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Boosting Children's Persistence through Scientific Storybook Reading

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ABSTRACT

Eighty-six 4- and 5-year-old children were assigned to one of four conditions, three experimental conditions, in which children read a story about a famous scientist, and one baseline condition. In the *Achievement* condition: the scientist was described as receiving awards and recognition through their lifetime, with no discussion of setbacks; in the *Intellectual Struggles*, the scientist was described as making mistakes along the way to success; and in the *Life Struggles*, the book emphasized personal struggles, such as having no money for food. In the *Baseline* condition, children completed a persistence task without having first read the story. In each experimental condition, children were asked 12 questions adapted from the Dimension of Mastery Questionnaire-18, which examined their persistence and motivation when faced with a challenging task. Finally, children were presented with the persistence task. Analyses revealed that children in the *Intellectual Struggles* and *Life Struggles* conditions persisted longer on the task than children in the *Achievement Condition*. These findings suggest that storybooks that emphasize the process of science, rather than solely focusing on achievement can impact persistence as well as feelings of relatedness in STEM.

I was taught that the way of progress was neither swift nor easy.

- Marie Curie

In our daily lives, we typically focus on scientific research outcomes, without considering the challenges and failures scientists face before achieving success. However, as the above quote illustrates, scientific advancement rarely occurs without setbacks. In the current study, we explore how exposure to scientists' failures on the path to success impacts children's own motivation and persistence. Before turning to the current study, we briefly review literature on children's achievement motivation and persistence in science.

Bempechat and Mirny (2005) define achievement motivation as "the study of goal-directed behavior in educational settings." Today, the field of achievement motivation is rooted in social cognition, recognizing that motivation is not a monolithic factor, but rather a "constellation of beliefs and behavior" that influence how children interpret their learning

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experiences (Bempechat & Mirny, 2005). For example, children's beliefs about intelligence, their expectations about their own and others' performance, and their attributions of success and failure, all influence children's decisions to pursue challenging tasks.

Recent research has explored subtle differences in language as one factor that impacts children's motivation and beliefs about who belongs in STEM. For example, four-year-old children felt more demoralized after receiving generic praise (e.g., "You are a good drawer") and making a mistake than after receiving nongeneric praise (e.g. "You did a good job drawing") and making a mistake (Cimpian, Arce, Markman, & Dweck, 2007). Additionally, subtle language cues activate young children's stereotypes related to ability in the domain of STEM, impacting children's preferences and performance. For example, six-year-old girls preferred to play a game for children who "work very hard" rather than a game for children who are "very smart" (Bian et al., 2017). Similarly, five- to seven-year-old girls persisted longer on a difficult task when told that they are "doing science" rather than "being scientists" (Rhodes, Leslie, Yee, & Saunders, 2019). Such differences in persistence were attributed to children's sensitivity to linguistic cues (i.e., "doing" versus "being") that highlighted scientists as a social group they might not be a member of. In the current study, we focus not on how *subtle* language differences influence motivation, but on how thematic differences in a storybook about a famous scientist influence children's persistence on a challenging task.

An individual's motivation can also be impacted by whether or not they believe intelligence is a stable trait or can be developed (e.g., fixed versus growth mind-set; Dweck, (2008), 2014; Dweck & Leggett, 1988). Some of this research has focused specifically on STEM: in a longitudinal study, Blackwell, Trzesniewski, and Dweck (2007) found that across two years, seventh grade students with a growth mind-set focused significantly more on learning goals and scored significantly higher grades in math than students with a fixed mind-set. Additionally, college students with a growth orientation, rather than a fixed orientation performed better in chemistry (Grant & Dweck, 2003). Taken together, this research indicates that perceptions of learning and intelligence impact performance in STEM.

In the current study, we explored children's beliefs about their own mastery motivation. Mastery motivation, a concept related to but distinct from mind-set theory, is defined as the intrinsic drive to explore and master one's environment (DMQ18). Messer (1993, 2016) posits that mastery motivation is not intrinsic in the sense that it is a stable characteristic, but rather is an innate capacity that develops over time. By this definition, mastery motivation is sensitive to recent experiences of success and failure in the short term. Some research with high school students indicates that students who read about scientists' intellectual and life struggles performed better in their science classes than students who only read about scientists' academic success (Lin-Siegler, Ahn, Chen, Fang, & Luna-Lucero, 2016). Students exposed to the scientists' struggles reported higher levels of connectedness to the stories than students who only read about the scientists' success. Passages that emphasized achievement, focusing on scientists' innate brilliance rather than their effort, made it difficult for students to relate to the story, leading to decreased science motivation. Here, we explore whether exposure to similar stories about scientists' struggles might also impact motivation and persistence in early childhood.

The current study

To date, the research on children's beliefs about mastery motivation and persistence in STEM has focused on elementary age students and older. However, from an early age, children's beliefs and motivation in STEM are impacted by their social contexts, including language from adults (e.g., Rhodes, Cardarelli, & Leslie, 2020; Rhodes et al., 2019). The primary goal of the current work is to investigate how persistence on a task and beliefs about motivation are shaped through exposure to messages about how to approach a challenging task prior to the onset of formal schooling. To explore this question, we adapted the stories from Lin-Siegler et al. (2016) to be developmentally appropriate for 4- and 5-year-old children by creating researcher-designed storybooks about famous scientists. Children's picture book reading has been associated with early scientific knowledge and analogical reasoning (Brown, Ronfard, & Kelemen, 2020; Ganea, Ma, & DeLoache, 2011; Kelemen, Emmons, Seston Schillaci, & Ganea, 2014; Shtulman, Neal, & Lindquist, 2016; Strouse, Nyhout, & Ganea, 2018). In addition to providing children with access to content, storybooks can also impact children's social inferences and highlight who 'belongs' in science (e.g., Farland, 2006; Leech, Haber, Arunachalam, Kurkul, & Corriveau, 2019; Leech, Haber, Jalkh, & Corriveau, 2020). For example, eight-year-old children who engaged in inquiry science and read historical scientific biographies produced more diverse and inclusive drawings of scientists than children who engaged in inquiry without reading a related biography (Farland, 2006).

In the current study, children were randomly assigned to one of four conditions: *Achievement, Intellectual Struggles, Life Struggles*, or a *Baseline* group. We explored relations between the storybook condition and children's motivation (adapted from the Dimensions of Mastery Questionnaire; Morgan et al., 2019) and persistence on an impossible task. Our first research question asked how differences in a storybook about scientific achievement and success impact children's persistence and motivation during an impossible task. In line with Lin-Siegler et al. (2016), we predicted that children would persist longer at the impossible task when hearing a storybook about struggle as compared to one focusing only on success. Our second research question focused on relations between the storybook conditions and children's beliefs about their own motivation. We predicted that children would report higher levels of motivation after hearing a book about struggle as compared to a book about achievement without struggle. Our third research question asked whether there might be a relation between children's motivation scores and persistence on the impossible task.

Method

Participants

Eighty-six 4- and 5-year-old children participated (M_{age} = 59.76 months, age range: 48–70 months, 37 girls). Children were recruited from preschools located in a Northeastern U.S. city. The sample included mainly a mid/high socioeconomic status population in Boston and surrounding suburbs. Most participants were White. As compensation for participating in the study, schools received books. Data were collected between September 2019 and March 2020.

A priori power analyses were conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the sample size needed to test differences in children's persistence on the impossible task by 3 experimental conditions and our baseline group using an ANOVA. The power analysis indicated a sample of at least 76 children (f = 0.4, critical F value = 2.73, power = 0.82, alpha = .05). Our total sample included 86 children, indicating sufficient power.

Procedure

Baseline sample

To explore children's baseline persistence on the challenging task without exposure to the storybooks, 24 children completed the impossible task only.

Experimental conditions

The remaining 62 children completed one of three *experimental* conditions (*Achievement*: n = 19, *Intellectual Struggles*: n = 21, *Life Struggles*: n = 22). Each condition consisted of three phases in a fixed order: book reading session, adapted Dimensions of Mastery Questionnaire 18 and persistence task.

Book reading session

Two sets (Albert Einstein, Marie Curie) of 3 researcher-designed books (1 per condition) were developed. Books were matched on story length (in words) and were all 8 pages (see Figure 1). For each set of books, the first, second and last pages were identical.

The major difference between conditions was the story's focus on *achievement without failure, intellectual struggles* or *personal life struggles*. In the *Achievement Condition*, children heard a story about a famous scientist who had received awards and recognition, with no discussion of any struggles. For example, the child read, "*Marie Curie won many awards in her life. She was the only person to receive a Nobel Prize in both physics and chemistry and the first woman to ever receive this award*." In the *Intellectual Struggles Condition*, children the book highlighted that the scientist made mistakes along the way to achieving success. For example, children read, "*Even though she did not always succeed right away, she knew that she needed to keep trying to learn*

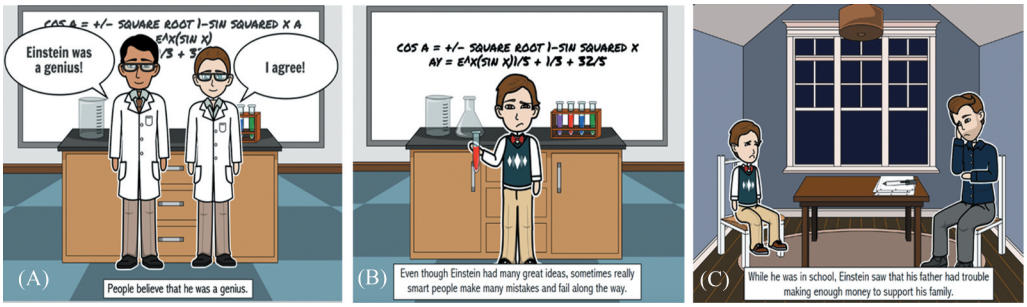

Figure 1. Sample pages from the three storybook conditions for the Albert Einstein stories: (a) Achievement, (b) Intellectual Struggle and (c) Life Struggle.

Table 1. Adapted questions from the dimensions of mastery questionnaire 18.

Questions
(Practice) I really like to eat candy.
(Practice) I really like to eat broccoli.
1. I work on a new problem until I can do it.
2. I get frustrated when not able to complete a challenging task
3. I get frustrated when I don't do well in something.
4. I try to figure out all the steps needed to solve a problem.
5. I get excited when I figure something out.
6. I do things that are difficult for kids my age.
7. I am very happy when I solve a problem for school.
8. I work for a long time trying to do something challenging.
9. I will work for a long time trying to solve a problem for school.
10. I give up after trying but not succeeding.
11. I like to try challenging problems instead of easy ones.
12. I get angry if I cannot do something after trying hard.

Note. For each question, children were presented with 5 choices and a corresponding scale: not at all like me (1), a little bit like me (2), somewhat like me (3), mostly like me (4) and just like me (5).

something new." In the *Life Struggles Condition*, the book emphasized personal struggles, such as having no money for food or not fitting in new school environments. For example, children read, "*She also struggled because she did not have enough money to pay for food*."

Immediately following the story, the experimenter asked the child one open-ended comprehension question, "What was the story about?" to ensure that children were attending to the story. Because this study focused on preschoolers, this question was primarily designed to ensure that children were on task prior to commencing the DMQ questions. Eighty percent of children responded by sharing a key aspect of the story such as, "there was a scientist."

Dimensions of mastery questionnaire 18

Next, children were presented with an adapted version of the Dimensions of Mastery Questionnaire 18 (DMQ; Morgan et al., 2019). Children were first introduced to the scale, which contained pictures of partially filled circles that corresponded to 5 ordered categories: "not at all like me," "a little bit like me," "somewhat like me," "mostly like me" and "just like me." For each question, the experimenter said a statement and the child was invited to respond by pointing to the circle on the scale. The experimenter said the scale aloud while pointing to the corresponding circle. To ensure that children understood the scale, they were asked two practice questions. For example, "I really like to eat candy." All children had no difficulty responding. Next, the child was presented with twelve statements that focused on their persistence on a challenging task (see Table 1). Items on the adapted DMQ probed at both expressive aspects of motivation (e.g., "I am very happy when I solve a problem at school") and instrumental aspects of motivation (e.g., "I work for a long time trying to do something challenging").

Persistence task

Finally, to measure children's persistence, children were presented with an impossible task (e.g., Pitcairn & Wishart, 1994; Sawyer, 2017). Although the task was STEM-themed, it is best described as a general persistence task. We were particularly interested in children's persistence because persistence in the face of a challenge is a critical aspect of the scientific

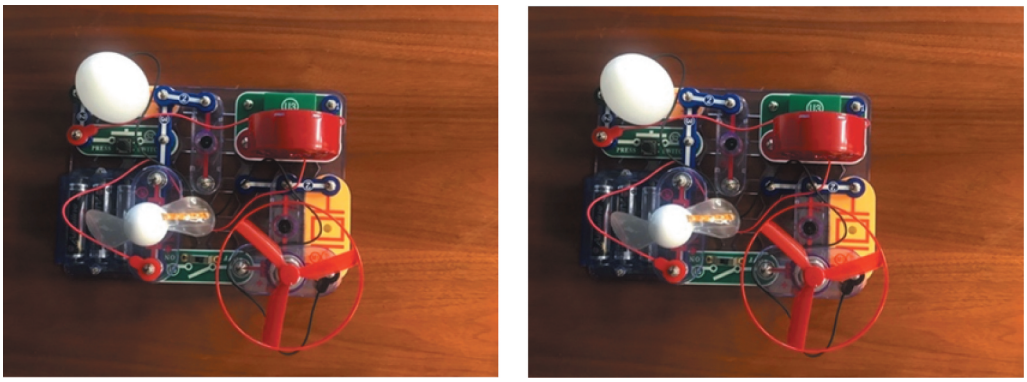

Figure 2. Picture used in the impossible persistence task.

method. Children viewed two identical photographs of Snap Circuits© (see Figure 2) and were told, "Your job is to find the differences between these two pictures of Snap Circuits. When you are done, let me know." There was no limit to the amount of time children could spend looking for differences.

Results

Our first research question explored relations between the storybook condition and the amount of time spent engaging with the impossible task. On average, children in the baseline sample (n = 24) persisted for 54.67 seconds (SD = 38.64 seconds). We then examined the average time children spent engaging in the impossible task on the three experimental conditions (n = 62), finding that they persisted on average 63.13 seconds (SD = 41.33 seconds).

We conducted an ANOVA to explore differences between children's persistence in the three experimental conditions compared to the baseline sample. Overall, children's persistence on the impossible task differed by condition $F(3, 82) = 6.08$, $p < .001$; see Figure 3). Next, we conducted post-hoc t-tests and found that children's baseline persistence differed significantly from children in the *Achievement* condition (M = 30.89, SD = 19.87, $t(41) = 2.44$, $p < .01$) and the *Intellectual Struggles* condition ($M = 78.95$, $SD = 40.00$, $t(43) = -2.07$, $p < .05$). Additionally, compared to the baseline condition, children's persistence was longer on the *Life Struggles* condition (M = 74.00, SD = 44.18, $t(44) = -1.58$, p = .06). Whereas children's persistence in the *Achievement* condition was shorter than baseline sample, children's persistence in the *Intellectual* and *Life Struggles* conditions was longer than the baseline sample.

Because we had *a priori* predictions about the experimental conditions (and in line with Lin-Siegler et al., 2016), we conducted planned linear contrasts. Following Bonawitz et al. (2011), we used planned linear contrasts for this analysis to directly compare across the experimental conditions. We formalized the hypothesis that the *Achievement* condition would differ from the *Intellectual Struggles* and *Life Struggles* conditions by employing weights: 2, −1, −1. The analyses will therefore be significant when there is a difference between the *Achievement* condition and the two struggle conditions. The linear contrast was significant, ($F(2, 61) = 10.16$, $p < .001$), indicating that children in the *Achievement* condition persisted for less time compared to children in the two struggle conditions.

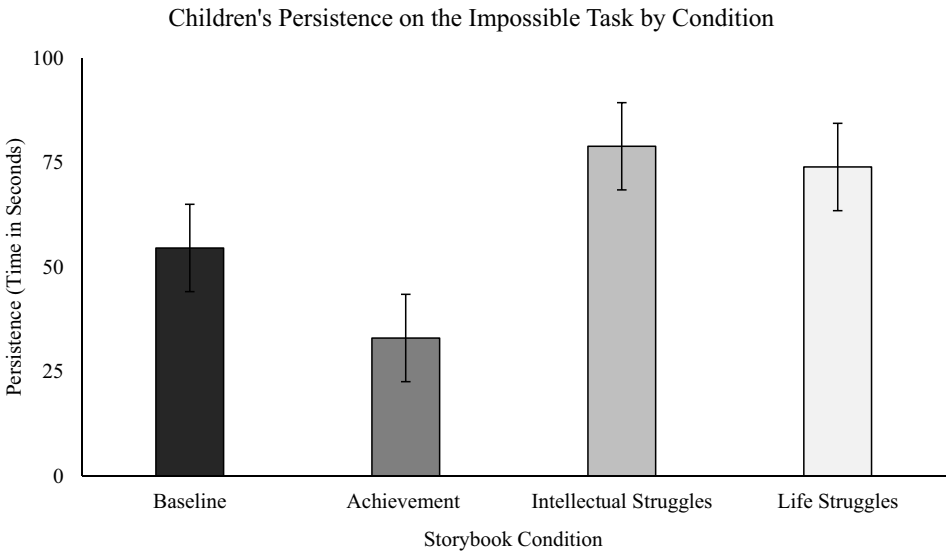

Figure 3. Children's persistence on the impossible task (in seconds) by storybook condition.

Our second research question examined relations between the storybook task and children's beliefs about their own motivation. Recall that children were asked to rate their agreement with 12 statements on a 5-point scale from 0 (not at all like me) to 5 (just like me) on the adapted DMQ (see Table 1). We first confirmed that the adapted DMQ used for our study displayed good internal consistency. Cronbach's alpha was highest (Cronbach's alpha = .84) when all 12 items were included (Cronbach, 1951). Accordingly, we computed a final score for each child by summing their scores (max score = 60), with higher scores reflecting greater levels of motivation. Using children's total DMQ score, we explored if there were differences in children's responses based on condition. An ANOVA revealed that there were no significant condition-level differences in children's ratings of their own motivation ($F(2, 59) = 0.40$, $p = .67$).

Our third research question explored the relation between children's motivation scores and persistence on the impossible task. We conducted a linear regression with persistence score as the dependent variable and condition and motivation score as predictors. The analysis yielded a significant effect of motivation ($F(3, 58) = 6.64$, $p < .001$) and condition ($\beta = 19.74$, $SE = 6.02$, $p = .002$). Confirming our initial findings, holding the DMQ scores constant, children in the *Intellectual* ($\beta = 47.02$, $SE = 11.62$, $p < .001$) and *Life Struggles* ($\beta = 40.72$, $SE = 11.45$, $p < .001$) conditions persisted longer on the impossible task than children in the *Achievement* condition. Holding condition constant, children's motivation scores did not predict their persistence, ($\beta = 0.56$, $SE = 0.74$, $p = .45$).

Discussion

Taken together, persistence on a challenging task was impacted by children's exposure to stories that included the struggles of a famous scientist. In line with Lin-Siegler et al. (2016) findings and our initial prediction, children persisted longer after hearing a storybook about struggle (regardless of if the story focused on academic failure or personal life challenges) as compared

to a storybook that only discussed success without failure. Whereas children's persistence in the *Achievement* condition was significantly shorter than the baseline persistence level, children's persistence in both *Struggle* conditions was significantly longer than the baseline. The significant differences between the baseline and storybook conditions suggest that differences in storybook theme can impact children's persistence during a challenging task.

One explanation offered by Lin-Siegler et al. (2016), based on post-hoc interviews with students, is that hearing about scientists who struggled on their path to achieve success might help students relate more to these individuals than only hearing about success without failure. Exposure to the challenges that very accomplished scientists face, "normalizes" failure as part of the process to achieve success, highlighting scientists' hard work and effort, rather than ability. In turn, when students struggle on a science problem, they may learn that this is a typical part of the process, "rather than a reflection of their lack of intelligence" (Lin-Siegler et al., 2016, p. 323).

Why would such limited exposure to a storybook struggle impact children's persistence? We suggest that exposing children to language that emphasizes any type of struggle, in this case through storybook reading, has the potential to shape children's persistence on a challenging task because they may connect or relate to the character in the story. Indeed, research on children's learning from storybooks indicate that they often adopt the main character's traits, which in turn, impacts their subsequent behavior (e.g., Dore, Smith, & Lillard, 2017). For example, classic moral stories such as *George Washington and the Cherry Tree* impact children's (aged 3 to 7) honest behavior (e.g., telling the truth) as compared to hearing stories such as *Pinocchio* which focus on negative consequences of dishonesty (Lee et al., 2014). Moreover, Dore et al. (2017) claim that children who read *George Washington and the Cherry Tree* may adopt traits of the character. Children were either exposed to a narrative about a professor or a cheerleader and invited to choose a toy. Children who heard the professor narrative viewed themselves as smart and displayed a preference for engaging with a toy that involved analytical skills, as compared to children who heard the cheerleader narrative. These results suggest that children's thinking and engagement in activities is impacted by the traits of a protagonist in a story.

The findings from our study appear to provide further evidence that children's persistence engaging in an activity may be impacted by the narrative or storybook language to which they are exposed. Here, we extend this research to include younger children and focus on the domain of science. It is plausible that children who read or hear about scientists who struggled felt more connected to that character, as demonstrated through their greater persistence in the impossible task. Determining a mechanism for these findings is outside the scope of this paper, so future work should explore how preschoolers' relatedness to characters in a story impact their motivation and persistence when faced with difficult tasks.

Our second research question examined relations between the storybook and their own motivation. Contrary to our predictions, we found no differences in motivation by storybook condition. Why was children's implicit behavior differentially impacted by reading a book about achievement, as compared to books about struggle, but their explicit ratings of their own mastery motivation did not reflect this difference? Below, we outline two possible explanations for these findings.

First, it is plausible that the linguistic and cognitive demands of this questionnaire were too great for four- and five-year-old children. Indeed, although the DMQ18 can be used as a self-report measure for older children, teens, and young adults, it has typically been used

by parents and teachers to assess young children's and infants' mastery motivation. Because we had piloted this questionnaire with 30 4- and 5-year-olds and did not observe any difficulty with comprehension of the questions or scale, it is unlikely the results of the survey reflect a lack of comprehension. Nevertheless, future research might continue to explore the extent to which our adapted DMQ-18 is a developmentally appropriate, reliable, and valid self-report measure of motivation in young children.

Second, a component of mastery motivation is that short-term environmental changes (e.g., successes or failures) can have a short-term impact on children's motivation; repeated successes or failures over a longer period of time yield more long-term changes (Messer, 1993). On this reasoning, although reading a storybook was enough to impact implicit task persistence, it was not enough to impact children's explicit understanding of their own motivation. We suggest that the most plausible explanation for an implicit, but not explicit, impact of motivation and persistence is that the stories focused on a third-party scientist and did not directly target children's beliefs about their own motivation. Indeed, Lin-Siegler et al. (2016) similarly found that although high school students who read struggle stories achieved higher grades in science than those who read achievement stories, students showed no clear pattern of response on measures exploring beliefs about intelligence and effort. Although the stories in this study, like those in Lin-Siegler et al. (2016), modeled the message that struggle can be a valuable part of the process of achievement, they required children to draw inferences from struggling scientists in a book to their own experiences and motivations. Future research should explore how first-person stories might impact children's prospective motivation and persistence and the extent to which repeated exposure to storybooks might impact implicit performance and explicit beliefs about motivation.

Limitations and future directions

This study provides evidence that preschool-age children's performance is impacted by differences in the portrayal of the degree of effort high-achieving scientists put into their work. However, there are several limitations of this work. First, one limitation is the lack of a reliable and valid measure of young children's motivation that is not parent/teacher self-report. This paper provides an adapted, internally consistent, and developmentally appropriate measure of young children's self-reported motivation. Second, we present children with a brief intervention, which indicates a short-term behavioral change, but does not provide insight into potential long-term effects of the intervention. Future work should assess changes in children's motivation across a school year depending repeated exposure to storybooks. Third, rather than reading the storybook with researchers, future research should explore how a more naturalistic setting, such as story time with parents might help to scale up the delivery of such stories. Fourth, although both boys and girls were exposed to storybooks with both female and male main characters, we did not have the power to analyze differences in persistence and motivation by child gender, character gender or the interaction between the two. Future work should explore possible gender differences by condition and consider if the presence of a single focal character (as opposed to multiple characters) might impact children's persistence. Finally, the participants in the sample largely came from families of mid-SES. Future research should explore the extent to which exposure to such books might also be beneficial to more diverse populations of learners.

Conclusions

Taken together, these findings suggest that exposing children to language about famous scientists' struggles enhances their persistence on a challenging task. These results have implications for educational settings indicating that early childhood educators should use opportunities in preschool to increase feelings of relatedness through storybooks that emphasize the process of science, rather than solely focusing on achievement. Although Marie Curie was a physicist and chemist, and not a developmental psychologist, this study demonstrates the accuracy of her intuition that children benefit from being taught that the path to scientific success is neither swift nor easy.

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Ethics approval statement

The studies involving human participants were reviewed and approved by the Boston University Institutional Review Board Charles River Campus. Written informed consent to participate in this study was provided by the participants; legal guardian.

References

Bempechat, J., & Mirny, A. (2005). Achievement motivation. *Encyclopedia of Education and Human Development*, *3*, 433–443.

Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science*, *355*(6323), 389–391. doi:10.1126/science.aah6524

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, *78*(1), 246–263. doi:10.1111/j.1467-8624.2007.00995.x

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N. D., Spelke, E., & Schulz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition*, *120*(3), 322–330. doi:10.1016/j.cognition.2010.10.001

Brown, S. A., Ronfard, S., & Kelemen, D. (2020). Teaching natural selection in early elementary classrooms: Can a storybook intervention reduce teleological misunderstandings? *Evolution: Education and Outreach*, *13*, 1–19. doi:10.1186/s12052-020-00127-7

Cimpian, A., Arce, H. M. C., Markman, E. M., & Dweck, C. S. (2007). Subtle linguistic cues affect children's motivation. *Psychological Science*, *18*(4), 314–316. doi:10.1111/j.1467-9280.2007.01896.x

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. doi:10.1007/BF02310555

Dore, R. A., Smith, E. D., & Lillard, A. S. (2017). Children adopt the traits of characters in a narrative. *Child Development Research*, 2017. doi:10.1155/2017/6838079

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256. doi:10.1037/0033-295X.95.2.256

Dweck, C. S. (2008). *Mindset: The new psychology of success*. New York: Random House Digital, Inc.

Dweck, C. S. (2014). *Mindsets and math/science achievement* https://www.growthmindsetmaths.com/uploads/2/3/7/7/23776169/mindset_and_math_science_achievement_-_nov_2013.pdf .

Farland, D. (2006). The effect of historical, nonfiction trade books on elementary students' perceptions of scientists. *Journal of Elementary Science Education*, *18*(2), 31–47. doi:10.1007/BF03174686

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. doi:10.3758/BF03193146

Ganea, P. A., Ma, L., & DeLoache, J. S. (2011). Young children's learning and transfer of biological information from picture books to real animals. *Child Development*, *82*(5), 1421–1433. doi:10.1111/j.1467-8624.2011.01612.x

Grant, H., & Dweck, C. S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology*, *85*(3), 541. doi:10.1037/0022-3514.85.3.541

Kelemen, D., Emmons, N. A., Seston Schillaci, R., & Ganea, P. A. (2014). Young children can be taught basic natural selection using a picture-storybook intervention. *Psychological Science*, *25*(4), 893–902. doi:10.1177/0956797613516009

Lee, K., Talwar, V., McCarthy, A., Ross, I., Evans, A., & Arruda, C. (2014). Can classic moral stories promote honesty in children? *Psychological Science*, *25*(8), 1630–1636. doi:10.1177/0956797614536401

Leech, K. A., Haber, A. S., Arunachalam, S., Kurkul, K., & Corriveau, K. H. (2019). On the malleability of selective trust. *Journal of Experimental Child Psychology*, *183*, 65–74. doi:10.1016/j.jecp.2019.01.013

Leech, K. A., Haber, A. S., Jalkh, Y., & Corriveau, K. H. (2020). Embedding scientific explanations into storybooks impacts children's scientific discourse and learning. *Frontiers in Psychology* 11,12 . doi:10.3389/fpsyg.2020.01016

Lin-Siegler, X., Ahn, J. N., Chen, J., Fang, F. F. A., & Luna-Lucero, M. (2016). Even Einstein struggled: Effects of learning about great scientists' struggles on high school students' motivation to learn science. *Journal of Educational Psychology*, *108*(3), 314. doi:10.1037/edu0000092

Messer, D. J. (Ed.). (2016). *Mastery motivation in early childhood: Development, measurement and social processes*. New York: Routledge. 10.4324/9780203415610

Messer, D. J. (1993). Mastery motivation: An introduction to theories and issues. In D. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 1–16). London: Routledge.

Morgan, G. A., Wang, J., Barrett, K. C., Liao, H. F., Wang, P. J., Huang, S. Y., & Jozsa, K. (2019). *The revised Dimensions of Mastery Questionnaire (DMQ 18): A manual and forms for its use and scoring* (New York).

Pitcairn, T. K., & Wishart, J. G. (1994). Reactions of young children with Down's syndrome to an impossible task. *British Journal of Developmental Psychology*, *12*(4), 485–489. doi:10.1111/j.2044-835X.1994.tb00649.x

Rhodes, M., Cardarelli, A., & Leslie, S. J. (2020). Asking young children to "do science" instead of "being scientists" increases science engagement in randomized field experiment. *Proceedings of the National Academy of Science*, *117*(18), 9808–9814. doi:10.1073/pnas.1919646117

Rhodes, M., Leslie, S. J., Yee, K. M., & Saunders, K. (2019). Subtle linguistic cues increase girls' engagement in science. *Psychological Science*, *30*(3), 455–466. doi:10.1177/0956797618823670

Sawyer, J. (2017). I think I can: Preschoolers' private speech and motivation in playful versus non-playful contexts. *Early Childhood Research Quarterly*, *38*, 84–96. doi:10.1016/j.ecresq.2016.09.004

Shtulman, A., Neal, C., & Lindquist, G. (2016). Children's ability to learn evolutionary explanations for biological adaptation. *Early Education and Development*, *27*(8), 1222–1236. doi:10.1080/10409289.2016.1154418

Strouse, G. A., Nyhout, A., & Ganea, P. A. (2018). The role of book features in young children's transfer of information from picture books to real-world contexts. *Frontiers in Psychology*, *9*, 50. doi:10.3389/fpsyg.2018.00050