Answering the Unexpected Questions: Exploring the Relationship Between Students’ Creative Self-Efficacy and Teacher Ratings of Creativity

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Two studies explored the relationship between elementary students’ creative self-efficacy (CSE) beliefs (i.e., self-judgments of creative ability) and teachers’ ratings of students’ creativity. In Study 1, elementary students’ (N = 595) CSE beliefs in science predicted teachers’ ratings of students’ creative expression in science, accounting for a significant, but small (3.4%), proportion of variation in teachers’ ratings. Results of Study 1 also indicate that students’ CSE beliefs tended to decline by grade level and teachers tended to rate females and White students as more creative. In Study 2, elementary students’ (N = 306) CSE beliefs in science and math predicted teachers’ ratings of creative expression in math and science, again accounting for a significant, but small (2.1% in science; 4.2% in math), proportion of variation in teachers’ ratings. Also similar to Study 1, results indicate students’ CSE beliefs declined by grade level. Results of Study 2 indicate that students tended to underestimate their creative ability and tended to differentiate between creative ability in science and math (whereas their teachers did not). Implications for creativity research are discussed.

Keywords: creativity, self-beliefs, teacher-ratings, creative self-efficacy

“There is frequently more to be learned from the unexpected questions of a child than the discourses of men.” – John Locke

Creativity is often approached as a dichotomy. Many creativity researchers distinguish between “Big C” (eminent, genius-level) creativity and “little c” (everyday) creativity. In essence, creativity is viewed as a light switch. Either a person is a creative genius or she is a creative everywoman. More recently, creativity has begun to be conceptualized more as a dimmer switch, with newer theories accounting for many gradations of ability; part of this emphasis places a stronger focus on the creative process (Niu & Sternberg, 2006; Richards, 2007; Runco, 2004). One such approach is the Four C model (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009), which expands the little-c and Big-C categories to include mini-c and Pro-c.

Pro-c creativity refers to professional-level creators who have not yet attained truly eminent status (Kaufman & Beghetto, 2009). Whereas a poet who reads at her local coffee house might be little-c and Emily Dickinson would be Big-C, a Pro-c poet would be one who has published in several literary magazines and perhaps a chapbook or two. A magician performing at birthday parties might be little-c whereas Harry Houdini is Big-C; a professional magician who has appeared on TV and regularly performs for large crowds would probably be Pro-c.

Mini-c creativity represents novel and personally meaningful interpretation of experiences, actions, and events (Beghetto & Kaufman, 2007). Mini-c creativity includes the “personal” (Runco, 2004), “expressive” (Taylor, 1959), “fluid” (Necka, Grohman, & Slabosz, 2006), and “developmental” (Cohen, 1989) aspects of creativity. Examples of mini-c creativity might include someone having the inspiration to tinker with a recipe (such as adding cinnamon to mashed potatoes) or a student realizing that she can learn the state capitals by singing them to the tune of her favorite song (mini-c creativity only needs to be new to the individual, not new to the world).

There are reasonably straightforward ways of measuring the highest of the four C’s. Big-C has traditionally been measured historiometrically (e.g., Simonton, 2009), a method by which biographies and life events (such as suicide attempts or awards) are analyzed statistically. A traditional Big-C study might examine how Nobel Prize winners’ acceptance speeches vary by category. Pro-c is often measured via professional accomplishments, peer or boss ratings, or via the evaluation of creative products. At the little-c level, one might use the Torrance Tests of Creative Thinking (TTCT; Torrance, 2008), the Consensual Assessment Technique (Amabile, 1982) with everyday products, peer ratings, or creative behavior checklists.

Mini-c, however, defies most of these measures. Given that Pro-c creativity does not require a judgment from others, it would not be appropriate to use external or expert ratings of products to...
measure mini-c creativity. Similarly, there is no reason to assume that a divergent thinking test or similar psychometric instrument would be the best choice. The TTCT (Torrance, 2008), for example, are scored on dimensions such as originality; these scores are based on how a person’s responses compare to those of other people. Given that mini-c creativity pertains to subjective, self-appraisals of creativity (e.g., “Is this idea new and personally meaningful to me?”) using an assessment that generates scores based on comparisons to others does not adequately represent the subjective nature of mini-c creativity. A mini-c response to an open-ended divergent thinking question might be considered quite ordinary and common, but new and quite meaningful for that person. Imagine someone being asked, for example, to offer uses for a rubber band. That person may offer ideas that are new and meaningful to him (i.e., the rubber band could be used for a weapon or a headband), but when compared to others these same ideas may be viewed as quite commonplace and thereby receive lower scores on assessments such as the TTCT.

A key question for researchers, then, is how might mini-c be measured or studied—particularly when, by definition, it has not yet revealed itself? One way is to ask people about their own perceived creative ability. Researchers have raised serious concerns about self-report measures highlighting how they are prone to bias and inaccuracy (see Dunning, Heath, & Suls, 2004; Kyllonen, Walters, & Kaufman, 2005). Indeed, some people may perceive themselves as being less or more creative than they really are (Kaufman, 2006; Kaufman, Evans, & Baer, 2010; see also discussion in Kaufman, Plucker, & Baer, 2008). These are serious issues when considering the use of self-reports as proxies for observable creativity. When used as a way to examine subjective (or mini-c) appraisals of creativity, however, these concerns might be viewed in a different manner. Indeed, an initial step in helping to develop the creative potential of youngsters involves identifying how they view their own (mini-c) creative ability and helping them calibrate that ability in light of external (little-c) appraisals of that ability (see Beghetto, 2007; Beghetto & Kaufman, 2007).

Prior research exploring the relationship between (mini-c) self-reports of creative ability with more objective or external (larger-c) measures of creativity are somewhat mixed. There is, for instance, evidence of self-report measures being associated with the TTCT (Furnham, Batey, Anand, & Manfield, 2008; Park, Lee, & Hahn, 2002). However, most studies have not found a strong connection between self-report measures and expert-rated creativity (e.g., Kaufman et al., 2010; Lee, Day, Meara, & Maxwell, 2002; Priest, 2006).

One particularly promising mini-c measure is “creative self-efficacy” (CSE). This is because CSE beliefs not only represent a subjective appraisal of specific creative ability (e.g., creative ideational ability), but CSE beliefs have also been linked to actual creative behavior. Results of prior research have linked CSE beliefs with range of adaptive outcomes and beliefs, including: creativity ratings by supervisors (Tierney & Farmer, 2002); creative production (Kawrowski, in press); and teacher feedback on students’ creative ability (Beghetto, 2006). CSE refers to a self-judgment of one’s imaginative ability and perceived competence in generating novel and adaptive ideas, solutions, and behaviors (Beghetto, 2006; Tierney & Farmer, 2002).

CSE beliefs—like other self-efficacy judgments (Bandura, 1997)—differ from more global self-assessments (such as “I am a creative person”); “I enjoy novel experiences”) in that they focus on one’s perceived ability to accomplish particular behaviors and tasks (such as “I am good at coming up with new ideas”). Given that efficacy beliefs pertain to particular capabilities (creative ideational ability, for instance), they are thought to be a more precise predictor of actual behaviors (such as creative ideation) than would more general self-appraisals (e.g., “I am a creative person”) or feelings (e.g., “I enjoy new situations”) associated with such behaviors (see Bandura, 1997).

CSE beliefs represent a potentially promising measure of mini-c creativity in that they—unlike other self-judgments of creativity—are not limited to recognized creative ability or achievement. Whereas other self-assessments of creativity (e.g., Creative Achievement Questionnaire; Carson, Peterson, & Higgins, 2005) often focus on self-reports of demonstrated creativity by asking respondents to indicate whether their creativity has been recognized at various levels of achievement (e.g., “My recipes have won a prize or award”; Carson et al., 2005), CSE beliefs tap into the more subjective, self-judgments of creative ability. This would include children’s emerging creative ability—in-classroom setting, for instance—that has not (yet) received more formal or objective recognition by others (e.g., awards, honors, or other signifiers of highly accomplished creativity). In this way, CSE beliefs may be able to more precisely capture the transitional space between students’ intrapersonal (mini-c) creative ideation and interpersonal (or little-c) creative expression (Beghetto, 2007). At this point, additional research is needed to further explore the relationship between CSE (representing a proxy for mini-c) and external rating of little-c creative behaviors.

Exploring this relationship in younger populations is needed given that many CSE studies have focused on older students and adults and mini-c often pertains to the creative ideation of youngsters or novices in domains. Identifying and supporting the development of healthy CSE in youngsters may, as Bandura (1997) has argued, help in developing resilience and the fortification necessary for later creative behaviors.

The domain specificity of CSE beliefs is also unclear. Previous studies of CSE haven’t sufficiently explored whether there are differences in CSE across domains (such as, whether CSE beliefs in math differ from CSE beliefs in science). The “domain question” is a live issue in creativity studies—which in recent years has moved from more clearly distinct positions (cf. Baer, 1998; Plucker, 1998) to more hybrid stances (e.g., Baer & Kaufman, 2005; Plucker & Beghetto, 2004). At this point, little is known regarding the domain specificity of students’ CSE beliefs.

In these two studies we, therefore, endeavored to explore not only whether students’ CSE judgments were related to external measures of observable (little-c) creative expression as rated by teachers but to explore this question with elementary school age students in the domains of math and science.

**Study 1**

**Method**

The 595 participants in this study were students from seven elementary schools located on the coast of the Pacific Northwest. Students were enrolled in grades three (n = 193, 32.4%), four (n = 234, 39.3%), five (n = 111, 18.7%) and six (n = 57, 9.6%). The
majority of students reported their ethnicity as White (n = 448, 75.3%). Slightly over half of the participants reported their gender as female (n = 305, 51.3%).

Data used in this study were drawn from data collected as part of larger project focused on supporting science teaching and learning in coastal elementary schools. Data used in this study were collected from two data sources: (a) a paper-and-pencil student survey, and (b) teacher-ratings of students’ science ability.

The study survey, administered in late spring of the academic year, included four items that asked students to report their age, gender, ethnicity, and grade level. Five Likert-type items ranging from 1 (not true) to 5 (very true) were used to measure students’ creative self-efficacy in science. The items were based on previous measures of creative self-efficacy (Beghetto, 2006; Tierney & Farmer, 2002) and adapted for this study to assess creative self-efficacy in science. A CSE-science scale score was calculated by averaging student responses on the five items. The items used to assess creative self-efficacy in science (α = .83) are listed in Appendix A.

Teachers (N = 33), with an average of 14 years of teaching experience (ranging 1 to 30 years), completed ratings of their students’ creative expression in science. Ratings were drawn from a rating sheet that asked teachers to rate each of their students (using other students in the class as a comparison) on expression of creative ideas during science instruction (i.e., expressing ideas that are novel and appropriate for the given task). Teachers rated each of their students for two time periods (fall of the academic school year and late spring of the academic school year) on a five point rating scale (1 = lowest, 3 = average, 5 = highest). Teachers’ fall and spring ratings of students were significantly correlated (r = .66, p < .001) and therefore combined to form an averaged measure of students’ creative expression in science.

Results

Descriptive statistics for the major variables used in this study are reported in Table 1. Regression analysis was used to examine the relationship between students’ CSE beliefs in science and their demographic characteristics (gender, ethnicity and grade level). The regression model explained a statistically significant amount of the variance (2.8%) in students’ CSE beliefs, F(3, 591) = 5.778, p = .001. Students’ CSE beliefs were negatively related to grade level (β = -.16, p < .001). No statistically significant differences were found between gender and CSE in science or ethnicity and CSE in science.

Regression analysis was then used to examine the relationship between students’ characteristics, CSE beliefs in science and their teachers’ ratings of creative expression in science. Student characteristics included: grade level (a continuous variable), dummy-coded variables representing gender (0 = male, 1 = female), ethnicity (0 = non-White, 1 = White). As presented in Table 1, the regression model explained a statistically significant amount of the variance (6.8%) in teachers’ ratings of students’ creative expression in science, F(4, 590) = 10.77, p < .001. Teachers’ ratings of creative expression in science were positively related to female students (β = .11, p = .004), White students (β = .14, p < .001), and students’ self-rating of creative self-efficacy (β = .19, p < .001).

Semipartial correlations were also calculated (see Table 2) and squared to explore the proportion of variance uniquely accounted for in teachers’ ratings of creative expression in science. Students’ CSE beliefs uniquely accounted for a statistically significant, but small (ΔR2 = 3.4%, p < .001), proportion of variation in teacher ratings of creativity.

Finally, given prior literature on self-assessments that suggest the possibility of inflated or deflated self-ratings (see Kaufman et al., 2008), paired-sample t tests were used to explore whether students, on average, tended to rate their creative ability similar to how their teachers rated their creative expression. Results indicated no significant difference in students’ self-ratings (M = 3.12, SD = .97) and their teachers’ ratings (M = 3.16, SD = .80), paired-sample t(594) = -.820, p = .413.

Discussion

These findings indicate that students’ CSE ratings served as a unique, significant predictor of teacher ratings of student creativity. The magnitude of this relationship was, however, quite modest (accounting for 3.3% of the variation in teacher’s ratings of student creativity). This finding is in alignment with prior research which has suggested that although relationships between self-judgments and external ratings have been found, they are often quite small (see Kaufman et al., 2008 for a discussion).

An interesting and somewhat unanticipated finding was the discrepancy between student and teacher ratings of creativity as they pertain to demographic characteristics. Specifically, students CSE beliefs tended to decline by grade level. Teachers, on the other hand, did not tend to rate creativity differently by grade level,

Table 1
Descriptive Statistics of Study 1 & Study 2 Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Potential</th>
<th>Actual</th>
<th>Skew</th>
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<td>CSE-Science</td>
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<td>1.0–5.0</td>
<td>-.064</td>
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<td>TR-Science</td>
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<td>.80</td>
<td>1–5</td>
<td>1.0–5.0</td>
<td>-.100</td>
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<tr>
<td>STUDY 2</td>
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<td>CSE-Science</td>
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<td>1.17</td>
<td>1–5</td>
<td>1.0–5.0</td>
<td>.072</td>
</tr>
<tr>
<td>CSE-Math</td>
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<td>3.12</td>
<td>1.12</td>
<td>1–5</td>
<td>1.0–5.0</td>
<td>-.070</td>
</tr>
<tr>
<td>TR-Science</td>
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<td>1.25</td>
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<td>-.305</td>
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<td>TR-Math</td>
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<td>3.43</td>
<td>1.25</td>
<td>1–5</td>
<td>1.0–5.0</td>
<td>-.356</td>
</tr>
</tbody>
</table>

Note. CSE = Creative self-efficacy; TR = Teacher rating. The variation in sample size for Study 2 is due to the variation in students’ and teachers’ responses to the particular items.

1 Participants in this study were drawn from a larger sample (N = 1,042) of students. Of that larger sample, 57% (n = 595) had records that included teacher ratings of creative ability and responses to items measuring creative self-efficacy.

2 No item used to measure CSE had more than 2% of responses missing. In cases of missing item-level responses (3.5% of respondents), individual mean imputation was used to calculate CSE scale scores (e.g., if a student answered four out of five CSE items, his or her total CSE scale score would be calculated by taking the average of those four items). No significant difference was found on CSE scores or teacher ratings between respondents who had imputed CSE scores and those who did not.
but rather tended to rate White and female students as more creative than nonwhite and male students. This finding is consistent with past research examining unconscious gender and ethnicity biases in assigning slightly higher scores to White females (Eagly, Mladinic, & Otto, 1991; Eagly, Makhijani, & Klonsky, 1992; Kaufman, Baer, Agars, & Loomis, 2010; Kaufman, Niu, Sexton, & Cole, 2010).

In Study 1, only one domain was tested (science). As noted earlier, however, there is evidence in creativity research for domain effects (Baer, 1993; Kaufman & Baer, 2005; Kaufman, Cole, & Baer, 2009). In order to explore how these relationships held together in a second domain, a second study was conducted. This study was comparable to the first study but examined student CSE and teacher ratings across two domains (math and science) with a different sample of teachers and students.

### Study 2

The 306 participants were students from 12 elementary schools located in a midsized city in the Pacific Northwest. Students were enrolled in grades three (n = 98, 32.0%), four (n = 130, 42.5%) and five (n = 78, 25.5%). The majority of students reported their ethnicity as White (n = 166, 70.6%). Slightly over half of the participants reported their gender as male (n = 161, 52.6%).

Data used in this study were drawn from data collected as part of larger project4 focused on supporting science and math teaching in elementary schools. Data used in this study were collected from two sources: (a) a paper-and-pencil student survey, and (b) teacher-ratings of students’ creative expression in science and math.

The student survey, administered in the fall of the academic school year, included four items that asked students to report their age, gender, ethnicity, and grade level. Likert-type items ranging from 1 (not true) to 5 (very true) were used to measure students’ creative self-efficacy in science and mathematics. The 10 items were based on previous measures of creative self-efficacy (Beghetto, 2006; Tierney & Farmer, 2002) and adapted for this study to assess creative self-efficacy in science and mathematics. Five items were used to assess students’ creative self-efficacy in science (α = .90) and five items were used to assess students’ creative self-efficacy in mathematics (α = .90). CSE-science and CSE-math scale scores were calculated by averaging student responses across the five items measuring each construct. The items are listed in Appendix A.

Item-level principal axis factor analysis, with Promax rotation and k value of 4 (Tataryn, Wood, & Gorsuch, 1999), was used to examine the factor structure of the items used in this analysis. Two interpretable factors were extracted which accounted for 65.58% of the variance. The factor loadings are reported in Appendix A. Construct scores were created from calculating mean ratings for items making up each of the two constructs: Creative self-efficacy in science (CSE-Science) Creative self-efficacy in math (CSE-Math).

Teachers (N = 17), with an average of 16 years teaching experience (ranging 2 to 41 years), rated their students’ creative expression in science and math. Ratings were drawn from a rating sheet that asked teachers to rate each of their students (using other students in the class as a comparison) on expression of creative ideas during science instruction (i.e., expressing ideas that are novel and appropriate for the given task) and their expression of creative ideas during math instruction (i.e., expressing ideas that are novel and appropriate for the given task). Teachers rated each of their students in late spring of the academic school year on a five point rating scale (1 = lowest, 3 = average, 5 = highest) on creative expression in science and math.

### Results

Descriptive statistics for the major variables used in this study are reported in Table 1. Regression analysis was used to examine the relationship between students’ CSE beliefs in science/math and their demographic characteristics (gender, ethnicity and grade level). With respect to CSE in science, the regression model explained a statistically significant amount of the variance (2.9%) in students’ CSE-science beliefs, F(3, 298) = 2.972, p = .032. Students’ CSE science ratings were negatively related to grade level (β = -.13, p = .025). No statistically significant differences

### Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>Semi-partial r</th>
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<tr>
<td>Grade</td>
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<td>.034</td>
<td>.059</td>
<td>.059</td>
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<tr>
<td>Gender</td>
<td>.181</td>
<td>.063</td>
<td>.114**</td>
<td>.114**</td>
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<tr>
<td>Ethnicity</td>
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<td>.073</td>
<td>.143***</td>
<td>.143***</td>
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<td>.053</td>
<td>.186***</td>
<td>.184***</td>
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<tr>
<td>R²</td>
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<td></td>
</tr>
<tr>
<td>n</td>
<td>595</td>
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</table>

Note. Gender (1 = female, 0 = male); Ethnicity (1 = White, 0 = non-White).
*p < .05. ** p < .01. *** p < .001.

3 Nearly a quarter of the students (n = 71, 23.2%) did not report their ethnicity. Thus, 70.6% is the percentage based on those reporting ethnicity. No significant (p > .05) difference was found between this group and the group reporting their ethnicity as Anglo/White on students’ reports of creative self-efficacy or teachers’ ratings of creative expression in math and science. Students who did not report ethnicity were therefore combined with the Anglo/White to make up the comparison group in the regression models. Given this limitation, results pertaining to ethnicity in this study should be interpreted with caution.

4 Participants in this study were drawn from a larger sample (N = 444) of students. Of that larger sample, 69% (n = 306) had records that included teacher ratings of creative expression.

5 No item used to measure CSE-science or CSE-math had more than 5.2% of responses missing. Respondents with highly incomplete (i.e., missing more than three) responses on items measuring CSE-science (n = 4, 1.3%) or CSE-math (n = 4, 1.3%) were not included in the analysis. In all other cases of missing item-level responses (CSE-science, n = 30, 9.8%; CSE-math, n = 25, 8.2%) individual mean imputation was used to calculate CSE scale scores (e.g., if a student answered four out of five CSE items, his or her total CSE scale score would be calculated by taking the average of those four items). No significant difference was found on CSE scores or teacher ratings between respondents who had imputed CSE scores and those who did not.
were found between gender and CSE in science or ethnicity and CSE in science. With respect to CSE in math, the regression model did not explain a statistically significant amount of the variance (2.1%) in students’ CSE math ratings, \( F(3, 297) = 2.273, p = .091 \). As with CSE in science, however, students’ CSE math ratings were negatively related to grade level (\( \beta = -.12, p = .034 \)). No statistically significant differences were found between gender and CSE in math or ethnicity and CSE in math.

Next, regression analysis was used to examine the relationship between students’ characteristics, CSE beliefs in science and math, and their teachers’ ratings of creative expression in science and math. The first regression model explained a statistically significant amount of the variance (8.9%) in teachers’ ratings of students’ creative expression in science, \( F(5, 291) = 5.661, p = .001 \). As presented in Table 3, teachers’ ratings of creative expression in science were positively related to students’ CSE beliefs in science (\( \beta = .16, p = .010 \)) and CSE beliefs in math (\( \beta = .16, p = .008 \)). No statistically significant differences (at the .05 level) were found between teacher ratings of creative expression in science and students’ characteristics (gender, grade level, or ethnicity).

The second regression model explained a statistically significant amount of the variance (9.0%) in teachers’ ratings of students’ creative expression in math, \( F(5, 282) = 5.582, p < .001 \). As presented in Table 3, teachers’ ratings of creative expression in math were positively related to students’ self-ratings of creative self-efficacy in math (\( \beta = .22, p < .001 \)) and creative self-efficacy in science (\( \beta = .14, p = .024 \)). No statistically significant differences were found between teacher ratings of creative expression in math and students’ characteristics (gender, grade level, or ethnicity).

### Table 3

**Summary of Study 2 Regression Analysis Science & Math Creative Expression**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>B</th>
<th>SE B</th>
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<th>Semi-partial ( r )</th>
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<td>.050</td>
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<td>-.090</td>
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<td>.101</td>
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<td>.150**</td>
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<td>( R^2 )</td>
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<td>( n )</td>
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<tr>
<td><strong>MODEL 2 (Creative Expression in Math)</strong></td>
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<td>Student Characteristics</td>
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<td>.035</td>
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<tr>
<td>( R^2 )</td>
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<tr>
<td>( n )</td>
<td>288</td>
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*Note. Gender (1 = female, 0 = male); Ethnicity (1 = White, 0 = non-White).  
**p < .05. ***p < .01. ****p < .001.

Semipartial correlations were calculated (see Table 3) and squared, as in Study 1, to explore the proportion of unique variance accounted for in teachers’ ratings of creative expression by students’ CSE beliefs. A similar finding was found: students’ CSE beliefs uniquely predicted a significant, but small proportion of variation in teachers’ ratings of creative expression in science (CSE-Science, \( \Delta R^2 = 2.1\%, \; p = .010 \)) and creative expression in math (CSE-Math, \( \Delta R^2 = 4.2\%, \; p < .001 \)).

Next, in order to compare whether students and teachers differed in their views of creativity by domain, we examined the relationship between students’ CSE in math and students’ CSE in science \( (n = 302; \; r = .339, \; p < .001) \) and teachers’ perceived relationship between students’ creative expression in math and science \( (n = 283, \; r = .889, \; p < .001) \). We then compared the difference between the two correlations by using the Fisher’s z-to-\( r \) transformation and computed the \( z \) value for the difference between the two correlations. The resulting \( z \) value was found to be significantly different \( (z = 12.8, \; p < .001) \). These results indicate that students were significantly more likely than their teachers to see a difference between creative expression in math and science.

Finally, paired-sample \( t \) tests were used to explore whether students, on average, tended to rate their creative ability in math and science similar to how their teachers rated their creative expression in math and science. Results indicated students, on average, tended to significantly underestimate their creative ability (CSE) in science \( (M = 2.99, \; SD = 1.16) \) as compared to their teachers’ ratings of their creative expression in science \( (M = 3.42, \; SD = 1.25) \). Paired-sample \( t(296) = -4.974, \; p < .001 \). A similar pattern was found in math: students, on average, tended to significantly underestimate their creative ability (CSE) in math \( (M = 3.15, \; SD = 1.13) \) as compared to their teachers’ ratings of their creative expression in science \( (M = 3.43, \; SD = 1.25) \). Paired-sample \( t(287) = -3.201, \; p = .002 \).

### Discussion

To a certain extent, Study 2 replicated the findings of Study 1. As with Study 1, students’ CSE ratings in math and science served as unique, significant predictors of teachers’ ratings of creativity in math and science that accounted for a small proportion of variation in teachers’ ratings \( (2.1\% \text{ for science and } 4.2\% \text{ for math, respectively}) \). Also similar to Study 1, students’ CSE ratings were found to decline with age. Unlike Study 1, teachers in this sample did not tend to view females or White students as more creative.

Most interesting in this study were discrepancies in CSE and teacher ratings across math and science. Whereas students tended to distinguish between their self-judgments of creative ability in math and science, their teachers tended not to make this distinction. Although prior research has indicated that judgments of scientific and mathematical creativity often end up correlating highly with each other (Kaufman, 2006; Kaufman & Baer, 2004), the results of the present study suggest that students were able to distinguish between their own CSE in these domains. Conversely, teachers seemed to make more of a general rating of creativity (not really seeing difference in creative expression in math vs. science). This finding supports Plucker’s (2004) general assertion: creativity appears domain-general or domain-specific based on its assessment. In this particular case, students’ CSE beliefs suggested domain-specificity of creative ability in math and science and
teachers external judgments tended to suggest domain-generality of the expression of that ability in math and science.

Finally, students, on average, tended to significantly underestimate their creative ability in both math and science (as compared to teachers’ ratings of their creative expression in math and science). This is a potentially important finding and, at least in this sample of students, aligns with concerns raised by creativity researchers regarding the potential for the underestimation of creative ability in self-ratings (see Kaufman et al., 2008). Left unchecked, self-judgments that underestimate ability can be particularly problematic. As Bandura (1997) has noted, regardless of actual ability, when people don’t believe they have the capacity to perform a particular behavior they will be less likely to try, sustain effort, and, ultimately, fulfill their potential.

**General Discussion & Conclusion**

In this study we endeavored to explore CSE as proxy for elementary students’ mini-c creativity that could then be explored in relation to external little-c teacher ratings of domain-specific creative behavior. The results of these two studies indicate that although CSE in math and science can uniquely predict teachers’ ratings of little-c creativity, the amount of variation in teachers’ ratings accounted for by students’ CSE beliefs is rather small. This finding is in general alignment with previous research that has indicated that the links between self-assessed and more expert ratings of creativity often are not that strong (e.g., Kaufman et al., 2010; Lee et al., 2002; Priest, 2006).

In the context of the classroom, such findings raise the important question of whether and how student and teacher assessments of creativity might be better aligned. General recommendations have been offered in this area (e.g., Beghetto, 2007; Beghetto & Kaufman, 2007), but further empirical work is needed. For instance, how might interventions aimed at developing broader conceptions of creativity—both on the part of teachers and students—influence this link? Also, given that CSE beliefs have been found to be related to teacher feedback (Beghetto, 2006), what specific types of feedback might teachers provide to help students—at various age levels—develop and better calibrate their self-judgments of creativity? Subsequent work is needed that explores not only how teachers and students might be in more alignment in their assessments of developing creativity but also explores whether and how these assessments of creativity predict the development of larger C levels of creative expression.

The findings from these two studies also highlight potentially important discrepancies in student and teacher judgments of creativity. First, both studies demonstrated declines in students’ CSE beliefs across grade level; whereas there were no such declines in how teachers rated student creativity across grade levels. Declines in self-perceptions of creative ability can have important implications for the development of creative potential and provide additional empirical support for long standing concerns about the potential for school to have a suppressing influence on student creativity. Some scholars, most notably Torrance, have argued that there is a “fourth grade slump,” in which creative performance suffers in year four due to socialization and other factors (Torrance, 1962, 1965, 1968). Other research opposes this idea, arguing for a surge of creativity in the fourth grade (Charles & Runco, 2001; Claxton, Pannells, & Rhoads, 2005; Smith & Carlsson, 1983, 1985). Our own findings do not indicate a sharp drop at fourth grade, but rather an on average decline in self-perceptions of creativity as students get older. Given that our results are based on a cross-sectional study, longitudinal research would be needed to further explore the consistency and nature of such declines in individual students. It is important to also emphasize that this decline was only seen in the students’ CSE ratings, and not in teacher perceptions. Exploring the consistency of this discrepancy and its implications might serve as an important area of subsequent inquiry—including what relationship, if any, such declines have with the types of assessments and learning tasks older students engage in as compared with younger students.

These studies also provide additional—albeit somewhat mixed—evidence that teachers may have a slight unconscious bias when assigning creativity scores to female and White students. Given that self-efficacy beliefs are thought to be influenced by external performance-related feedback (Bandura, 1997), bias judgments can eventually stifle healthy self-beliefs and negatively impact creative performance in the classroom. This finding warrants subsequent inquiry, both to explore the nature and consistency of such biases and to examine how to help teachers become aware of possible biases so they don’t unfairly judge students. Carefully exploring teachers’ beliefs about the nature of creativity—in conjunction with their ratings of student creativity—may provide additional insights into their judgments about student creativity.

Moreover, the results of these studies suggest that although students do see some relationship between their creative ability in math and science, they are more likely than their teachers to distinguish between these domains. That students would see some relationship, but ultimately distinguish between domains in their CSE judgments is consistent with Bandura’s (1997) self-efficacy theory (i.e., viewing CSE in math and science as somewhat related in that the judgments pertain to creative ideation, but ultimately different in that they pertain to creative ideation in different academic domains). Still, subsequent research is needed to explore the consistency of this finding, including: what age children can most reliably assess their CSE in various subject areas and whether the inclusion of additional measures of student creativity (in addition to teacher ratings) would yield similar results.

Finally, two potentially important findings from Study 2 are worth stressing: (a) teachers tended not to differentiate between math and science in their ratings of creative expression, whereas students did; and (b) students tended to significantly underestimate their creative ability in math and science. These findings raise several questions that need additional exploration, including: When and why might teachers not differentiate between creative expression in math and science? What are the implications of not making this distinction? How might students’ better calibrate their self-appraisals of creative ability? As noted earlier, demonstrated ability is not a sufficient predictor of subsequent performance. Rather, other factors, such as efficacy beliefs, can play a key role. While strong efficacy beliefs alone cannot increase creative performance, weak efficacy beliefs can (and likely will) have a negative impact on creative performance (including, precluding some students from even being willing to share their ideas). It is therefore important that teachers help students calibrate their CSE beliefs—particularly in the case where they may be underestimating their creative ability.
Taken together, the results of these two studies point to important areas of subsequent inquiry and suggest that although CSE may serve as a useful proxy for exploring mini-c self-beliefs, it is still somewhat limited in its ability to serve as a strong predictor of external ratings of creative expression. There is, therefore, a need for the further exploration of the potential use of CSE measures in assessing mini-c creativity as well as the development of measures that might better predict creative performance. In particular, additional research is needed to further explore at what age children can reliably assess CSE—particularly when considered in relation to external ratings of creative performance. Cross sectional and longitudinal studies exploring whether CSE is a stronger predictor of creative performance in older students are also needed.

Moreover, there is a need to develop more fine-grained studies that explore the relationship between mini-c self-ratings and external ratings of larger-c creative expression, including the development of multiple and different types of measures of creative ideation and performance. Karwowski (2009) has begun studying self-assessments on all levels of the Four C model (and, indeed, people are more likely to see themselves as little-c or mini-c than Pro-c or Big-C). We are encouraged by such efforts and would additionally suggest developing studies in which students’ creative products and performances would use additional external measures of creativity (in addition to teacher evaluations). One possibility might be to use an adapted version of the Consensual Assessment Technique (CAT), (Amabile, 1982), modified to provide an evaluation of creativity across the various levels of the Four C model. Such external measures (e.g., a modified CAT) could be considered in relation to students’ CSE beliefs as well as more detailed self-judgments of specific creativity ability and performance (measured across the Four C levels of creativity—including, for instance, the self-judgments of “creative only to me” and “not creative to me or anyone else”).

Broadly, this line of inquiry supports the emphasis placed on exploring smaller-c appraisals and expressions of creativity. As articulated by the epigram of this paper, there can be a different type of creative insight offered by children (or by any novice, i.e., Schooler & Melcher, 1995). More research focusing on ways to measure, develop, and nurture mini-c creativity can lead to more creative children—and adults.

References
Lee, J., Day, J. D., Meara, N. M., & Maxwell, S. E. (2002). Discrimination of social knowledge and its flexible application from creativity: A...

Appendix

CSE Items, Alpha Reliabilities, and Factor Loadings

STUDY 1

Creative Efficacy in Science (α = .83)
I am good at coming up with new ideas during science class.
I have a good imagination during science class.
I have a lot of good ideas during science class.
I am good at coming up with my own science experiments.
I am good at coming up with new ways of finding solutions to science problems.

STUDY 2

Creative Efficacy in Science (α = .90)

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am good at coming up with new ideas during science class.</td>
<td>.779</td>
<td>.260</td>
</tr>
<tr>
<td>I have a good imagination during science class.</td>
<td>.806</td>
<td>.253</td>
</tr>
<tr>
<td>I have a lot of good ideas during science class.</td>
<td>.894</td>
<td>.340</td>
</tr>
<tr>
<td>I am good at coming up with my own science experiments.</td>
<td>.751</td>
<td>.325</td>
</tr>
<tr>
<td>I am good at coming up with new ways of finding solutions to science problems.</td>
<td>.811</td>
<td>.406</td>
</tr>
</tbody>
</table>

Creative Efficacy in Math (α = .90)

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am good at coming up with new ideas during math class.</td>
<td>.289</td>
<td>.752</td>
</tr>
<tr>
<td>I have a good imagination during math class.</td>
<td>.377</td>
<td>.840</td>
</tr>
<tr>
<td>I have a lot of good ideas during math class.</td>
<td>.360</td>
<td>.858</td>
</tr>
<tr>
<td>I am good at coming up with my own math problems.</td>
<td>.245</td>
<td>.745</td>
</tr>
<tr>
<td>I am good at coming up with new ways of finding solutions to math problems.</td>
<td>.294</td>
<td>.835</td>
</tr>
</tbody>
</table>

Note. Principal Axis Factoring using Promax Rotation with Kaiser Normalization. Pattern Coefficients > .50 in bold.

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