pieces of information. First, all children were familiar with the characters in the study before entering the lab. The quantitative measure of exposure (e.g., how often does your child watch this program) was not significantly related to character trust or identification, suggesting amount of exposure to the characters either a) did not relate to character perceptions, b) did not vary greatly enough in this sample to explain variations in character perception, or c) had reached some critical level for the establishment of character perceptions. Recent studies have indicated it is central to understand the quality and types of interactions with characters, rather than quantity of exposure, in
order to understand how children develop their perceptions of and emotional relationships with characters (Bond & Calvert, 2014; Brunick et al., 2016).

Second, the relatively brief exposure to female characters solving difficult problems did not result in children having equivalent levels of trust in the female and male characters. A related limitation is that a pretest assessment of children’s beliefs about these characters was not taken. Although it is unlikely a 90-second reintroduction to familiar characters would change children’s beliefs about the characters (Schlesinger et al., 2016), the fact that following short exposures children’s trust was not equivalent for female and male characters makes the discrepancy in representations of female STEM experts in children’s programming all the more problematic, as once preschoolers make judgments about unreliable informants, they are unlikely to revise their judgments even after additional exposure to the same informants displaying expertise or reliability (Nurmsoo & Robinson, 2009).

Similarly, if preschoolers are exposed to a previously reliable informant being unreliable, even if there is a good explanation for unreliability (e.g., the informant had been blindfolded), they are unlikely to trust that informant in the future even when the cause of the unreliability is no longer applicable (e.g., not wearing a blindfold anymore) (Jaswal, et al., 2008; Nurmsoo & Robinson, 2009). Research on children’s revisions to how they trust informants has practical implications for television producers. Children’s already established character trust before entering the lab was not revised by brief exposure to STEM competency in the current study, and resistance to revising character perceptions may operate similarly outside of the lab: Preschoolers may be unlikely to trust typically incompetent characters who display expertise in a few sporadic episodes, but children may revise their trust for inquisitive, and often ignorant, characters who display some knowledgetability in the future. Although, in the current study we were unable to evaluate revisions in children’s selective trust, we did find trust related to other variables.

**Limitations**

We have addressed limitations where relevant throughout the discussion; a few others warrant additional consideration. A primary limitation is drawn from the dichotomous and stringent ways in which gender is presented in children’s programs in the United States, and the limited presentation of female characters. Our stimuli, assessments, and analyses focused on an inflexible gender binary that is exclusively presented in young children’s television programming in the United States, and our study did not include questions about general gender stereotypes or about how children conceptualize characters who do not adhere to mainstream categories. In the current study, no parents reported their children as gender nonconforming, agender, transitioning, or displaying inconsistencies about gender category membership. We have not found mainstream
educational television programs targeted to preschool-aged children in the United States that incorporate characters outside of the binary gender categories. However, related to our findings that even young children recognize cultural stereotypes of more negative perceptions of girls’ STEM knowledge, parents and program creators should consider the potential influences of diverse and flexible gender representations on children’s perceptions of characters or themselves. Similarly, our study did not evaluate children’s interest in learning or trust of characters to teach other curriculum typically present in young children’s educational media, such as literacy or socio-emotional skills. Although results could have differed if we focused on stereotypically feminine or gender neutral domains, the lack of competent female characters on television generally makes it unlikely that the results would differ; future research should examine how children’s trust of media characters differ by domain, particularly important for characters who teach a variety of curricula.

Although our sample was diverse in race and ethnicity, increasing generalizability of our results in the United States, due to the degree of diversity, we did not have large enough groups to analyze how race, ethnicity, or cultural identity may differentially impact the variables in this study. The social cognitive processes through which underrepresented populations in the United States perceive characters of diverse races and ethnicities has similar implications as the current study (e.g., poor representations in media), and future research should examine these factors (Ryan, 2010).

An additional limitation focuses on the STEM exemplars used in this study. The items meant to capture STEM had wide inclusivity, falling under multiple domains. However, the examples were by no means inclusive of all STEM activities and concepts, and did not explicitly capture any STEM content presented in the short video clips children watched in the lab, but were reflective of activities and learning domains children recognize and are typically presented in television series that teach STEM content. A final limitation is that the current study focused on four comparable familiar media characters, but was not inclusive of all male and female media characters who teach STEM. The sample of characters were chosen because their shows included STEM content and aired new episodes when the study was developed, but as a related limitation both television programs feature STEM content as well as other curriculum for developing other school readiness skills. As the population of screen-based characters is ever evolving and growing, research should continue to consider the effects of gender-based messages (whether implied or explicit) on children learning from characters, self-perceptions, and beliefs about people they encounter in their daily lives outside of the screen.
Conclusions

In conclusion, despite a lack of gender differences in STEM interest during the preschool years, preschool-aged children are aware of gender stereotypes in media about STEM, and boys hold those stereotypes more strongly than girls. We found evidence that children overall have greater trust of male characters to teach STEM content, and trust is related to identification. Although, paths between trust in informants and learning are complex, under circumstances in which trust extends to learning, fewer positive portrayals of female characters as STEM experts could have negative ramifications for girls (Corriveau & Harris, 2009; Corriveau, et al., 2011; Koenig & Harris, 2005; Koenig & Jaswal, 2011; Schlesinger et al., 2016). We found evidence that girls want to learn from female characters just as much as they want to learn from male characters; however, if female characters continue to be portrayed as less knowledgeable on educational television programs, girls may lose trust for female characters over time, while continuing to identify with the female characters, which may result in girls assimilating the female characters’ negative traits into their own self-perceptions. Future research should examine how trust and identification relate to learning, specifically for girls and children in under-represented groups who are poorly represented on children’s television; and media procedures should continue to concentrate on increasing the quality of representation of television characters.

Note

1. Due to the emphasis of Dora and Diego representing Latino, Hispanic, and Spanish-origin cultures in the clips and on the respective television series, numerous one-way analyses of variance (ANOVA) were conducted examining any differences in exposure and character belief variables by character ethnicity. One-way ANOVAs with character ethnicity as the independent variable and the exposure difference score, $F(1,47) = 0.63, p > .10$, identification difference score, $F(1,47) = 0.45, p > .10$, and trust difference score, $F(1,47) = 0.56, p > .10$, indicated no significant differences in character beliefs or exposure by character ethnicity.

References


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