

## **UC Merced**

# **Proceedings of the Annual Meeting of the Cognitive Science Society**

### **Title**

Practice what you preach: Consistent messages about the value of effort foster children's persistence

### **Permalink**

<https://escholarship.org/uc/item/63x5x03f>

### **Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 46(0)

### **Authors**

Wang, Elaine

Radovanovic, Mia

Sommerville, Jessica

et al.

### **Publication Date**

2024

Peer reviewed

# Practice what you preach: Consistent messages about the value of effort foster children's persistence

Elaine Wang (elaine.yilin.wang@yale.edu)<sup>1</sup>

Mia Radovanovic (m.radovanovic@mail.utoronto.ca)<sup>2</sup>

Jessica A. Sommerville (jessica.sommerville@utoronto.ca)<sup>2</sup>

Julia A. Leonard (julia.leonard@yale.edu)<sup>1</sup>

<sup>1</sup>Department of Psychology, Yale University

<sup>2</sup>Department of Psychology, University of Toronto

## Abstract

Young children are frequently exposed to mixed messages about the value of their effort: Educators talk about the importance of effort, but give rewards (e.g., grades) based on children's achievement. How do these mixed messages about effort influence children's motivation? Here, we presented 4- to 5-year-old children ( $N = 80$ ) with an initial verbal message preaching about the importance of effort and generated mixed messages by rewarding participants either by their effort or performance across a series of visual search tasks. We found that children persisted longer on the immediate task, as well as on a novel, transfer task, when they received consistent versus mixed messages about effort. These findings suggest that congruent verbal- and reward-based messages about the value of effort foster children's persistence.

**Keywords:** persistence; adult testimony; reward structures; effort allocation; social learning

## Introduction

"Try your best!" and "great effort!" are commonly heard phrases in the daily lives of young children. These messages reflect caregivers' and teachers' value of effort in fostering productive learning spaces (Duffy, May, Wright, & Hewlett, 2023; Saidah, Louvet, & Pansu, 2019) and are backed by scientific research showing that children who focus on effort, rather than achievement, have better academic and motivational outcomes (Dweck & Leggett, 1988; Yeager & Dweck, 2012). Despite this verbal emphasis on effort, most evaluation frameworks in the education system continue to explicitly reward achievement, not effort (Frey & Schmitt, 2010; Harlen et al., 2002; Schinske & Tanner, 2014). Thus, children may be receiving mixed messages about the value of their effort from adult testimony and rewards. However, it is unknown how these inputs influence young children's effortful actions in learning contexts. Here, we explore how contradictory verbal- and reward-based messages about the value of effort impact children's persistence.

A great deal of work shows that young children are sensitive to adult messages about the value of effort. In particular, several studies have found that praise focused on hard work (process praise, "You tried so hard!") promotes children's persistence more than praise focused on ability (person praise, "You're so smart!") by signaling that effort is valued (Brummelman, Nelemans, Thomaes, & Orobio de Castro, 2017; Gunderson et al., 2013; Henderlong & Lepper, 2002; Lucca, Horton, & Sommerville, 2019). For example, 18-

month-old infants are more persistent on difficult motor tasks if their parents use more process-based praise, especially in moments when children's effort leads to success (Lucca et al., 2019; Radovanovic, Soldovieri, & Sommerville, 2023). Longitudinal work shows that toddlers who receive a higher proportion of parental process praise go on to develop growth-oriented motivational frameworks in 2nd and 3rd grade and enhanced academic achievement in the 4th grade (Gunderson et al., 2013; Gunderson et al., 2018). In line with the praise literature, work on growth mindsets – the belief that intelligence can be developed through effort – shows that children are sensitive to more general adult testimony about the value of effort (Yeager & Dweck, 2012). Specifically, Blackwell, Trzesniewski, and Dweck (2007) showed that teaching middle school students about the importance of effort in learning across an eight-week intervention enhanced students' growth mindsets, and in turn, their classroom motivation and academic achievement over the next two years. Taken together, this work shows that adult messages about the value of effort impact not only children's momentary persistence but also their broader beliefs about the importance of effort over time.

In alignment with the effectiveness of effort-based testimony in supporting children's persistence, a growing literature reveals that incentivizing effort, independent of verbal input, also enhances motivation. For example, adults rewarded for their effort, rather than their performance, on a demand selection task chose to continue playing more challenging levels of the task, even when no rewards were presented (Lin, Westbrook, Fan, & Inzlicht, 2024). Likewise, adults incentivized for their cognitive effort on a working memory task were more likely to seek challenges on subsequent novel tasks compared to adults who received random rewards uncorrelated with effort (Clay, Mlynski, Korb, Goschke, & Job, 2022). In school-aged children, rewards for effort, strategy, and improvement instead of performance on an online educational game led to enhanced strategy use and persistence (O'Rourke, Haimovitz, Ballweber, Dweck, & Popović, 2014). This body of work suggests that by rewarding hard work, adults and school-aged children alike have the potential to learn to value and exert effort across various learning contexts (Inzlicht, Shenhav, & Olivola, 2018). Despite this research, most educational contexts continue to reward performance and achievement (e.g., accuracy-based assessments, letter grades; Schinske & Tanner, 2014). Al-

though extrinsic performance-contingent rewards have been shown to foster task interest and mastery (Karniol & Ross, 1977; Pierce, Cameron, Banko, & So, 2003; Wiersma, 1992), decades of research have also revealed that solely rewarding performance has detrimental effects on student mental health and intrinsic motivation (Bates, 1979; Harlen et al., 2002; Lepper, Greene, & Nisbett, 1973).

Critically, verbal- and reward-based messages about the value of effort often co-occur, requiring children to integrate these inputs to decide when their effort is worthwhile. As noted, children are often confronted with conflicting messages where educators preach about effort but reward achievement. Our driving question asks: How do young children, who have yet to experience performance-based assessments in formal education, integrate and respond to these conflicting messages? Based on the literature reviewed above showing that praising and rewarding effort increase persistence independently, we hypothesize that children will be more motivated when adults praise and reward effort (consistent messages) compared to the norm of praising effort but rewarding performance (mixed messages). This hypothesis is further supported by work in preschool-aged children showing that consistent evidence about the value of effort across actions and words boosts persistence: 4- to 5-year-old children persisted longer on a puzzle box game after watching an adult verbally preach the value of effort in addition to exerting effort herself to successfully open a different puzzle box compared to when the adult did not practice what she preached (Leonard, Garcia, & Schulz, 2020). Evidence from the growth mindset literature similarly supports this hypothesis. Specifically, recent work has found that growth mindset interventions are successful to the extent that these messages about the value of effort are supported by contextual factors, like teachers' mindsets and school norms aligning with this message (Hecht, Yeager, Dweck, & Murphy, 2021; Walton & Yeager, 2020; Yeager et al., 2022). The mindset literature presents a helpful analogy of seed and soil: In order for messages about the value of effort to be impactful (the seed), they need a supportive and aligned context (the soil; Walton & Yeager, 2020). Thus, we expect that children will persist more in contexts where messages about the value of effort are matched by incentive structures that reward effort.

## The Present Study

Here, we explore how mixed verbal- and reward-based messages about the value of effort impact 4- to 5-year-old children's persistence across tasks. We focus on preschool-aged children to examine how reasoning about effort develops through a naïve lens rather than studying those who have already conformed to the systematic reward structures present in formal education. Furthermore, prior work has shown that preschoolers are sensitive to verbal messages emphasizing the value of effort, but little is known about how they reason about performance-based rewards, as previous investigations have primarily focused on school-aged children (Harlen et al.,

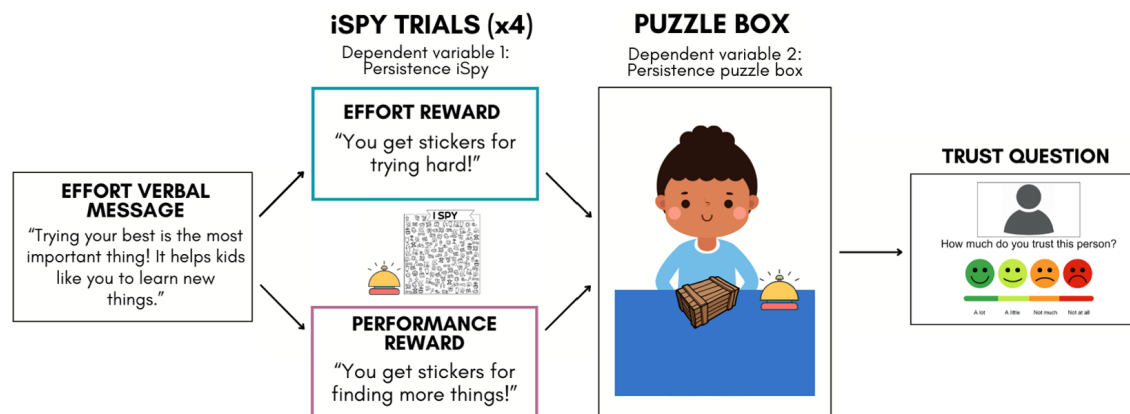
2002; Schinske & Tanner, 2014).

Our paradigm highlights one common instance of mixed messages by asking how children integrate verbal messages about the value of effort with effort-based rewards or performance-based rewards. First, an experimenter told all children about the importance of effort and trying in everyday life. Then, children played four trials of iSpy games where they were randomly assigned to either a consistent, Effort/Effort condition, where they were told that they would be rewarded for effort on the iSpy games (time spent trying to find items), or a mixed-message, Effort/Performance condition, where they were told that they would be rewarded for performance on the iSpy games (number of items found). Persistence (trying time) was measured both during the four iSpy trials as well as on a second, novel task (impossible puzzle box) to assess whether effects would transfer when no rewards were offered. Specifically, this second task allowed us to test whether the impact of mixed messages transcends the immediate context and subsequently shapes children's broader beliefs about the efficacy of their persistence in solving challenging problems, even when no rewards are promised (similar to work from the mindset literature; Dweck & Leggett, 1988; Yeager & Dweck, 2012). Based on prior literature showing that messages about the value of effort can influence children's immediate and long-term motivation, we hypothesize that children will persist more when they receive effort-based verbal messages *and* rewards, both in the iSpy games as well as in the transfer task, compared to when they receive effort-based verbal messages and performance-based rewards (mixed messages).

## Method

**Participants.** Our sample consisted of 80 4- to 5-year-old children (40 per condition,  $M_{age} = 4.98$  years, range: 4.06 - 5.94, age did not differ by condition:  $t(78) = .30, p = .76$ ) in the United States ( $n = 26$ ) and Canada ( $n = 54$ ; results did not differ by country). Based on parental report, 53% were female and 47% were male (Effort/Effort condition: 19 females, Effort/Performance condition: 22 females, gender did not differ by condition:  $\chi^2(3) = .55, p = .9$ ). The racial and ethnic makeup of the final sample was as follows: 30% white, 29% Asian, 23% multiracial, 8% other, 3% Hispanic/Latino and 1% American Indian or Alaskan (missing race and ethnicity data from 6 participants). Caregivers reported their highest level of education as less than a high school degree (1%), high school degree (3%), associate's degree (1%), bachelor's degree (30%), master's degree (39%), professional degree (20%) or did not report (6%). Data were excluded from an additional six participants due to opting out of the study part way through ( $n = 3$ ) or an inability to meet task performance criteria ( $n = 3$ ; see details below).

**Procedure.** The experimental paradigm consisted of four phases: 1) verbal effort-based message, 2) visual search trials (iSpy game) with rewards for effort or performance, 3) generalization task (puzzle box), and 4) a brief trust ques-



**Figure 1. Schematic depicting the four phases of the present study.** First, all children heard a verbal message emphasizing the importance of effort. Children were then randomly assigned to one of two conditions. In the Effort/Effort condition, children were told that they would receive stickers on the following iSpy game based on how hard they tried (trying time per trial). In the Effort/Performance condition, children were told that they would receive stickers based on how well they did on the game (number of items found per trial). A maximum of two minutes were allotted per iSpy trial (4 trials in total) and children could terminate the trial early by ringing a bell. Trying time on the four iSpy trials served as our first persistence dependent variable. Next, all participants were given a puzzle box that was secretly impossible to open and told that there was something interesting inside. Children were given a maximum of four minutes to play with the box and they could end the trial early by ringing a bell. No rewards were offered. Trying time on the box task served as our second persistence dependent variable. Finally, a second experimenter asked children about their trust in the first experimenter.

tionnaire (see Figure 1). First, all participants listened to a verbal message delivered by the experimenter focusing on the importance of effort in everyday life. Specifically, the experimenter told children, “Trying your best is the most important thing because it helps you to learn new stuff and get better at everything that you do!”. Next, the experimenter showed children a sticker board and explained that it tracked either how hard they tried (Effort/Effort condition) or how well they did (Effort/Performance condition) on the following visual search tasks (random assignment to condition). Across conditions, participants were told that their goal was to get as many stickers as possible because they were allowed to take the sticker board home after the games. The iSpy games were printed on individual sheets of paper and children were instructed to use a marker to find and circle the target items. Children had a maximum of two minutes to play each iSpy game and were told that they could end the trial early by ringing a bell. In the Effort/Effort condition, given a maximum trying time of two minutes, children received additional stickers for every 24 seconds they tried on the iSpy game while in the Effort/Performance condition, children received an additional sticker for each item they found in that trial. Critically, the maximum number of items that children could find across all four trials of the iSpy game as well as the maximum number of stickers that children could receive were matched in both conditions (20 maximum items, 20 maximum stickers).

Children were also informed that there were a total of ten targets to find in each iSpy game. However, we surreptitiously manipulated the number of discoverable items in the iSpy games across trials in our design. We originally hoped

to examine how children’s performance interacted with mixed messages in a 2 x 2 design crossing the consistency of messages and rewards by performance (increasing or constant). Thus, we randomly assigned children to a condition where the number of items increased across trials (finding 4, 5, 5, 6 items) or remained constant across all four trials (consistently finding 5 items). However, we found that only 35% of participants’ performance aligned with our intended performance conditions, deeming our performance manipulation ineffective. Analyses with this variable are therefore not presented in the results section. To ensure that the Effort/Effort and Effort/Performance conditions did not systematically vary by performance, we coded performance data into the following categories: constant, increasing, decreasing, and other. We found that participants’ performance patterns did not vary by condition ( $\chi^2(3) = 2, p = .6$ ). Finally, to ensure that participants were sufficiently attending to our paradigm, we excluded participants who found less than 50% of the total possible items across all four trials of the iSpy game ( $n = 2$ ), or who tried for less than 24 seconds on any one of the iSpy trials ( $n = 1$ ).

To examine if children translated their learning experiences from the iSpy trials to a novel task, all participants were then asked to play with a puzzle box. Following the script and procedure from Leonard et al. (2020), children were given the puzzle box and told that there may be something interesting inside. To control for individual differences in children’s performance on this task, the puzzle box appeared as if it could be opened but, unknown to participants, the box was glued together and could not be unlocked. Children were

asked to play with the box independently and all participants had a maximum of four minutes to try to open the box or they could terminate the trial early by ringing a bell. The experimenter explicitly stated that this was a new task, distinct from the prior iSpy games. No rewards were offered. To avoid reputational concerns, the experimenter worked on their computer and limited eye contact and interactions with participants during this transfer task. Across both the iSpy trials and puzzle box tasks, children engaged with the games independently (e.g., parents waited behind children and were instructed to avoid verbal communication during the games).

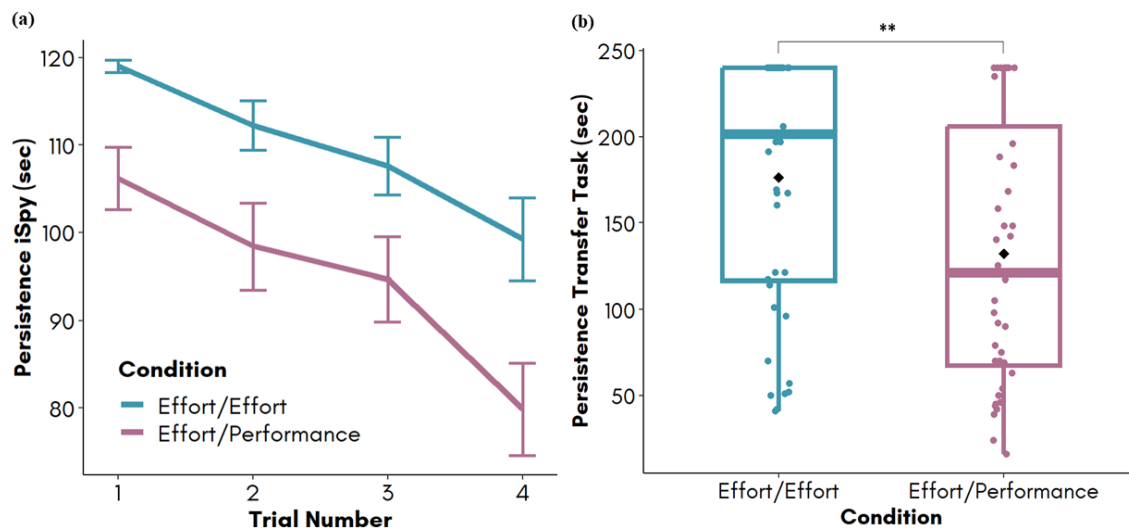
Finally, we wanted to disambiguate the underlying mechanisms explaining persistence differences across conditions. Critically, although prior work suggests that mixed messages about effort may reduce motivation (Leonard et al., 2020), an alternative explanation is that children may simply lose trust in the experimenter and decrease trying behaviors in light of the unreliable context (e.g., children may believe that no matter how much they try, the experimenter will not deliver rewards). Thus, to conclude the paradigm, a second experimenter came into the testing room to ask about children's trust in the first experimenter who conducted the iSpy and puzzle box games. The second experimenter displayed the trust question on a computer screen with a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*a lot*) and read the question and responses out loud to the child. Participants were asked to verbally select or point to a specific response.

**Coding.** Persistence was operationalized as children's latency to ring the bell in both the iSpy task and the transfer task (Leonard et al., 2020). On the iSpy task, trying time was measured from the start of each game until children rang the bell or after two minutes passed – whichever came first. In

order to gain a more fine-grained measure of trying time differences between conditions, we coded the time that children continued to try after they found their last item on each trial of the iSpy game. On the box task, persistence was coded from the initiation of the game (e.g., child first touches the box) until when the child rang the bell or after four minutes passed – whichever came first. Data were first live-coded by the experimenter and then a research assistant blind to conditions and hypotheses double-coded 64% of the data. The inter-rater reliability was high across all persistence measures (0.98 for iSpy total trying time, 0.99 for transfer task trying time, 0.98 for trying time after last item found), indicating substantial agreement among coders.

## Results

Throughout, we rely on non-parametric tests as our dependent variables did not adhere to a normal distribution (Shapiro-Wilk  $ps < .001$ ). Our first goal was to understand whether children's immediate persistence was influenced by mixed messages about the value of effort. A Generalized Estimating Equation (GEE; Højsgaard, Halekoh, & Yan, 2006) predicting persistence on the iSpy task using participants as a clustering variable and the main effects of trial and condition as predictors revealed a main effect of trial, showing that children's trying time decreased across iSpy trials ( $\chi^2(1, N = 80) = 34.41, p < .001$ ). This model also revealed a main effect of condition, with children on average persisting longer on the iSpy games in the Effort/Effort condition compared to the Effort/Performance condition across trials ( $\chi^2(1, N = 80) = 8.47, p = .004$ ; Figure 2a). These results do not differ by country ( $\chi^2(1, N = 80) = .84, p = .36$ ). Notably, a Wilcoxon rank-sum test revealed that a condition difference appeared



**Figure 2. Children's persistence in study tasks. (a)** Children's trying time by condition as measured in seconds across four trials of the iSpy game. Error bars depict standard errors of the means. **(b)** Children's trying time by condition as measured in seconds in the puzzle box game. The top and bottom of the boxes correspond to the first and third quartiles (the 25th and the 75th percentiles). The horizontal line in the middle of the boxes denotes medians. The black diamond represents the means. \*\* represents  $p = .01$ .

on the first trial ( $W = 552, p < .001$ ), and there was no trial by condition interaction ( $\chi^2(1, N = 80) = 2.46, p = .12$ ) indicating that condition differences emerged early and remained stable across trials. A GEE predicting trying time after finding the last item using participants as a clustering variable and main effects for trial and condition revealed no effect of condition ( $\chi^2(1, N = 78) = .10, p = .76$ ) or trial ( $\chi^2(1, N = 78) = 1.36, p = .24$ ). In other words, condition differences in trying time on the iSpy task were driven by overall trying time, not trying time after the last item found.

Next, we sought to explore whether longer trying times in the Effort/Effort versus Effort/Performance condition impacted children's actual performance or the amount of rewards received. In the iSpy games, performance and rewards were intentionally matched by condition and therefore, should not systematically vary. Indeed, children in both conditions were near ceiling for performance (number of items found;  $M_{Effort/Performance} = 17.35, M_{Effort/Effort} = 17.10$ ) and near ceiling for rewards (number of stickers received;  $M_{Effort/Performance} = 17.35, M_{Effort/Effort} = 18.30$ ), both of which did not differ by condition (items found:  $\chi^2(1, N = 80) = .31, p = .58$ ; stickers received:  $\chi^2(1, N = 80) = 3.67, p = .06$ ).

Our next goal was to understand whether children generalized their prior experiences to a novel task. A Wilcoxon rank-sum test revealed that children in the Effort/Effort condition persisted longer on the puzzle box task than children in the Effort/Performance condition ( $W = 537, p = .01$ ; Figure 2b). In other words, consistent effort-based messages and rewards enhanced persistence even on a new task where no rewards were offered. These condition differences did not vary by country (quantile regression predicting persistence with a condition by country interaction:  $b = 25, 95\% \text{ CI } [-93.24, 143.24], p = .67$ ).

Finally, to ensure that the effects of mixed messages were not driven by lowered trust in the first experimenter, we analyzed whether children's trust in the experimenter differed by condition. We found that children's trust ratings were high on average and showed no condition differences ( $W = 643, p = .8$ ;  $M_{Effort/Performance} = 3.45, M_{Effort/Effort} = 3.51$ ).

## Discussion

We found that 4- to 5-year-old children are more persistent when they are exposed to consistent versus mixed verbal- and reward-based messages about the value of effort. Children not only persist longer on the rewarded task but also on a second, novel task where no rewards were offered. Thus, children may be generalizing the value of persistence across contexts, highlighting the potential broad-scale impact of conflicting messages about effort on motivation. Importantly, the observed effect was not driven by children trusting the experimenter less when they gave mixed messages. Taken together, our results suggest that the mixed messages children often confront in formal education – adults preaching about the value of effort but rewarding children's performance – may

demotivate children across learning contexts even before they step foot in the classroom.

Our findings advance theoretical and empirical work on children's sensitivity to messages about the value of effort in a number of ways. First, we extend research on the motivational consequences of reward structures (Clay et al., 2022; Lin et al., 2024; O'Rourke et al., 2014) to younger children by showing that even preschoolers may find effort-based rewards motivating across contexts. Second, by showing that 4- to 5-year-old children are sensitive to conflicting messages about effort across modalities, our work adds to broader research on rational learning in early childhood (Gweon & Schulz, 2011; Leonard et al., 2020; Sobel & Kushnir, 2013). To this point, our work corroborates with research on children's cost-benefit analyses (Gweon, Chu, & Schulz, 2014; Lucca, Horton, & Sommerville, 2020; Ruggeri, Swaboda, Sim, & Gopnik, 2019; Sommerville et al., 2018) by showing that children rationally allocate less effort across trials after learning that trying longer is not associated with increased success on the immediate task. Third, our findings contribute to the growth mindset literature by suggesting that reward structures, in addition to adult praise (Haimovitz & Dweck, 2017; Haimovitz & Henderlong Corpus, 2011), may shape young children's broad-scale beliefs about the value of their effort and their learning potential. Finally, our findings are the first to demonstrate causal support for the "seed and soil" model (Walton & Yeager, 2020) in young children by showing that preschoolers are demotivated when the reward context fails to align with the original effort-based message.

In line with prior work showing that young children integrate multiple forms of adult input into their decision-making (Leonard, Duckworth, Schulz, & Mackey, 2021; Leonard et al., 2020; Lucca et al., 2020), we have suggested that children track both verbal messages and rewards and rationally try harder when they hear that effort is valued and rewarded. However, an alternative explanation is that children only track rewards and try harder when rewarded for effort versus performance, regardless of the initial verbal message. In other words, it may not be that consistent messages about effort are more motivating than contradictory ones, but rather that incentives speak louder than words. The repeated exposure to rewards across four trials of the iSpy games may have additionally increased the saliency of rewards when compared to the verbal message. To distinguish between these interpretations, we are conducting an ongoing study that manipulates both the initial message (preaching effort or performance) and the reward structure (giving out stickers for effort or performance) in the iSpy games. If children are indeed attending to and integrating adults' words with rewards, they should persist the most in the Effort/Effort condition, the least in the Performance/Performance condition, and in the middle for the conditions that contain mixed messages. However, if children's behaviors are solely informed by rewards, then they should persist more in the conditions that reward effort, irrespective of whether the initial message is consistent or not.

The result that children persisted longer on the transfer task in the Effort/Effort condition raises the possibility that children are generating broader beliefs about the importance of effort based on adult messages and actions. This finding is in line with prior research showing that children generalize the value of effort across tasks (Leonard, Lee, & Schulz, 2017) and work in the mindset literature on children forming broader beliefs about the utility of effort from adult testimony (Blackwell et al., 2007; Haimovitz & Dweck, 2017; Yeager & Dweck, 2012). However, it is possible that children's persistence on the transfer task is not driven solely by their own updated beliefs about the importance of hard work, but also by their interest in pleasing an adult who previously stated their effort-focused values through their actions and words, even though the adult was not attending to them during this task (see Asaba & Gweon, 2022; Good & Shaw, 2021; Ma et al., 2023; Silver & Shaw, 2018). Importantly, children's increased effort as a result of reputational concerns could eventually foster the internalization of effort as intrinsically worthwhile. We are currently coding social referencing (e.g., eye contact with the experimenter) in our videos to assess the viability of this reputational hypothesis. Another possibility is that children somehow expect to receive rewards based on effort or performance in this second task, even though they are told that this is a new game. Future studies could test whether our results replicate when children are explicitly told that they will not get stickers on this second puzzle box task.

Our finding that consistent verbal- and reward-based messages around effort increase children's persistence raises the key question of how to best implement this motivational scheme in practice. Despite empirical evidence suggesting the importance of rewarding effort, such an incentive structure is difficult to realize as effort is an invisible process associated with individual heterogeneity (Zinn et al., 2011). In particular, educators may disagree about what type of student behavior constitutes as effortful (e.g., participation in class, self-report time spent on homework) and the clarity of these definitions is further complicated by the fact that it is difficult to objectively assess effort independent of performance (López-Pastor & Sicilia-Camacho, 2017; Zinn et al., 2011). Another potential concern suggests that rewarding effort may cause children to take longer than necessary to complete assignments, leading to inefficiency instead of motivated learning. Although we found that children in the Effort/Effort (versus Effort/Performance) condition were slower at finding the same number of items, we artificially bounded performance, and thus, more research is necessary for disambiguating whether and when rewarding effort leads to careful work versus inefficiency. In sum, further investigations are required to explore what types of effort-related incentive structures are both feasible and motivating in classroom contexts.

The present findings inspire key future avenues of research concerning the developmental and sociocultural factors that influence how children integrate mixed messages about the value of effort. For example, older students' prolonged ex-

posure to performance-based contexts in formal education (Schinske & Tanner, 2014) may change how they respond to mixed messages when compared to younger children hearing them for the first time. Specifically, praising effort has been shown to motivate younger children, but backfire in adolescence (Amemiya & Wang, 2018). In the same way, older children may not find verbal and tangible rewards for effort motivating, but instead, a signal of low competence. Alternatively, older students may discount verbal messages entirely and only focus on rewards, as they have learned that performance-based rewards are more consequential in their academic career. Furthermore, children may receive different messages about effort from the various adult figures (e.g., parent and teacher) in their lives across home and school contexts. It is unclear how children integrate these verbal messages across sources and whether mixed messages across contexts (e.g., home and school) are just as demotivating as mixed messages in the same context (e.g., just school). Finally, children likely receive heterogeneous messages about the value of effort based on social and cultural backgrounds. For example, socioeconomic status plays a role in affecting parental values of effort as countries with relatively higher income inequality (e.g., China, USA) also have parents who report that hard work is one of the top five values they hope to instill in their children (Doepke & Zilibotti, 2019). Thus, children attending schools that differ from their families' sociocultural background (e.g., immigrants, students at boarding school, on scholarship) may in some cases be the most likely to receive mixed messages across learning contexts. Understanding how age, input, and sociocultural factors influence children's response to mixed messages about effort are critical areas of future research.

Children are exposed to a variety of messages about the value of effort and are tasked with synthesizing these inputs to inform their learning. Often these messages conflict: Teachers say that effort is important but only give out As for a perfect score, not for students' hard work. Here, we find that mixed (versus consistent) messages about the value of effort across words and rewards reduce preschoolers' motivation in both immediate and future learning experiences. Together, this work reinforces the age-old concept of practicing what we preach: To effectively foster children's persistence, we need to not only talk about the value of effort but also reward it when we see it.

## Acknowledgments

We thank members of the Leonard Learning Lab and the Toronto Early Cognition Lab for helpful discussions and feedback. We also thank Anicole Tan, Ellen Imamura, and Annabelle Persaud for their assistance in data collection and coding. This research was supported by an Education Studies Grant awarded to E. Wang, funding from the Social Sciences and Humanities Research Council awarded to J. A. Somerville, and a Jacobs Foundation Research Fellowship awarded to J. A. Leonard.

## References

- Amemiya, J., & Wang, M.-T. (2018). Why effort praise can backfire in adolescence. *Child Development Perspectives*, 12(3), 199–203.
- Asaba, M., & Gweon, H. (2022). Young children infer and manage what others think about them. *Proceedings of the National Academy of Sciences*, 119(32), e2105642119.
- Bates, J. A. (1979). Extrinsic reward and intrinsic motivation: A review with implications for the classroom. *Review of Educational Research*, 49(4), 557–576.
- 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.
- Brummelman, E., Nelemans, S. A., Thomaes, S., & Orobio de Castro, B. (2017). When parents' praise inflates, children's self-esteem deflates. *Child development*, 88(6), 1799–1809.
- Clay, G., Mlynski, C., Korb, F. M., Goschke, T., & Job, V. (2022). Rewarding cognitive effort increases the intrinsic value of mental labor. *Proceedings of the National Academy of Sciences*, 119(5), e2111785119.
- Doepke, M., & Zilibotti, F. (2019). *Love, money, and parenting: How economics explains the way we raise our kids*. Princeton University Press.
- Duffy, B., May, G., Wright, J., & Hewlett, K. (2023). Parenting priorities: International attitudes towards raising children.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review*, 95(2), 256.
- Frey, B. B., & Schmitt, V. L. (2010). Teachers' classroom assessment practices. *Middle Grades Research Journal*, 5(3).
- Good, K., & Shaw, A. (2021). Achieving a good impression: Reputation management and performance goals. *Wiley Interdisciplinary Reviews: Cognitive Science*, 12(4), e1552.
- Gunderson, E. A., Gripshover, S. J., Romero, C., Dweck, C. S., Goldin-Meadow, S., & Levine, S. C. (2013). Parent praise to 1-to 3-year-olds predicts children's motivational frameworks 5 years later. *Child development*, 84(5), 1526–1541.
- Gunderson, E. A., Sorhagen, N. S., Gripshover, S. J., Dweck, C. S., Goldin-Meadow, S., & Levine, S. C. (2018). Parent praise to toddlers predicts fourth grade academic achievement via children's incremental mindsets. *Developmental psychology*, 54(3), 397.
- Gweon, H., Chu, V., & Schulz, L. (2014). To give a fish or to teach how to fish? Children weigh costs and benefits in considering what information to transmit. In *Proceedings of the annual meeting of the cognitive science society* (Vol. 36).
- Gweon, H., & Schulz, L. (2011). 16-month-olds rationally infer causes of failed actions. *Science*, 332(6037), 1524–1524.
- Haimovitz, K., & Dweck, C. S. (2017). The origins of children's growth and fixed mindsets: New research and a new proposal. *Child development*, 88(6), 1849–1859.
- Haimovitz, K., & Henderlong Corpus, J. (2011). Effects of person versus process praise on student motivation: Stability and change in emerging adulthood. *Educational Psychology*, 31(5), 595–609.
- Harlen, W., Crick, R. D., Broadfoot, P., Daugherty, R., Gardner, J., James, M., & Stobart, G. (2002). A systematic review of the impact of summative assessment and tests on students' motivation for learning.
- Hecht, C. A., Yeager, D. S., Dweck, C. S., & Murphy, M. C. (2021). Beliefs, affordances, and adolescent development: Lessons from a decade of growth mindset interventions. In *Advances in child development and behavior* (Vol. 61, pp. 169–197). Elsevier.
- Henderlong, J., & Lepper, M. R. (2002). The effects of praise on children's intrinsic motivation: A review and synthesis. *Psychological bulletin*, 128(5), 774.
- Højsgaard, S., Halekoh, U., & Yan, J. (2006). The r package geepack for generalized estimating equations. *Journal of statistical software*, 15, 1–11.
- Inzlicht, M., Shenhav, A., & Olivola, C. Y. (2018). The effort paradox: Effort is both costly and valued. *Trends in cognitive sciences*, 22(4), 337–349.
- Karniol, R., & Ross, M. (1977). The effect of performance-relevant and performance-irrelevant rewards on children's intrinsic motivation. *Child Development*, 482–487.
- Leonard, J. A., Duckworth, A. L., Schulz, L. E., & Mackey, A. P. (2021). Leveraging cognitive science to foster children's persistence. *Trends in Cognitive Sciences*, 25(8), 642–644.
- Leonard, J. A., Garcia, A., & Schulz, L. E. (2020). How adults' actions, outcomes, and testimony affect preschoolers' persistence. *Child development*, 91(4), 1254–1271.
- Leonard, J. A., Lee, Y., & Schulz, L. E. (2017). Infants make more attempts to achieve a goal when they see adults persist. *Science*, 357(6357), 1290–1294.
- Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis. *Journal of Personality and social Psychology*, 28(1), 129.
- Lin, H., Westbrook, A., Fan, F., & Inzlicht, M. (2024). An experimental manipulation of the value of effort. *Nature Human Behaviour*, 1–13.
- López-Pastor, V., & Sicilia-Camacho, A. (2017). Formative and shared assessment in higher education. Lessons learned and challenges for the future. *Assessment & Evaluation in Higher Education*, 42(1), 77–97.
- Lucca, K., Horton, R., & Sommerville, J. A. (2019). Keep trying!: Parental language predicts infants' persistence. *Cognition*, 193, 104025.
- Lucca, K., Horton, R., & Sommerville, J. A. (2020). Infants rationally decide when and how to deploy effort. *Nature human behaviour*, 4(4), 372–379.



- Ma, F., Gu, X., Tang, L., Luo, X., Compton, B. J., & Heyman, G. D. (2023). If they won't know, I won't wait: Anticipated social consequences drive children's performance on self-control tasks. *Psychological Science, 34*(11), 1220–1228.
- O'Rourke, E., Haimovitz, K., Ballweber, C., Dweck, C., & Popović, Z. (2014). Brain points: A growth mindset incentive structure boosts persistence in an educational game. In *Proceedings of the sigchi conference on human factors in computing systems* (pp. 3339–3348).
- Pierce, W. D., Cameron, J., Banko, K. M., & So, S. (2003). Positive effects of rewards and performance standards on intrinsic motivation. *The Psychological Record, 53*(4), 561–578.
- Radovanovic, M., Soldovieri, A., & Sommerville, J. (2023). It takes two: Process praise linking trying and success is associated with greater infant persistence. *Developmental Psychology, 59*(9), 1668–1675.
- Ruggeri, A., Swaboda, N., Sim, Z. L., & Gopnik, A. (2019). Shake it baby, but only when needed: Preschoolers adapt their exploratory strategies to the information structure of the task. *Cognition, 193*, 104013.
- Saidah, B., Louvet, E., & Pansu, P. (2019). Are students who make an effort perceived as successful or just liked by their teachers? *Social Psychology of Education, 22*, 405–419.
- Schinske, J., & Tanner, K. (2014). Teaching more by grading less (or differently). *CBE—Life Sciences Education, 13*(2), 159–166.
- Silver, I. M., & Shaw, A. (2018). Pint-sized public relations: The development of reputation management. *Trends in cognitive sciences, 22*(4), 277–279.
- Sobel, D. M., & Kushnir, T. (2013). Knowledge matters: How children evaluate the reliability of testimony as a process of rational inference. *Psychological Review, 120*(4), 779.
- Sommerville, J. A., Enright, E. A., Horton, R. O., Lucca, K., Sitch, M. J., & Kirchner-Adelhart, S. (2018). Infants' prosocial behavior is governed by cost-benefit analyses. *Cognition, 177*, 12–20.
- Walton, G. M., & Yeager, D. S. (2020). Seed and soil: Psychological affordances in contexts help to explain where wise interventions succeed or fail. *Current Directions in Psychological Science, 29*(3), 219–226.
- Wiersma, U. J. (1992). The effects of extrinsic rewards in intrinsic motivation: A meta-analysis. *Journal of occupational and organizational psychology, 65*(2), 101–114.
- Yeager, D. S., Carroll, J. M., Buontempo, J., Cimpian, A., Woody, S., Crosnoe, R., . . . others (2022). Teacher mindsets help explain where a growth-mindset intervention does and doesn't work. *Psychological Science, 33*(1), 18–32.
- Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational psychologist, 47*(4), 302–314.
- Zinn, T. E., Magnotti, J. F., Marchuk, K., Schultz, B. S., Luther, A., & Varfolomeeva, V. (2011). Does effort still count? More on what makes the grade. *Teaching of Psychology, 38*(1), 10–15.