

Growth Mindset and Persistence in Children's Creative Performance

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ABSTRACT

TIFFANY LYNN GERLINGER: Growth Mindset and Persistence in Children's Creative Performance (Under the direction of Stephanie Miller)

Motivation literature regarding children's academic achievement is quite extensive and can typically be separated into two mindsets: growth mindset and fixed mindset, which vary on their level of persistence (i.e., effort toward a task, Dweck, 2006). Individuals with a growth mindset find persistence is useful because they believe their abilities can change through hard work. Individuals with a fixed mindset find persistence is not useful because they believe their abilities cannot change with hard work. In the domain of creative achievement there is a lack of research on mindset and persistence during creative performance. Research shows that adults underestimate the value of persisting in their own creative performance (Lucas & Nordgren, 2015). However, this has not been examined in conjunction with mindset or in a younger sample. The aim of this study was to determine if children also show this underestimation of persistence and if children who are more growth minded will value persistence during their own creative performance. Children of all age groups undervalued their persistence in a creativity task, but children who were more creative did a better job in estimating their persistence. Mindset was not related to children's value of persistence for their own creative performance, nor did mindset interact with age. These results suggest children are doubtful of persistence as a valuable strategy in their own creative performance for creative achievement.

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Growth Mindset and Persistence in Children's Creative Performance

Effort given toward a task is often studied as persistence (Dweck, 2006; Lucas & Nordgren, 2015), and is an important aspect of motivation related to what moves an individual toward action (Ryan & Deci, 2000). There is an extensive literature on motivation and persistence, and most work focuses on academic achievement and intelligence (Blackwell, Trzesniewski, Dweck, 2007; Dweck, 2006; Eccles & Wigfield, 2002; Yeager & Dweck, 2012) and suggests that motivation can be separated into two mindsets that vary with regard to persistence (Dweck, 2006). "Growth minded" individuals believe their abilities can develop through hard work and persistence, whereas "fixed minded" individuals believe their abilities cannot develop with hard work and persistence (Dweck, 2006). Although research demonstrates that adults underestimate the value of persistence for their own creative performance (i.e., the ability to generate novel and useful responses in a given context Lucas & Nordgren, 2015), there is a lack of research examining mindsets and persistence in creativity achievement, especially in children. The purpose of the present study is to examine these three constructs (i.e., mindset, creativity, and persistence) in a child sample to determine if children also show this underestimation of persistence and if children who are more growth minded will value persistence for their own creative performance.

Mindsets

Views or beliefs about one's abilities can greatly affect an individual's motivation (Eccles & Wigfield, 2002, see also Amabile, Hill & Hennessey, 1994), often referred to as one's mindset (Dweck, 2006). Mindsets are often separated into two general categories related to an individual's perspective on success and failure (Dweck, 2006). Individuals

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with a *fixed mindset* believe their traits are stable and attribute their success and failure to innate abilities (Dweck, 2006). For example, in regard to intelligence, individuals with a fixed mindset would believe they achieved a task because they are inherently smart, not that they developed the ability through putting forth more effort. They are unlikely to put in additional effort when they find a task challenging, because trying and failing would undermine their identity as a smart individual. On the other hand, individuals with a *growth mindset* see their abilities as malleable (i.e., can change through learning) and attribute both success and failure to learning (Dweck, 2006). For example, in regard to intelligence, these individuals believe in the development of their intelligence (Dweck, 2006). Individuals with a growth mindset are likely to persist and engage in effortful behavior put forth on new, challenging tasks (Dweck, 2006), because even if they fail, they are still learning something from that failure or success and will not label themselves as smart or not smart due to the outcome.

The Role of Persistence in Mindsets

A big aspect of mindset is persistence (Dweck, 2006; O'Rourke, Haimovitz, Ballweber, Dweck, Popović, 2014) or how much effort individuals put forth during difficult tasks or for a specific goal (Lucas & Nordgren, 2015). As suggested above, individuals with the fixed mindset believe effort put forth on a task is proof they do not possess the ability to complete a task whereas individuals with the growth mindset believe effort is necessary for learning opportunities (Dweck, 2006). Therefore, an individual with the growth mindset sees persistence as necessary and rewarding, whereas an individual with the fixed mindset sees persistence as undermining one's natural ability to complete a task. Studies have also shown that persistence plays a primary role in

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growth minded individuals. O'Rourke and colleagues demonstrates how persistence can be encouraged in children through a growth mindset incentivized game rewarding effort in solving math fractions. In this game, children in the experimental group were provided with growth feedback (e.g., statements rewarding effort, new strategies, and progress) while they work to solve and complete levels of the game (O'Rourke et al., 2014).

Children who received growth feedback were also rewarded brain points throughout each level for each new idea they tried (O'Rourke et al., 2014). Every time a child earned any brain points, an image of a character climbing a mountain on a planet was shown with growth feedback (i.e., "you worked out your brain and kept trying") and when children received zero points (i.e., "that level didn't give you a chance to struggle and use your brain") (O'Rourke et al., 2014). When children earned fifty brain points they moved to the next planet providing them with an exciting reward that also highlights their progress throughout the game (O'Rourke et al, 2014). This educational game rewards children's incremental effort and progress throughout the entire time played. Children in the experimental group with growth feedback and brain points played the game for longer during one sitting and learned behaviors that support learning goals (i.e., persisting, creating new strategies for setbacks, and reflecting on incremental progress), which resulted in children developing a growth mindset (O'Rourke et al., 2014). The authors suggest this game shows that persistence is important to growth mindset and achievement because children are not only learning that they can develop their intelligence, but also that hard work or effort is crucial in this development (O'Rourke et al., 2014).

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Development of Mindsets

Mindsets have been studied in children as early as 14 months and have been shown to change and evolve in response to environmental factors (Cimpian, Arce, Markman & Dweck, 2007). For example, because of the many positive attributes associated with a growth mindset (e.g. coping with setbacks, persistence in tasks, love of learning, Dweck, 2006), many researchers have examined how to encourage a growth mindset in children (Cimpian et al., 2007; Dweck, 2006; Mueller & Dweck, 1998). Mueller and Dweck (1998) found that praise for intelligence rather than effort undermined motivation in children. Presenting feedback praising the effort put forth in a task (e.g., “you’re not there, yet” or “That feeling of math being hard is the feeling of your brain growing”), and not just their ability to complete the task, resulted in children attributing success and failure to effort and learning 5 years later (Muller & Dweck, 1998). In a similar study, generic praise (e.g., You are a good drawer) and non-generic praise (e.g., You did a good job drawing) were tested on a group of preschoolers (Cimpian et al., 2007). Preschoolers who received generic praise after a setback showed signs of helplessness (i.e., fail to generate strategies to cope with setback) compared to preschoolers that received non-generic praise. This study suggests that receiving generic praise (e.g., you are a good drawer) may lead to the belief that one is inherently artistic. Children receiving non-generic praise (e.g., you did a good job drawing) may develop the belief that their artistic abilities can change through effortful behavior (Cimpian et al., 2007). Further, studies have shown that mindsets can change from fixed to growth by actually teaching about the growth mindset (Muller & Dweck, 1998; Yeager & Dweck, 2012). For example, Yeager and Dweck (2012) found that teaching middle school

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students that their intellectual abilities can be developed were better able to deal with challenging courses and transitioning into the next grade compared to students who were taught study skills alone. Overall, these studies show that mindsets can develop as more fixed or growth according to influences from the environment. Although individuals have different mindsets, it is important to note that these mindsets are not set in stone and change in response to the environment.

Mindsets and Creativity

Although there is a substantial literature examining the development of mindsets in children and the factors that influence them, mindset has typically been studied in academic settings (Blackwell et al., 2007; Dweck, 2006; Greene & Noice, 1988; Sawyer, John-Steiner, Moran, Sternberg, Feldman, Nakamura, Csikszentmihalyi, 2003, though see Dweck, 2006 for discussion on extending mindset into other domains). One promising area for the extension of mindset research is creativity (i.e., the ability to generate responses that are novel and useful in a given context, Maksić & Povlović, 2011), as there are many benefits of developing creativity in children (e.g., improved problem-solving and self-regulation, Sawyer et al., 2003). Further, there is some evidence to suggest that mindsets should be important to consider in creative achievement. For instance, research shows that changing beliefs about learning to be more creative helps to increase a creative growth mindset; however, studies have been primarily limited to adolescents (Green & Noice, 2014). Green & Noice (2014) found that giving general positive statements or compliments (i.e., regarding hair, clothes, or jewelry) to adolescents before beginning a creative task increased positive feelings which increased their creative achievement. Similar to the study by Cimpian et. al., (2007) with

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preschoolers, this study demonstrated that individuals can be influenced by environmental factors such as feedback to change their beliefs about their own creative performance. In addition, development of a creative mindset scale (CMS) also suggests that mindsets are important to creative achievement. The CMS was developed to understand adults' implicit theories of creativity (Karwowski, 2014) by examining adults' responses to both malleable (e.g., view of abilities as changeable with increased effort) and entity (e.g., view abilities as unchangeable, characteristic-like) theories of creativity in a psychometrically sound scale. The CMS suggest that individuals can hold both a fixed and growth mindset towards creativity and that the two mindsets are independent from each other. In sum, these studies suggest creative achievement is associated with adults' beliefs about their mindset.

The Role of Persistence in Creativity

Current research also demonstrates that persistence, an important characteristic of growth mindset, is valuable for adults' creative performance (Lucas & Nordgren, 2015). In a poll given to 143 creativity researchers, Dweck (2006) found that persistence within a growth mindset was consistently rated as one of the most important factors contributing to creative achievement. Lucas and Nordgren (2015) found that adults often underestimate the value of persisting in terms of their own creative performance. In their study, Lucas and Nordgren (2015) investigated fluency (i.e., generation of multiple novel ideas) in creative thought. Participants were asked to come up with as many thanksgiving themed foods and drinks in an idea generation task for ten minutes. Participants then estimated how many more ideas they could come up with before persisting in the task for 10 more minutes. Although adults estimated they would not generate many more novel

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ideas when given additional time, they actually generated a higher quantity and higher quality of ideas when given time to persist compared to when they initially generated ideas. This study demonstrates that adults are underestimating how useful persistence will be for them in a creative task. Lucas and Nordgren (2015) suggested this underestimation comes from a downward bias in which they base their estimates of future performance off of past performance, which is often marked by disfluency (i.e., difficulty in generating novel ideas) on the creative task. However, the importance of persistence is evident from the findings that adults were generating more quantity and quality of ideas for the task when given time to persist. Persistence, shown in this study, plays an important role in creative performance by demonstrating that individuals can be more creative than they originally thought possible when they put forth the effort and persist.

Present Study

Research has shown that persistence is important to mindsets and creativity, but the importance of this persistence is often underestimated, particularly in adults. Two questions will be answered from this study. First, I will examine whether children will underestimate how many novel ideas they will generate when given time to persist, similar to the study of Lucas and Nordgren (2015) in adults. Second, I will examine whether individual differences in mindset predict how much children value persistence during creative performance. To examine these questions, an Alternative Uses Task (AUT) will be used. The AUT involves a list of items (i.e., brick, cardboard box, shoe, chair) for children to come up with as many uses as they can think of for a particular item. Research in adults has demonstrated that individuals underestimate the value of persistence for their own creative performance. However, this has never been examined

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in conjunction with mindset or in a younger sample. Examining how children will estimate the value of persisting in their own creative performance and if this is associated with the growth mindset is new, as most research done focuses on adults and their implicit theories of creativity. I hypothesize children in the first- and fourth-grade will also show this underestimation of persistence seen in adults by underestimating how many novel ideas they can come up with when given time to persist in the AUT. This goes against previous research that demonstrates children overestimate their abilities when comparing themselves to others (Butler, 1990). However, this does line up with adult research in which adults underestimate how valuable persistence is for their own creative performance. This has not been examined with mindset or a younger sample. I also hypothesize that children who are more growth minded will be less likely to underestimate how many novel ideas they will generate when given time to persist in the AUT since individuals who are more growth minded believe persistence is useful.

Methods

Participants

Participants in the present study ($N = 85$) consisted of 44 first graders ($M = 7.13$ years, $SD = .79$), 41 fourth graders ($M = 9.95$ years, $SD = .80$). A total of 60% reported on their demographics. Sixty percent lived in households with an average annual income above \$60,000. Forty-two percent lived in households with an average annual income below \$60,000. Participants were predominately white (first-grade: 83.3% White, 4.8% Hispanic, 11.9% did not state ethnicity; fourth-grade: 39% White, 61% did not state ethnicity). Participants were tested in a quiet room in the schools or at a research

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laboratory at a university in the southern United States. All children received parental consent and verbally assented to participate in this study.

Procedure

Participants were part of a larger study examining the relationship between divergent thinking, executive function, language, and mindset in children and adults. For the present study, we considered children's performance on an Alternative Uses Task and a growth/fixed mindset questionnaire. Children also completed several Executive Function tasks outside the scope of the present study. Parents were recruited by sending information home with students at elementary schools and Montessori schools and by calling parents indicating interest in studies on cognitive development to set up an appointment to come to the university laboratory.

Alternative Uses Task. The Alternative Uses Task is a widely used and reliable measure that is appropriate for measuring creativity (Wallach & Kogan, 1965). In this task, individuals are asked to generate as many uses for an object as they can, with the number of responses generated often used as one indication of higher creativity. The items used in the present study were selected after pilot testing with a group of children to determine which items they would be familiar enough with to generate responses. Three variables were measured in the AUT: baseline creativity, estimated persistence, and the difference between estimated persistence and actual persistence (i.e., difference score).

AUT Baseline Creativity. Baseline creativity was measured using the classic method developed by Wallach and Kogan (1965) in which an individual named as many uses for a given object when given the following instructions:

“In this game, I am going to name an object—any kind of object like a cup or the floor—and it will be your job to tell me lots of different ways

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that the object could be used. Any object can be used in a lot of different ways. For example, think about a string. What are some of the ways you can think of that you might use a string?" (*The experimenter lets the participant try*). "Yes, those are fine. I was thinking that you could also use the string to attach a fish hook, to jump rope, to sew with, to hang clothes on, and to pull shades." (*The experimenter varies her suggestions so as not to duplicate any the child has provided.*) "There are lots more too, and yours were very good examples. I can see that you already understand how to play this game. So let's begin now. And remember, think of different ways you could use the object that I name. Here we go."

Each child was then asked to name as many unique uses for each object (i.e., brick, cardboard box, shoe, chair) as they could come up with to get a baseline of their creative ability. Participants were given one minute to respond. All responses were coded based on fluency (i.e., number of uses generated for an object).

AUT Estimated Persistence. For each object, after the first minute, participants were asked, "how many more uses could you come up with if given more time" to measure how useful (i.e., valuable) children view persistence for the creative task (Lucas & Nordgren, 2015). A lower number indicated that participants did not think of persistence as useful and a higher number indicated that participants did think of persistence as useful.

AUT Difference Score [estimated – actual]. After participants estimated how many more unique uses they would generate for an object when given time to persist, participants were given an additional minute to persist in generating more unique uses for an object. Thus, for each object children completed three phases. They were asked how many uses they could come up for the item (e.g., a brick), how many uses they thought they would come up with if given more time, and finally they were given one more minute to generate novel uses. They then completed the same procedure for the following

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items (i.e., box, show, chair). A difference score was calculated by taking how many uses participants estimated they would generate when persisting and subtracting how many uses they actually generated when persisting. Negative scores indicated children underestimated the value of persistence for their own performance in the creative task, a score of 0 indicated they estimated accurately, and positive scores indicated they overestimated the value of persistence.

Coding of the AUT. There are four ways to measure creativity on the AUT: fluency, flexibility, originality, and elaboration. For the purpose of this study, only fluency was measured. Responses (i.e., each alternative use the participant stated) was digitized using Microsoft Excel. Fluency for each item was calculated by adding all responses for that item on the AUT. For example, if a response for an item (i.e., brick) was repeated (e.g., “build a house” and “build house”) then the response was only counted once (e.g., given a score of “1”). Responses that were similar but not exact (e.g., “build a house” and “build a wall”) were counted separately (e.g., given a score of “2”). An average creativity score for each item was measured.

Growth/ fixed mindset questionnaire. The growth and fixed mindset survey consisted of 8 questions on a 6-point Likert scale. The scale was divided into 4 items related to a growth mindset (i.e., “you can always change your talent a good amount, no matter how much you have”) and 4 items related to a fixed mindset (i.e., “you can always learn things, but you can’t really change how smart you are”). The four items related to a growth mindset used a 6-point Likert scale ranging from 1 “disagree big time” to 6 “agree big time” and the other four items related to a fixed mindset used a 6-point Likert scale ranging from 1 “agree big time” to 6 “disagree big time”. Responses were

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calculated by summing all responses together. Lower scores indicated more of a fixed mindset and higher scores indicated more of a growth mindset.

Results

To examine whether children as a group overestimated or underestimated how many items they would generate, I calculated a paired sample *t* test comparing estimations scores to actual fluency when given time persist. Results demonstrated a significant difference where children's estimation scores were lower than their actual fluency when given more time, $t(78) = -6.18, p < .01$, suggesting that they may underestimate how much persistence will help them in generation, see Figure 1.

To determine whether baseline creativity, age, and mindset predict children's estimated persistence, I first examined participants' estimation score, which was the number of items they estimated they would generate if they were given additional time (i.e., one more minute) on the Alternative Uses Task. I used a hierarchical linear regression to analyze whether baseline fluency, age, and mindset influenced participants estimation scores, see Table 1. In the first step of the analysis I added the predictor of baseline fluency and found a significant relationship showing that individuals with higher baseline fluency gave higher average estimation scores, $\beta = .522, t = 5.33, p < .001, \Delta r^2 = .27, p < .01$. In the second step I added the predictors of age and mindset and found that age and mindset did not produce a significant r^2 change in the model, $\Delta r^2 = .001, p > .05$, nor did they significantly predict the estimation score, age $\beta = 0.20, t = .185, p < .854$; mindset $\beta = .029, t = .287, p < .755$. Finally, in the third step I added an Age \times Mindset interaction to see if the effect of mindset may depend on age (e.g., it may be only older children with growth mindset who predicted they will generate more ideas). I found no r^2

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change in the model, $\Delta r^2 = .00$, $p > .05$, or a significant interaction between age and mindset on estimation scores $\beta = -.079$, $t = -.116$, $p < .908$.

To address the predictors of baseline creativity, age, and mindset in children's creative performance when given time to persist, I examined the difference score (i.e., estimation – actual generation) for the number of novel ideas a participant would generate minus the actual number of novel ideas generated. For this measure, a higher number indicated that a participant thought more time would be useful for persisting in the task (i.e., an overestimation of persistence) and a lower number indicated that more time would not be useful for persisting in the task (e.g., an underestimation of persistence). In the analysis, I analyzed whether baseline creativity, age, and mindset influenced participants difference scores, see Table 2. First, I added the predictor of baseline creativity and found a significant relationship $\beta = -.273$, $t = -2.453$, $p < .016$, $\Delta r^2 = .07$, suggesting children with higher baseline creativity underestimated their persistence more (i.e., they thought they would generate fewer items than they actually did). Next, I added the predictors of age and mindset separately and found no significant relationship, age $\beta = -.051$, $t = -.415$, $p < .999$, mindset $\beta = -.668$, $t = -1.021$, $p < .311$, nor was there an Age \times Mindset interaction, $\beta = .798$, $t = 1.036$, $p < .303$.

Discussion

The general aim of this study was to determine whether children show an underestimation of persistence, similar to adults, and if children who are more growth minded value persistence during creative performance. Contrary to my hypothesis, results did not suggest age or mindset predicted how much children value persistence, nor did the influence of mindset depend on age. I found that only baseline creativity predicted

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how many more uses children estimated they would generate when given time to persist. I also found that children show similar patterns as adults in underestimating how valuable persistence would be for their own creative performance. Based on these results, children's estimations of how useful persistence is does not seem to be influenced by the mindset they hold, but rather how creative they already are.

The most surprising finding of this study was that mindset was not related to children's perceptions of persistence on a creativity task. This may be due to several reasons. First, the measure of mindset used for the present study measured a general mindset about math or about IQ, which focuses more toward intelligence rather than creativity. Although using a questionnaire that could capture mindset in a wider variety of areas was the initial draw of using this particular questionnaire, it is possible that using a more specific questionnaire related to creativity could have yielded different results. One such questionnaire is the Creative Mindset Scale (CMS), in which specific mindset are measured related to creativity and creative self-concept (Karwowski, 2014). The CMS developed by Karwowski (2014) consists of 10 items on a 5-point Likert scale used to measure individuals' perceptions of creativity. Participants responded to the extent in which they agreed with creativity specific statements like "Rome wasn't built in a day—creativity requires effort and work, and these two are more important than talent" and "Some people are creative, others aren't—and no practice can change it" (Karwowski, 2014). Karwowski (2014) demonstrated with the CMS that individuals can hold both a growth and fixed mindset at the same time for different things. The mindset measure used for the present study considered mindset as a universal ability, in which individuals hold only a growth or a fixed mindset that is applicable to any domain. For future studies, the

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CMS can be used to measure specific mindsets related to creativity in order to demonstrate if a growth mindset is in fact related to creativity and influences an individual to persist on a creative task.

Another explanation as to why mindset did not have an effect on how useful children think of persistence could be that children have not yet completely developed their growth mindset in this particular age group. For example, Dweck (2006) suggests that mindsets, in regard to intelligence, develop wholly during adolescence. Children at this age begin transitioning into more challenging courses with a new environment and fresh successes and failures to navigate (Dweck, 2006). It is unclear from the motivation literature what children's mindsets look like in the first- and fourth-grade. However, past research suggests young children overestimate their abilities (Butler, 1990). Further study could examine mindsets in this age group with a specific measure to see if mindsets are a predictor for valuing persistence during creative performance.

In the present study I found that only baseline creativity (fluency) predicted how many uses children estimated they would come up with for the items when given an opportunity to persist. This is in line with findings from Lucas and Nordgren's (2015) study in which adults who were less fluent on a general creativity task thought they would generate fewer items when given the opportunity to persist. Research suggests that if an individual has a difficult time initially on a creative task, this downward biases creative performance expectations on future creative tasks (Lucas & Nordgren, 2015). Children in the present study with a higher baseline creativity underestimated their persistence more. If true, this study would suggest that this downward bias is present early in development (i.e., children thought they would generate fewer items than they

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actually did), which fits in with current work in development that suggests even 4- and 5-year-olds begin to socially compare themselves and experience disappointment from a failure (Sigelman & Rider, 2015).

The present study also found a similar pattern of results in children as seen in the study with adults by Lucas and Nordgren (2015), in which children also underestimated how useful persistence would be in a creativity task. The fact that children in the sample actually generated more novel ideas than they estimated goes against past research suggesting that children overestimate their abilities (Butler, 1990). However it is consistent with the study by Lucas and Nordgren (2015), in which adults underestimate the number of novel ideas they will generate before persisting. It is likely that the disfluency hypothesis proposed by Lucas and Nordgren (2015) is operating in the same manner with children. For example, while children who were disfluent (i.e., lower baseline creativity) estimated they will generate less items than they actually did in the AUT, so did children who were more fluent (i.e., higher baseline creativity). Children in this study may be operating in a similar pattern as adults in that they show a downward bias on future performance expectations based off of past performance outcomes regardless if they have lower or higher baseline creativity.

The Social Cognitive Career Theory (SCCT) (Brown, Tramayne, Hoxha, Telander & Fan, 2008) could be another explanation for why children show an underestimation of persistence in terms of the expectations put on future performance based off of past performances (Lucas & Nordgren, 2015). The SCCT suggests that students who perform well academically base their success on self-efficacy (i.e., ones belief about their own abilities) resulting from past performance (e.g., high school GPA)

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and general cognitive ability (e.g., ACT) (Brown et al., 2008). Individuals could be experiencing poor self-efficacy regarding creative achievement (e.g., underestimating how valuable persistence is in their own creative performance), which could likely contribute to poor outcome expectations for future creative tasks. Research on alternative pedagogical models of teaching (i.e., Montessori schools) show that an emphasis on creative pedagogy improves children's academic achievement (Besancon & Lubart, 2008). If future studies examined persistence in creative tasks for both a traditional pedagogical environment and an alternative pedagogical environment, variances may emerge, in which children may estimate their persistence correctly in a more alternative pedagogical environment.

Conclusion

In sum, the present work suggests that like adults, elementary age children underestimate their ability to persist during creative performance. Age and mindset did not influence children's perceptions of the value of persistence on a creative task. However, children with higher baseline creativity were more likely to underestimate the value of persistence. This presents new ideas in the area of creativity and mindset suggesting that mindsets are not significant for creative performance outcomes in regard to how much children value persistence, but children, even children who are more creative, do underestimate how valuable persistence is for their own creative performance. Creativity provides essential skills for life such as problem solving, analytical and reflexive thinking, and self-regulation (i.e., managing thinking, behavior, and emotions) (Sawyer et al., 2003). Though this study presents new findings, there are limitations that exist. First, the mindset measure used treats mindset as holding only a

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fixed or growth mindset in any domain. Using a measure related to creativity that examines specific mindsets (i.e., creative mindsets), such as the CMS (Karwowski, 2014), may help future studies determine if a relationship between mindset and creativity does exist. Lastly, the present study did not uncover possible reasons for this undervaluation; mindset was not a predictor for how much or how little children value persistence in their own creative performance. Future research may investigate the possible reasons for this undervaluation by examining whether self-efficacy beliefs about past performance is playing a similar role in creativity achievement as it does for academic achievement. Further, examination of different pedagogical environments could also reveal an effect of alternative pedagogical environments on the value of persistence for a creative task.

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Table 1

Summary of hierarchical regression analysis for whether baseline fluency, age, and mindset influenced participants' estimation scores

| Variable | <i>B</i> | <i>SE B</i> | β | <i>R</i> ² Change |
|------------------|----------|-------------|---------|------------------------------|
| Block 1 | | | | .27** |
| Baseline fluency | .44 | .08 | .52** | |
| Block 2 | | | | .00 |
| Baseline fluency | .44 | .09 | .52** | |
| Age | .03 | .14 | .02 | |
| Mindset | .01 | .03 | .03 | |
| Block 3 | | | | .00 |
| Baseline fluency | .44 | .09 | .52** | |
| Age | .08 | .53 | .07 | |
| Mindset | .03 | .18 | .10 | |
| Age X Mindset | .00 | .02 | -.08 | |

Note. * $p < .05$, ** $p < .01$

GROWTH MINDSET AND PERSISTENCE IN CHILDREN

Table 2

Summary of hierarchical regression analysis for whether baseline fluency, age, and mindset influenced participants' estimation difference score.

| Variable | <i>B</i> | <i>SE B</i> | β | <i>R</i> ² Change |
|------------------|----------|-------------|---------|------------------------------|
| Block 1 | | | | .07 |
| Baseline fluency | -.26 | .61 | -.27** | |
| Block 2 | | | | .00 |
| Baseline fluency | -.24 | .12 | -.25** | |
| Age | -.07 | .18 | -.05 | |
| Mindset | -6.83 | .04 | .01 | |
| Block 3 | | | | .01 |
| Baseline fluency | -.26 | .12 | -.27** | |
| Age | -.74 | .67 | -.52 | |
| Mindset | -.24 | .23 | -.67 | |
| Age X Mindset | .03 | .03 | .80 | |

Note. * $p < .05$, ** $p < .01$

GROWTH MINDSET AND PERSISTENCE IN CHILDREN

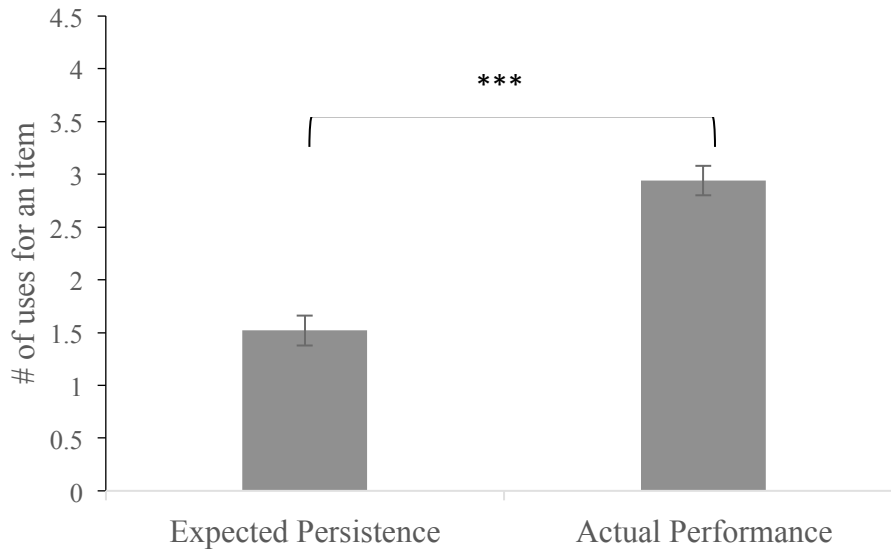


Figure 1. Mean scores for expected performance (i.e., number of items participants believed they would generate) compared to actual performance (i.e., number of items they actually generated when given more time). *** $p < .001$.

Appendix A: Growth and Fixed Mindset Questionnaire

MINDSET CHECK UP

Take a minute or two to answer these questions. There are no right or wrong answers here. Just circle the button that you think works best for you!

PART #1

CIRCLE THE BUTTON THAT YOU THINK BEST FITS

1. You can always change your talent a good amount, no matter how much you have.

1 — 2 — 3 — 4 — 5 — 6

disagree big time disagree kind of disagree kind of agree agree agree big time

2. I like work the best when it makes me think hard.

1 — 2 — 3 — 4 — 5 — 6

disagree big time disagree kind of disagree kind of agree agree agree big time

3. I like doing things that I'll learn from even if I make a lot of errors.

1 — 2 — 3 — 4 — 5 — 6

disagree big time disagree kind of disagree kind of agree agree agree big time

4. When something is hard, it makes me want to spend more time on it, not less.

1 — 2 — 3 — 4 — 5 — 6

disagree big time disagree kind of disagree kind of agree agree agree big time

PART #2

NO ONE WE CHANGED THE SCORING FOR THIS PART. READ CAREFULLY!

5. You can always learn things, but you can't really change how smart you are.

1 — 2 — 3 — 4 — 5 — 6

agree big time agree kind of agree kind of disagree disagree disagree big time

6. I like work the best when I can do well without putting a lot of effort in.

1 — 2 — 3 — 4 — 5 — 6

agree big time agree kind of agree kind of disagree disagree disagree big time

7. I like doing work that I can do perfectly almost all of the time.

1 — 2 — 3 — 4 — 5 — 6

agree big time agree kind of agree kind of disagree disagree disagree big time

8. When I have to put extra work in it makes me feel like I'm not as good as my peers.

1 — 2 — 3 — 4 — 5 — 6

agree big time agree kind of agree kind of disagree disagree disagree big time

PART #1 TOTAL _____

PART #2 TOTAL _____

(NOW ADD THE TWO PARTS TOGETHER!)

GRAND TOTAL



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