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The effect of task difficulty on preschoolers' problem-solving and emotion-regulation strategy use

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THE EFFECT OF TASK DIFFICULTY ON PRESCHOOLERS' PROBLEM-SOLVING AND EMOTION-REGULATION STRATEGY USE

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ABSTRACT

Although there has been a lot of research on problem-solving and emotion-regulation independently, little work has been done on how these constructs are related. The current investigation sought to explore differences in problem-solving, emotion-regulation, emotion-dysregulation and help-seeking based on task difficulty. Preschool children between 3-5 years of age participated in six frustration-inducing problem-solving tasks, three of which were possible (but difficult) and three of which were impossible for them to solve. Problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking behaviors were coded for each task. I hypothesized that children's behavior in each of these four areas would vary according to task difficulty, as well as within each task as they struggled more. I also aimed to investigate each of the constructs to see if they are domain-specific (i.e., traits of the children) or domain-general (i.e., products of the situation). Results revealed that children's help-seeking and emotion-dysregulation differed according to task difficulty. Problem-solving and emotion-dysregulation demonstrated some domain-specificity. Finally, younger and older preschoolers differed in their help-seeking.

INTRODUCTION

Problem-solving situations arise daily in all facets of life. The ability to attain a goal through problem-solving is an important faculty that has been the consideration of a substantial amount of developmental research. Problem-solving refers to all steps involved in the achievement of a goal through identifying the causes of the problem and planning a course of action to overcome obstacles to reach the goal. Research into problem-solving development often focuses on children's transitions from less to more sophisticated and more systematic strategies in early childhood (e.g., Richards & Seigler, 1981). Despite the vast amount of research in this area, few studies focus on how emotion-regulation is involved in problem-solving and how the context of the situation may affect strategy choice. Although many emotion-regulation studies utilize problem-solving tasks, it is rare for problem-solving strategies to be examined. The current study is unique because I look at both problem-solving and emotion-regulation strategies in the same session. Additionally, I explore a possible link between successful problem-solving and successful emotion-regulation. To do this, I looked at how preschoolers respond to frustrating problem-solving situations, while focusing on the role that emotion-regulation plays as a problem-solving strategy, and how different levels of frustration affect emotion-regulation strategy use.

I begin by reviewing the literature on problem-solving and outlining some of the strategies that children use. Then I look at the development of problem-solving strategies, while focusing on preschoolers, an age with significant advances in problem-solving abilities. Next, I review the literature on emotion-regulation and the development of complex emotion-regulation strategies, again focusing on the 3-5 age group, a time when emotion-regulation strategies are rapidly changing and becoming more complex. I then look at contextual influences on problem-solving, emotion-regulation, and help-seeking, specifically task difficulty. Finally, I explore the link

between emotion-regulation and problem-solving while illustrating the importance of studying these two constructs together.

Problem-solving

Problem-solving refers to the entire process of goal attainment. A number of steps are involved in successful problem-solving: encoding the situation, identifying the target problem, generating a variety of strategies and considering the costs and benefits associated with each strategy, anticipating obstacles and executing a plan to overcome them, and finally implementing the best solution (e.g., D'zurilla & Goldfried, 1971). Additionally, it is crucial that the strategy one chooses matches the demands of the problem (Blanchard-Fields, 2007). I propose that emotion-regulation is another critical step in many problem-solving situations because, by definition, a problem involves an obstacle to a goal which often leads to frustration or anger. Although most people automate problem-solving strategies and rarely explicitly go through each of these steps in every problem-solving situation, such formal problem-solving skills may still be important when facing novel or especially challenging problems.

Children's problem-solving strategies develop rapidly and the acquisition of more advanced strategies is a commonly studied developmental change. Younger children tend to utilize less deliberate, more holistic, intuitive, similarity based strategies while older children use more analytic, rational, and systematic strategies (Richards & Siegler, 1981). Although specific strategies vary depending upon the problem, there are domain-general strategies that may be used in any problem-solving situation. Some of the problem-solving strategies that are generally observed in young children are the following: Trial and error, means-ends-analysis, hill-climbing, analogical transfer, and help-seeking. Trial-and-error is the least sophisticated strategy and is often preceded by feelings of incompetence in the given task. This strategy involves manipulation of the elements of a task, with little sign of planning; however, trial-and-error often leads to insight into

how to solve the problem, or discovery of the solution itself (Matheson, 1931). I expect to observe this strategy because the frustrating problems we are presenting to children have probably not been encountered before, at least in this context. Means-ends-analysis involves breaking down the problem by setting sub-goals to lessen the disparity between the current and goal state (e.g. Klahr, 1985). Closely related, though less demanding, is hill-climbing in which one attempts at every step of the problem to move closer to the goal (Colvin, Dunbar, & Grafman, 2001). This strategy is less demanding because it requires the problem-solver to only look one step ahead to pick a move that brings them closer to the goal state. This is often effective; however, difficulties may arise because many challenges initially require one move away from the goal state in order to clearly see the solution (Colvin, Dunbar, & Grafman, 2001). Analogical transfer involves identifying similarities between a current, novel problem, and a prior problem from a similar domain, and using the previously successful solution to solve the novel problem (Tunteler & Resing, 2007). Previous research suggests that the successful use of analogical transfer increases with age and practice. Children below five years of age are not spontaneously proficient with analogical transfer; they generally require instruction or reminders from an adult (Tunteler & Resing, 2007). I do not expect analogical transfer to be utilized frequently in the current investigation because there are relatively few similarities between the tasks and the participants are below the age reported for successful use of this strategy. Finally, help-seeking involves gaining information about a given situation from others and it is a very useful problem-solving strategy for children. The information may be in the form of an answer to a direct question, a hint about how to solve the problem, the solution to the problem itself, encouragement, or physical assistance. Some researchers suggest that the most optimal use of help-seeking involves children seeking help only when they are not capable of solving the problem themselves; also, they confine their questions to elicit only enough information so that they can finish the task on their own (Puustinen et al., 2008). Help-seeking is a very

common strategy in young children and will be discussed in more detail later. I expect trial-and-error and help-seeking to be used frequently in this study because these problems are challenging and may be novel to the children. In addition to these problem-solving strategies, I expect the necessity to regulate and overcome any negative emotions that are generated in response to a blocked goal before problem-solving solutions can be implemented. The current investigation looks for evidence of these problem-solving strategies in preschoolers while considering how the amount of frustration may affect strategy choice.

Many developmental processes contribute to problem-solving development. Cognitive processes that improve with age, such as processing speed, short term memory capacity, and working memory capacity, may affect which strategies a child can effectively use (e.g., Thornton, 1999). Additionally, the cognitive ability to coordinate memory demands and monitor task demands at the same time is necessary for successful planning. Previous research has demonstrated that these abilities emerge during preschool (e.g., Hudson & Fivush, 1991). Children must use cognitive control processes such as planning, monitoring success or failure, coordinating strategies, and goal retention when problem-solving (Freund, 1990). A child's social interactions serve as an additional venue through which they may develop sophisticated problem-solving strategies. Some of children's earliest experiences with problem-solving come from observing those around them in problem-solving situations (Crowley & Seigler, 1999). In line with Vygotsky's (1962) theory of socio-cultural development, the more an adult scaffolds a child through problem-solving, the more the child's independent problem-solving performance will advance (e.g., Freund, 1990). This helps to explain why help-seeking is such a common and advantageous strategy observed in young children.

Problem-solving development continues throughout the lifespan (e.g., Blanchard-Fields, 2007); however, the majority of cognitive and social contributions to development occur during early

childhood. In general, there are advances throughout early and middle childhood in strategy use. For example, Thorton (1999) investigated problem-solving strategies in five, seven and nine year olds utilizing a bridge building task and a 20-questions game. In both situations seven and nine year olds used significantly more strategies than five year olds and their strategies were significantly more successful. During the preschool years, children's self-understanding, social competence and problem-solving-skills advance rapidly (e.g. Colman & Thompson, 2002). The increases in these and other developmental abilities that occur during the preschool years suggest that this is the time for the emergence of complex problem-solving strategies. Bauer et al. (1999) investigated children between the ages of two and two-and-a-half in a problem-solving task, specifically looking at their ability to construct a sequence of actions to solve a problem. They systematically varied the amount of information regarding the start state, intermediated states, and goal state that they provided to the children on four novel problems. The problems they used were make a spinning top, make a gong, make a rattle, and make a horse ride. Each problem had three steps and any step could be done at any time; however, successful completion required the steps to be done in a specific order. The authors suggest that theirs is the first study to demonstrate planning in children younger than preschool age. Twenty-seven-month olds showed dramatic increases in their ability to plan a course of action to solve a problem when given helpful information as compared to 21-month olds. By 3-years of age children are capable of planning, but even within the preschool period there are increases in planning abilities. Welsh (1991) investigated children between the ages of 3- and 12-years on a traditional Tower of Hanoi task. Three-year olds were not adept in planning a course of action to achieve a goal, while 4-year olds demonstrated some proficiency in this ability. Hudson and Fivush (1991) found similar results in preschooler's planning abilities. Children were told that they were going to shop either for a birthday party or a breakfast and that they needed to plan things to buy for these occasions. They were then taken into

a mock grocery store and observed to see if they could enact the plan they had just devised. These researchers found that when left on their own, 3-year olds' performed very poorly on this task while 5-year olds excelled. When provided assistance by the experimenter, 3-year olds' performance was enhanced. It is possible that in some cases help-seeking may be a more beneficial problem-solving strategy for younger children than older children. Although proficiency in planning develops throughout life, the developmental literature points to the preschool period as a time of significant change in this area. I expect to see developmental differences in problem-solving between the oldest and youngest preschoolers.

Emotion-regulation

The role of emotion-regulation receives surprisingly little attention in the problem-solving literature. Although there can be problem-solving without emotion (e.g. putting together a puzzle casually without frustration) and emotion-regulation without problem-solving (e.g. dealing with the death of a loved one), in many cases these two constructs seem inevitably linked. Many emotion-regulation researchers acknowledge problem-solving in their work by stating that emotion-regulation may aid in goal accomplishment by helping one overcome negative emotions in order to successfully formulate and enact a plan to achieve one's goal (e.g., Zimmerman et al., 2001). Conversely, problem-solving researchers recognize that emotions play a part in problem-solving by stating that when one faces a task in which one's goal is obstructed by a complication, anger or frustration is often the result (e.g., Campos, Campos, & Barrett, 1989). Although each of these fields may recognize the relevance of both constructs, rarely are both types of behaviors examined in one study.

Emotion-regulation is a complex process that involves inhibiting or adjusting aspects of emotional experiences including emotion-related cognitions, physiological processes, and behaviors. Children with more advanced emotion-regulation abilities have been found to

demonstrate higher cognitive performance; specifically, they are more academically successful, have higher IQ's, and perform better on standardized tests (Graziano et al., 2006). Additionally, they are more accepted by their peers, demonstrat more social competence, (Dodge & Coie, 1987), and have higher self-esteem (Pulkkinen, Nygren, & Kokko, 2002).

Similar to problem-solving strategies, there are a number of emotion-regulation strategies that have been observed in young children. Across wide ranging situations children have been shown to self-soothe, distract themselves from arousing stimuli, use cognitive strategies, and seek help (e.g., Stansbury & Sigman, 2000; Calkins et al., 2002). Some children exhibit physical responses to frustration (such as throwing things or banging). For the present study physical outbursts will be considered emotion-dysregulation. Physical frustration demonstrates that the child has not changed their affect in response to the source of frustration but instead has resorted to physical outbursts.

Self-soothing alleviates a child's internal experience of a negative emotion with no attempt to manipulate the situation; examples include hair twirling, thumb sucking, self talk, and other self-directed behaviors. Distraction focuses attention away from the frustrating situation or stimuli. Examples of distraction include gaze aversion, physical aversion, or verbal distraction (e.g., changing the topic of conversation to something not related to the emotionally arousing situation). Cognitive strategies are used to reinterpret the frustrating situation in a more positive manner. For example, if a child is prohibited from eating a piece of desirable candy, he may report that he no longer wants the candy because he does not think it would taste good anyway. Also, coming up with alternative reasons for why a task cannot be completed independently serves as a cognitive strategy. Some children try to redefine the rules of the games, a strategy that Zimmerman and Stansbury (2003) termed bargaining or compromising. For example, in a separation-from-mother task, some 3-year olds allowed their mother to leave only if the door remained partially open. These behaviors are indicative of cognitive strategies because they involve generating alternative

options and rethinking the problem situation. Finally, help-seeking in emotion-regulation involves seeking comfort from another person and includes any bid towards another person such as establishing eye-contact or asking to be held. Next, I expand upon the development of each of these strategies, again focusing on the preschool period, a time when there are significant advances in emotion-regulation abilities.

There are numerous parallels between the development of emotion-regulation strategies and the development of problem-solving strategies. Like problem-solving, emotion-regulation abilities begin to emerge very early in life and continue to develop throughout the lifespan. Like problem-solving, younger children tend to use less sophisticated strategies than older children, presumably due to linguistic, cognitive, and motor limitations. Young children use more self-soothing behaviors than older children. In an investigation of 6-, 12-, and 18-month olds, Mangelsdorf, Shaprio and Marzolf (1995) observed interesting trends in emotion-regulation strategy use when children were introduced to a stranger. Six-month-olds used gaze aversion as their primary strategy. Although 12- and 18-month olds were very similar in their strategy usage, most commonly using distraction, 12-month olds engaged in significantly more self-soothing than 18-month olds, supporting previous research by showing that the use of self-soothing behaviors for emotion-regulation decreases by age. Therefore, I expect few children in the current study to utilize self-soothing behaviors as an emotion-regulation strategy. Stansbury and Sigman (2000) investigated 3- and 4-year olds in two emotion-inducing situations (a clean-up task and a candy given, then denied, task). Three-year old preschoolers demonstrated rudimentary abilities to use cognitive strategies; however, they did so significantly less often than 4-year old preschoolers. This again highlights the dramatic advances that children are making in their strategy use during this time. It is interesting that researchers consistently find that the use of self-soothing behaviors decreases with age; it seems that self-soothing behaviors (such as breathing techniques or self-talk)

continue into adulthood. One possible explanation for this is that with age, self-soothing behaviors tend to become more internalized, making them difficult for researchers to code. Help-seeking becomes common by about nine months of age; around this time infants begin to frequently engage in social behaviors such as joint attention, which refers to the ability to lead or follow the direction of another's gaze or gestures in order to share experiences (Mundy et al., 2007). Social referencing, which also emerges around this time, is a process of emotional communication that generally occurs in ambiguous situations; children use emotional information from others to learn how to interpret events and respond appropriately (Walden & Ogan, 1988). Help-seeking continues to increase in use and effectiveness with age (Nelson-Le Gall, 1981).

Help-seeking

Help-seeking is a particularly interesting strategy because of the similarities between it as an emotion-regulation strategy and a problem-solving strategy. Help-seeking bids can be verbal (e.g., asking for help, asking for information about the problem, making a statement about their own competence), non-verbal (e.g., pointing, moving closer to someone else, establishing eye contact), or aggressive (e.g., verbal insult, physical aggression, ordering or demanding help; Nelson Le-Gall, 1981). Children generally begin with basic physical bids for help, such as pointing or gazing; this may be due to the fact that children begin to seek help before their linguistic abilities have developed enough to verbalize requests. Help-seeking begins early in infancy, and by 12- to 15-months of age children demonstrate the ability to use adults as partners in action. Fourteen- and eighteen-month olds make significantly more bids for an experimenter's help than do 9-month olds (Goubet et al., 2006). Additionally, older infants are able to use the help that they receive to solve problems, whereas 9-month olds have more difficulty doing so. By preschool, children have gained a lot of experience in attaining help from others in their environment; therefore I would expect this

strategy to be fairly prevalent in the current study both for the purpose of regulating emotions and solving problems.

As noted previously, some researchers propose that optimal help-seeking involves one's asking for help only when necessary, and gaining only as much help as required to continue the problem on one's own. Infants have been found to seek more help when the task is impossible than when the task is possible, albeit difficult. Infants between the ages of 6- and 21-months engage in more help-seeking when a toy is hung out of their reach (impossible) than when the toy is out of reach, but on a long cloth that they could pull through a maze to retrieve the toy (difficult, but possible) (Grobman & Mueller, 2007). I conjecture that children may have an innate desire to solve problems on their own if possible, before asking for help. This drive to solve problems independently can be conceptualized as one having mastery-motivation, which is considered by some to be an instinct that serves the purpose to reduce anxiety and give one a feeling of control over their environment (White, 1959). There are differences in the expression of mastery-motivation with age (Harter, 1975). When tested on solvable versus unsolvable problems, preschool children persisted longer on unsolvable tasks than older children. They also demonstrated increased enthusiasm on both types of tasks. More importantly, young children tended to persist independently for the purpose of controlling their environment and older children persisted with the desire to solve the cognitively challenging problems that were presented to them (Harter, 1975). Because preschool children have a desire to be in control of the environment, I expect them to attempt to solve even the unsolvable problems individually before asking for help. However, I expect there to be differences in the amount of help-seeking between possible and impossible tasks, with more help-seeking occurring in the later part of the impossible tasks.

Task Difficulty

In addition to age-related changes, a number of contextual factors influence problem-solving and emotion-regulation. The current investigation focuses on task difficulty. Children are generally accurate in their perceptions of their own abilities on given tasks (e.g., Rohrkemper & Bershon, 1984; Nelson-Le Gall, DeCooke, & Jones, 1987). For example, children as young as 4-years of age have demonstrated that they recognize features of a task that will make it easy or difficult for them to perform (Futterman & Karrabenick, as cited in Nelson-Le Gall, 1981).

Previous research suggests that a problem encoded as a threat or challenge leads to an increase in frustration and ultimately affects task performance (e.g., Orback et al., 2007). In one study, adolescents completed a self-report measure on their general tendency to appraise problem-solving tasks as a threat or challenge and then participated in a means-ends problem-solving test. Results showed that appraising a problem-solving task as a threat was highly correlated to performance on the tasks as well as to feelings of helplessness (Burger & Cooper, 1979). This highlights the role that perceived task difficulty plays in both problem-solving and emotion-related cognitions in adolescents. These differences have also been found in younger children. For example, Lewis, Alessandri, and Sullivan (1992) investigated 3-year olds' responses to three tasks, each of which had an easy and difficult version. By 3-years of age, children differentiated between easy and difficult tasks and evaluated their performance relative to their success or failure on the task, with more positive evaluations occurring when they completed a difficult task than an easy task. Because difficult tasks lead to more frustration, more difficult tasks may evoke different emotion-regulation strategies. The more upset a child becomes from a problem, the more cognitive demands are placed upon them, and the fewer resources they have available for emotion-regulation. Zimmerman and Stansbury (2003) investigated 3-year olds responses to fear-, frustration-, and distress-inducing situations and found that the more distressed one became, the less-sophisticated

emotion-regulation strategies they employed. Specifically, during the most distressing task which was the stranger approach situation, no child used a cognitive strategy, rather, the majority resorted to comforting strategies. Conversely, in the least distressing task which was the delay of gratification task, cognitive strategies were used most frequently. Because challenging problems pose a threat to one's self perception, performance on the task will be affected. Perhaps children's problem-solving strategy use will differ depending upon task difficulty and the amount of negative affect that is exhibited.

Hypotheses

The current investigation aims to examine how problem-solving, emotion-regulation, emotion-dysregulation and help-seeking will differ depending upon task difficulty. Additionally, I will examine the relationship between problem-solving and emotion-regulation. To my knowledge, this is the first study to explicitly investigate both of these constructs in depth within one study. The goals of this research are to investigate (1) the effect of task difficulty on problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking (2) differences in problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking over time, (3) individual children's consistency of these types of behaviors across tasks, and (4) age- related differences between younger and older preschoolers.

I expect task difficulty to influence children's behavior. Specifically, I hypothesize that children will exhibit more problem-solving attempts on the possible tasks and less attempts on the impossible tasks. I hypothesize that children will experience more negative emotional reactions on the impossible tasks than on the possible tasks; therefore, I expect to see more emotion-regulation, as well as emotion-dysregulation, on the impossible tasks than on the possible tasks. I hypothesize that children will demonstrate more help-seeking on the impossible tasks.

I anticipate that children will use strategies differently over time within each task. Specifically, I hypothesize that children will make more problem-solving attempts toward the beginning of the tasks, presumably before they have had time to recognize the difficulty. I hypothesize that children will use more help-seeking and emotion-regulation during the middle and the end of the tasks as they struggle more. I hypothesize that emotion- dysregulation will become more common towards the end of each task.

I expect children to demonstrate consistency across tasks, suggesting that these behaviors are dispositional traits that children bring from task to task. Specifically, I hypothesize that children will be consistent in their propensity to try many or few problem-solving strategies (i.e., those children who attempt the most strategies on one task will attempt the most across all tasks). I hypothesize that children will be consistent with the frequency that they use or do not use help-seeking across tasks. Finally, I expect that children will be consistent in their use, or non-use, of emotion-regulation and in their expression of emotion-dysregulation across tasks.

I expect there to be age differences in strategy use. Specifically, I hypothesize that younger preschoolers will make fewer problem-solving attempts, demonstrate less emotion-regulation and emotion-dysregulation, and exhibit more help-seeking than older preschoolers. An additional exploratory research question involves the relationship between problem-solving and emotion-regulation. Specifically, are those children who are among the highest in independent problem-solving also those who have the best emotion regulatory abilities? I expect that as problem-solving behaviors increase, emotion-regulation behaviors will increase. Problem-solving involves an obstacle to a goal which may lead to negative emotions; I conjecture that emotion-regulation is an important component to the problem-solving process and that these two constructs are intricately linked.

MATERIALS AND METHODS

Participants

Forty-one preschool children participated in this study (26 boys, 15 girls). Two male participants were excluded, one due to a guardian coming to pick him up and the other due to problems with the video recorder. Twenty-three participants were enrolled in a higher SES preschool summer program at First Methodist church. First Methodist preschool was classified as high SES because none of the children receive free or reduced tuition. Eighteen were students at Southdowns, a lower SES preschool in Baton Rouge. Southdowns was classified as a low SES school because 67.5% of students there receive free lunch, and an additional 9.6% receive lunch at a reduced rate. Participants ranged from 3.80- to 5.65-years, with a mean age of 4.48 (SD=.39). The sample consisted of 21 African American, 18 Caucasian, 1 Asian, and 1 Latino children.

Design and Procedure

All sessions took place at the participant's preschool. This study utilized six frustration-inducing problem-solving tasks, each of which had a possible and impossible version. Each child participated in all six tasks, three possible versions and three impossible versions. Presentation of the possible and impossible versions of each task, as well as task order, was counterbalanced across children. Each task was allotted 2 minutes. After 2-mintues, if the child had not successfully completed the task on his/her own, the rules were changed allowing them to quickly solve the problem. Each session was videotaped, and coding of the videos was limited to the first 2-mintues, the time after was included so that the child could successfully complete the task. According to a learned helplessness model (Seligman & Schulman, 1986), repeated failure is stressful, and research suggests that preschool children will exhibit a helpless response to repeated failures (Burhans & Dweck, 1995).Therefore, I include the time after the initial two-minute task interval to reduce the negative affect or possible learned helplessness that may arise after the failure of one or more frustrating problems.

Tasks

The six frustration-inducing problem-solving tasks that were utilized in this study are as follows: Pull cloth to retrieve toy, toy in box, toy out of reach on shelf, ring toss game, bean bag game, and a puzzle game. Full scripts for each task are included in Appendix A.

Pull cloth to retrieve toy. A toy dog that is a bubble blowing machine was shown to the child. This toy was then placed out of reach five-feet away on a mat behind two gates. The child was instructed to retrieve the toy by pulling in the cloth without the toy falling over. They were instructed not to cross a designated line on the ground. In the possible condition, the gates were partially opened, allowing the possibility that the toy could be pulled in. In the impossible condition, the gates were closed so that no matter how the child pulled, the toy fell before passing through the gates.

Toy in box. A locked transparent plastic cube (see Goubet et al., 2006) with a miniature bowling game inside was given to the child. The experimenter then demonstrated how to manipulate the numbers and open the lock. In the impossible condition the lock required a five-number combination to be opened. In the possible condition, the lock required a two-number combination to be opened.

Toy out of reach on shelf. A toy airplane was shown to the child, along with a demonstration of how it flies. The toy was then placed out of their reach on a shelf. In the possible condition, the shelf was placed just out of reach, to where the child will plausibly be able to reach the toy if they jump or stretch in a certain way. In the impossible condition, the shelf was placed much too far to reach. The task of placing a desirable toy out of the child's reach on a shelf is one of the most widely represented frustration-inducing tasks in the literature (e.g., Diener & Mangelsdorf, 1999).

Ring toss game. The child was instructed to toss as many rings as possible onto a peg which was placed on the ground four-feet away. In the possible condition, the rings were Frisbees with a hole

in the center that was large enough to fit over the peg. In the impossible condition the rings were small bracelets that were large enough to fit over the peg, but too small to be tossed onto the peg from the distance.

Bean bag game. The child was instructed to toss as many bean bags into a hoop that was placed on the ground six-feet away from them. In the possible condition, a hula-hoop approximately three feet in diameter was the target. In the impossible condition, a small Frisbee (same Frisbee as used for the possible ring toss game) with an open center approximately one foot in diameter was the target, this small diameter makes it difficult for a child to toss a bean bag from a distance into the hoop.

Puzzle task. A puzzle was given to the child with the instructions to complete as much as they could. In the possible condition, the puzzle was a ten-piece puzzle, designed and pilot tested to be possible but challenging for preschool aged children. In the impossible condition, the puzzle had 100 small pieces and was designed for children aged 8 and older.

Coding

Two of four trained undergraduate research assistants independently coded each task for children's emotion-regulation, emotion-dysregulation, and help-seeking. Each task lasted for up to two-minutes; this two-minutes was divided into four 30-second intervals for coding. Within each interval, instance coding was used. Evidence of strategy use came from children's verbalizations, physical actions, and emotional reactions. Initially coders met and discussed the coding manual, using pilot participants as examples. Then, each coded a sample set of videos and met to discuss discrepancies, using the coding manual as a guide and updating the manual as needed. The coders again coded a sample set of videos at which point they had reached an adequate level of agreement and began coding. A full coding manual is included in appendix B.

Problem-solving. We measured the sophistication of children's problem-solving by counting the number of unique domain-specific approaches children used in attempting to solve each problem. Because the independently-written transcripts from two undergraduate assistants were identical in showing the use of an approach (i.e., the level of analysis), I did not calculate a reliability statistic. Each task had a different number of potential problem-solving approaches determined through pilot testing. The possible numbers of operators for each task were as follows: pull cloth to retrieve toy, 8; toy in box, 7; bean bag game, 4; ring toss game, 7; puzzle, 5; toy out of reach on shelf, 12. See appendix C for a full list of problem-solving approaches for each task. Children were given a problem-solving score for each interval that represented the number of unique strategies attempted during that interval, and not simply a count of the number of times they used any of the strategies. For example, in the ring toss, if a child threw the ring over-hand 12 times, side-arm 8 times, and rolled the ring 4 times within one interval, he or she scored 3 for that interval. Compare this to a child who threw the ring only over-hand 25 times in one interval (i.e., numerous attempts at a single strategy) which indicates only speed, not sophistication; this child would score 1 on this interval, to show that he or she is engaged in less sophisticated problem solving than the first child. Additionally, each child was given a task-total problem-solving score that represented the number of unique approaches attempted in each task over the 2-minutes (not simply the sum of the scores for each interval). Each child was given a possible problem-solving score indicating the sum of their 3 possible task problem-solving scores. Each child was given an impossible problem-solving score in the same manner. Finally, each child received a total problem-solving score as the sum of all 6 task scores.

Emotion-regulation. Emotion-regulation scores represent the total number of emotion-regulation strategies used within each interval. Three behaviors were used as evidence of emotion-regulation: physical distraction, verbal distraction, and a situational cognitive reappraisal. Physical distraction

was coded if a child averted their gaze for a prolonged time or physically moved away from the task and it accounted for 38% of all emotion-regulation strategies used. Verbal distraction was coded if the child attempted to start a conversation with the experimenter about something other than the task an it accounted for 36% of all emotion-regulation strategies used. Finally, a situational cognitive reappraisal was coded if a child gave an external or unstable reason for why he or she could not complete the task (e.g., "my hands are too small" or "I'm too short"). Situational cognitive reappraisals accounted for 26% of all emotion-regulation strategies used. Self-soothing strategies occurred so infrequently that they were not measured in this study. Each child received an emotion-regulation score for each interval that represents the number of emotion-regulation strategies used in that interval. Additionally, a task-total emotion-regulation score was made for each task by summing the totals from each interval. Each child was given a possible emotion-regulation score indicating the sum of their 3 possible task emotion-regulation scores. Each child was given impossible emotion-regulation score in the same manner. Finally, each child received a total emotion-regulation score as the sum of all 6 task scores.

Two of four trained coders rated each 30-second interval. Notable large discrepancies between coders were rare (0.7%) and were checked for possible errors (e.g., writing the code number in the wrong box). Inter-rater reliability was calculated by inter-class correlation coefficients comparing the primary and secondary coders. Intra-class correlation coefficients are the analog of Kappa for continuous data. In the few instances in which children completed the problem solving task before 2 minutes (4%), the remaining time intervals were not included in reliability calculations because including them would have artificially overestimated agreement . Inter-rater reliability for emotion-regulation in an interval was calculated as .70, which is acceptable by conventional standards, despite being lower than the other variables of interest. This could be due to the fact that the occurrence of emotion-regulation behaviors was lower for this than other measures.

Emotion-dysregulation. Emotion-dysregulation scores represent the total number of emotion-dysregulation instances that occurred within an interval. Four behaviors were used as evidence of emotion-dysregulation: giving-up, frustration, repeated rule breaking, and dispositional cognitive reappraisals. Thirty-six percent of emotion-dysregulation instances were from a child giving up by repeatedly expressing that he or she did not want to play the game anymore or totally disengaged and ceasing all efforts on the task. Thirty-five percent of emotion-dysregulation instances were coded as frustration, which occurred if a child exhibited physical or verbal signs of frustration (e.g., whining, crying, stomping their feet). Twenty-three percent of emotion-dysregulation instances were rule breaking that was coded if a child repeatedly broke the rules of the game after being reminded. This was considered emotion-dysregulation because it suggests that the child was attempting to relieve their frustration by becoming successful at the task, however, they broke rules to do so which is not an adaptive emotion-regulation technique. The remaining 5% of emotion-dysregulation instances were dispositional cognitive reappraisals that were coded when a child gave an internal/stable explanation for why they could not complete the task (e.g., "I'm dumb" or "I'm bad at games"). Each child received an emotion-dysregulation score for each interval. Additionally a task-total emotion-dysregulation score was made for each task by summing the totals from each interval. Finally, children received impossible-, possible- and overall- emotion-dysregulation scores in the same manner as the preceding two measures. Inter-rater reliability for emotion-dysregulation in an interval was calculated at .79 using an intra-class correlation coefficient.

Help-seeking. Help-seeking scores represent the number of times a child sought help from the experimenter in each interval. There are three ways a child could have sought help. Seventeen-percent of help-seeking attempts were from children asking a question or making a statement that implied that the task was too difficult for them to complete on their own (e.g., "How can I get that

if I am not tall enough?"). Thirty-percent of help-seeking attempts were direct requests to the experimenter (e.g., "Can you help me?" or "You do it"). The final way a child could seek help was by looking to the experimenter, this accounted for 53% of all help-seeking requests. This was the most ambiguous behavior and coders were instructed to code only a help-look if it was very clear that the child was looking to the experimenter for help (e.g., looking between the experimenter and the task or looking at the experimenter while saying "I can't do it") and not looking for approval or just to make sure that the experimenter was still present and watching them. Examining the histograms revealed that 98.5% of 30-second interval scores for help-seeking were between 0 and 3. The remaining scores went as high as 7; to limit the possibility of outliers distorting results, I made the highest possible score within each interval a 3. The data was also analyzed including all outliers and the results showed the same patterns. Each child received a help-seeking score for each interval. Additionally a task-total help-seeking score was made for each task by summing the totals from each interval, thus 12 was the maximum. Children received impossible-, possible- and overall- help-seeking scores in the same manner as the preceding three measures. Inter-rater reliability for help-seeking in an interval was calculated at .87 through an intra-class correlation coefficient.

RESULTS

First, I provide some broad descriptive data and preliminary analyses regarding the effect of task difficulty on problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking. Next, I discuss the results regarding the relative frequencies of all variables of interest across each interval within a task. Then I provide results regarding individual children's consistency in strategy use across tasks and explore any age effects on children's problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking. Finally, I investigate the relationships between problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking.

Descriptive Data

One goal of this study was to explore preschool children's problem-solving and emotion-regulation behaviors during frustrating problem-solving situations. Within the average 30-second interval, children engaged in 1.29 unique problem-solving approaches (SD=.89), made .57 help-seeking attempts (SD=.96), used .17 emotion regulation techniques (SD=.44), and became emotionally dysregulated .23 times (SD=.53). Independent sample *t*-tests showed that children at the high- and low-socio-economic-status preschools did not differ in problem solving, $t(38) = .282$, $p = .780$, help-seeking, $t(38) = .307$, $p = .761$, emotion regulation, $t(38) = .853$, $p = .399$, or emotion dysregulation $t(38) = .092$, $p = .928$. Independent sample *t*-tests showed that boys and girls did not differ in problem solving, $t(38) = .621$, $p = .539$, help-seeking, $t(38) = 1.256$, $p = .217$, emotion regulation, $t(38) = .217$, $p = .830$, or emotion dysregulation $t(38) = .589$, $p = .560$. Because there were no significant effects of gender or preschool, and none were predicted, these demographics were not included in the subsequent analyses.

Task Difficulty

To analyze the effect of task difficulty I conducted 4 two-tailed paired-sample *t*-tests comparing the sums of children's 3-possible task totals to the sums of their 3-impossible task totals for

each behavior of interest. Whereas children engaged in 6.38 (SD=2.662) unique problem solving approaches on their impossible tasks, they engaged in only 5.49 (SD=1.87) unique problem solving approaches on their possible tasks, $t(38) = 2.066$, $p = .046$ (see Figure 1). This does not support my hypothesis that children would engage in more problem-solving on their possible tasks than on their impossible tasks. Children sought help from the experimenter an average of 7.56 (SD=4.66) times on their impossible tasks, and an average of 4.41 (SD=3.72) times on their possible tasks, $t(38) = 3.841$, $p<.0005$ (see Figure 2). This supports my hypothesis that children would seek more help on the impossible tasks than the possible tasks. Children utilized an average of 2.36 (SD=2.32) emotion-regulation strategies on their impossible tasks, and they utilized an average of only 1.23 (SD=1.44) emotion-regulation strategies on their possible tasks, $t(38) = 2.613$, $p = .013$ (see Figure 3). This supports my hypothesis that children would utilize more emotion-regulation strategies on their impossible tasks than on their possible tasks. Finally, children demonstrated an average of 2.95 (SD=3.12) emotion-dysregulation instances on their impossible tasks, and an average of 2.03 (SD=2.995) emotion-dysregulation instances on their possible tasks, $t(38) = 1.919$, $p = .062$ (see Figure 4). This lends marginal support to my hypothesis that children would exhibit more emotion-dysregulation on the impossible tasks than the possible tasks.

Interval

To analyze differences in children's behavior across each task, I conducted four 4 (interval) by 6 (task) repeated measures ANOVAs. The interval-totals of each behavior of interest in each task were used. I hypothesized that children would make more problem-solving attempts toward the beginning of each task. To test the hypothesis, I conducted a 4 by 6 ANOVA to predict problem-solving. Results reveal a main effect of task, $F(5,38) = 4.428$, $p = .002$ and a marginal main effect of interval, $F(3,38) = 6.189$, $p = .002$. There was no significant interaction, $F(15,38) = 1.461$, $p = .124$. As hypothesized,

problem-solving marginally decreased over time, and the two tasks with the greatest overall problem solving, toy-out-of-reach and toy-in-box, showed the clearest decline.

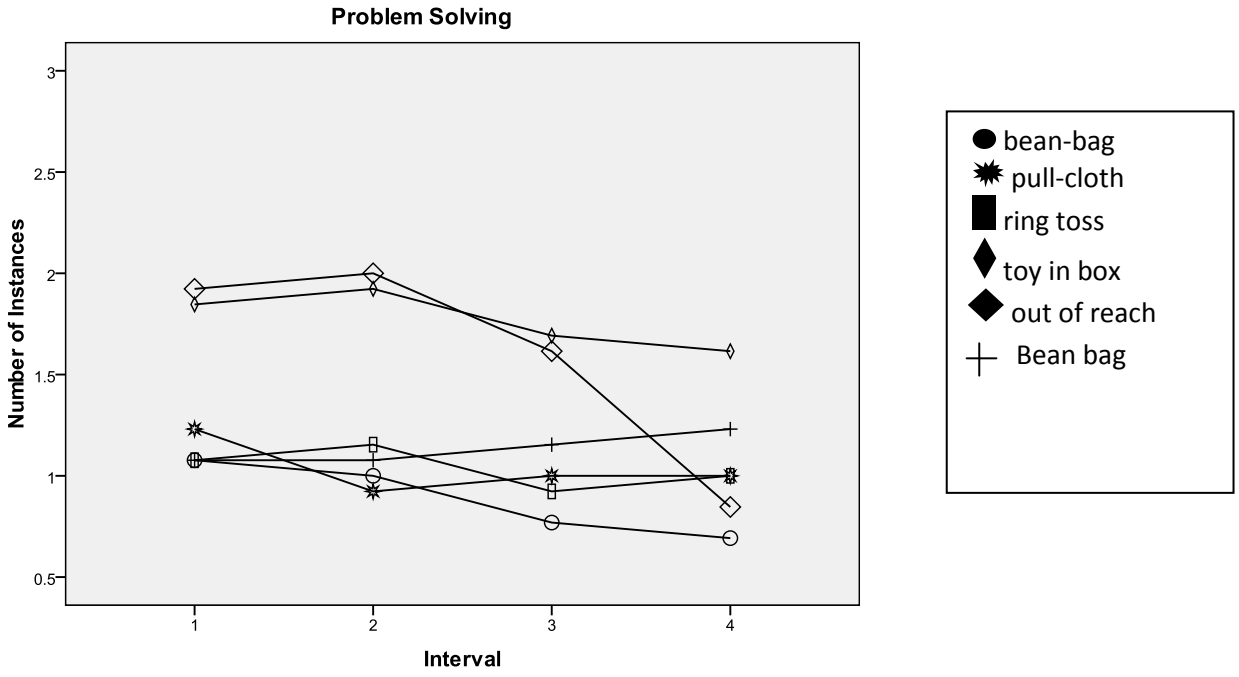

Figure 1: Problem-solving on each task across intervals.

I hypothesized that children would use more help-seeking in the later intervals of each task. To test this, I conducted a similar 4 x 6 ANOVA to predict help-seeking. Results revealed a main effect of task, $F(5,38) = 7.241$, $p < .0005$, and a main effect of interval, $F(3,38) = 5.360$, $p = .004$. The significant main effect of task suggests that some tasks encouraged more help-seeking than others. There was a significant main effect of interval, with a within-in subjects contrast suggests a linear trend $F(1) = 17.311$ $p = .002$. Children sought more help in the first intervals, and their requests decreased, linearly, across each task. This does not support my hypothesis that children would seek more help in later intervals of each task after they recognized the difficulty. There was a marginally significant interaction $F(15,38) = 1.713$, $p=.054$.

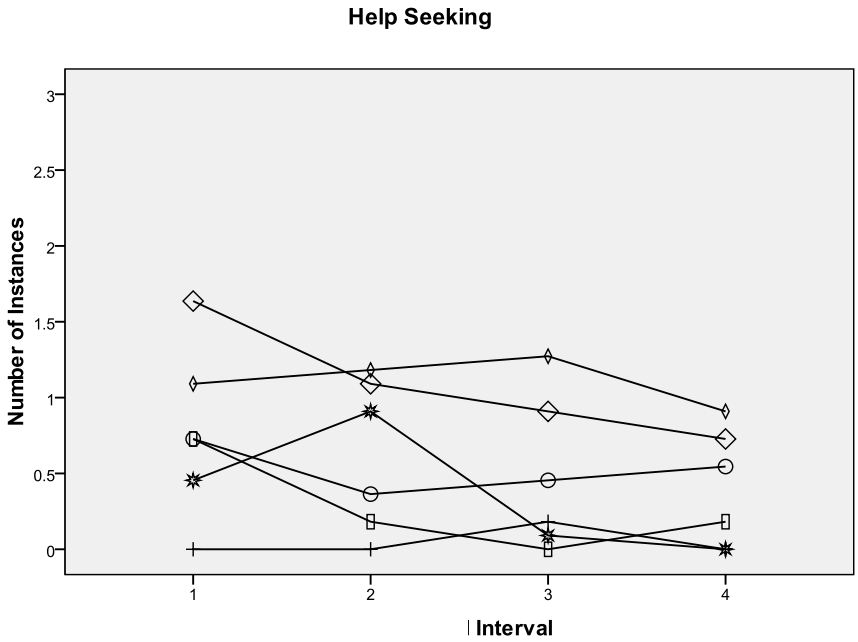

Figure 2: Help-seeking on each task across intervals.

I hypothesized that children would use more emotion-regulation strategies towards the end of each task. To test this, I conducted a similar 4 x 6 ANOVA to predict emotion-regulation. Results revealed a main effect of task, $F(5,38) = 3.130$, $p = .016$ and no main effect of interval, $F(3,38) = .063$, $p = .979$. The lack of a main effect of interval does not support my hypothesis that children would use more emotion-regulation strategies in later intervals within a task. One possible explanation for this is that the occurrence of emotion-regulation strategies was very low throughout all intervals of all tasks, suggesting there may be a possible floor effect. There was no significant interaction $F(15,38) = 1.075$, $p = .385$.

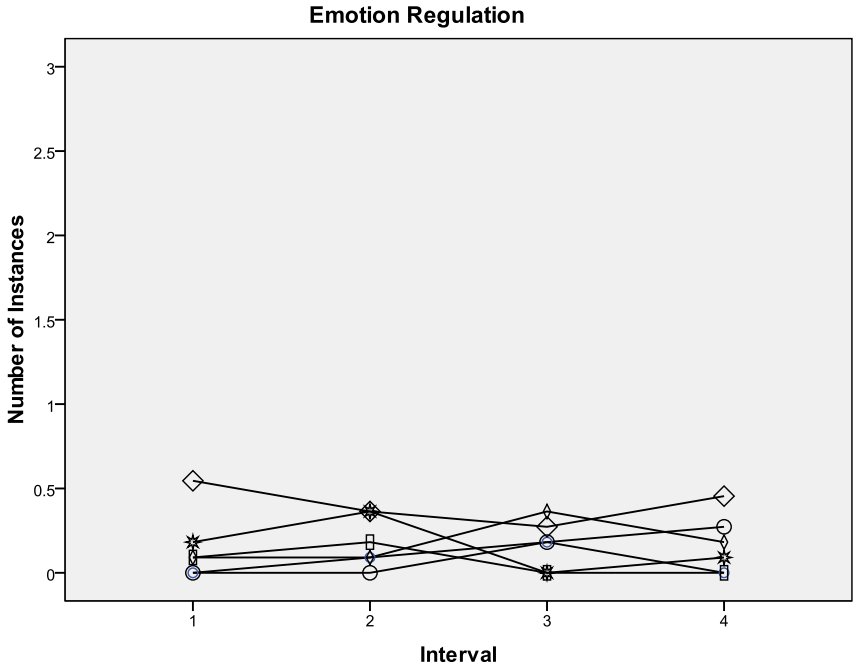

Figure 3: Emotion-regulation on each task across intervals.

I hypothesized that emotion-dysregulation would become more common towards the end of each task. To test this I conducted a similar 4 x 6 ANOVA to predict the occurrence of emotion-dysregulation. Results revealed a marginal main effect of task, $F(5,38)=3.444$, $p=.082$ and a marginal main effect of interval, $F(3,38) = 3.715$, $p= .061$. A within-subjects contrast suggests a linear trend $F(1) = 8.096$, $p = .017$. The linear trend was strongest for those tasks which started out with the least amount of frustration. Had there been a strong main effect of interval, my hypothesis that emotion-dysregulation becomes more common towards the end of each task would have been supported. I found marginal support for this hypothesis. There was no significant interaction $F(15,38) = .662$, $p = .818$.

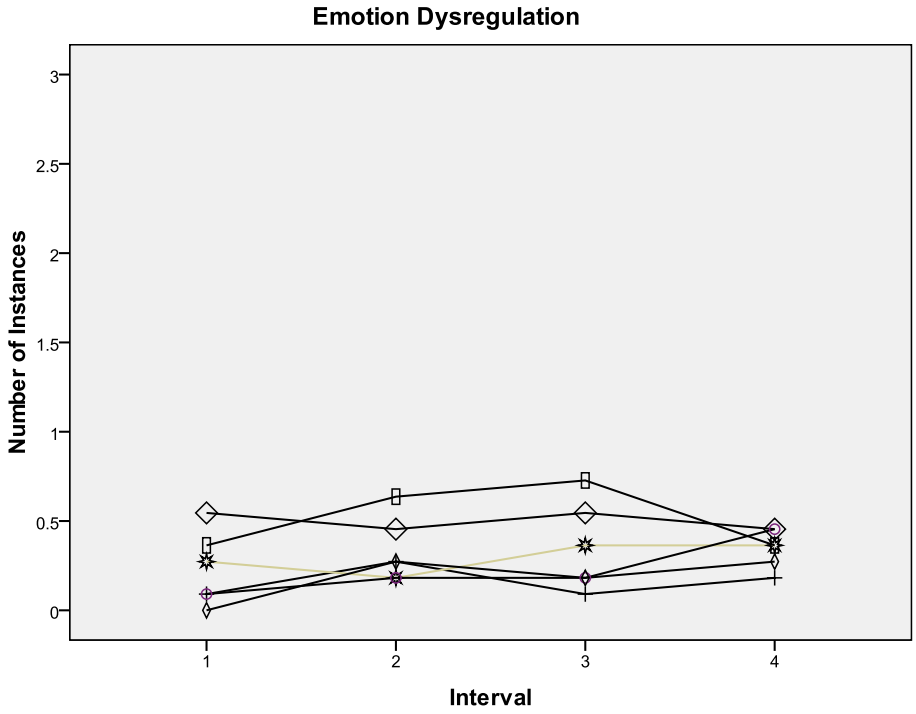

Figure 4: Emotion-dysregulation on each task across intervals.

Consistency across Tasks

To investigate the possibility that problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking have a dispositional quality that children carry from task to task, I examined inter-item reliability using the overall task score for each of the 4 behavioral measures. Emotion dysregulation showed a tendency to be a trait that children carried with them across tasks (α = .720) suggesting that the tendency to become emotionally-dysregulated is a feature of the child rather than being context dependent. Problem solving showed a slight tendency to be stable across tasks (α = .514). In other words, those children who made the most unique problem-solving attempts on one task made among the most on all tasks. Neither emotion regulation (α = .281) nor help-seeking (α = .392) displayed a much of dispositional quality, seeming to be more context dependent. I also examined the consistency of children's behaviors on their possible and impossible tasks. Children with the least or most emotion dysregulation on possible tasks were similarly the least or most emotionally-

dysregulated on impossible tasks, $r(39) = .518$, $p = .001$. Problem solving was similarly correlated, $r(39) = .325$, $p = .043$. Neither emotion regulation ($r(39) = .030$, $p = .858$) nor help-seeking ($r(39) = .269$, $p = .099$) were significantly related. My hypotheses about emotion-dysregulation and problem-solving potentially being dispositional traits were supported, but the hypotheses about emotion-regulation and help-seeking were not.

Age Effects

To analyze the effect of age on strategy use, I correlated children's problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking totals with age (years, months, and days). Results revealed no significant effect of age on problem-solving $r(39) = -.169$, $p = .305$, emotion-regulation $r(39) = -.272$, $p = .095$ or emotion-dysregulation $r(39) = .187$, $p = .255$. The relationship between age and help-seeking was statistically significant, $r(39) = -.357$, $p = .026$, with older preschoolers engaging in less help-seeking than younger preschoolers. This supports my hypothesis that older children would seek help less; however, my other hypotheses regarding age effects were not supported.

Relationships between Variables

To investigate possible connections between problem-solving, help-seeking, emotion-regulation, and emotion-dysregulation, I correlated children's problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking total scores, collapsing across all tasks. There was not a significant correlation between help-seeking and emotion regulation $r(39) = .228$, $p = .163$, or help-seeking and emotion-dysregulation $r(39) = .141$, $p = .390$. There was a significant correlation between help-seeking and problem-solving $r(39) = .430$ $p = .006$, supporting my hypothesis that help-seeking and problem-solving are related. Moreover, help-seeking and problem solving on only possible tasks, $r(39) = .343$, $p = .032$, and impossible tasks, $r(39) = .474$, $p = .002$, tasks showed the same pattern. There was not a significant correlation between emotion-regulation and emotion-dysregulation $r(39) = .080$, $p = .630$,

or emotion-regulation and problem-solving $r(39) = .260$, $p = .110$. Finally, there was not a significant correlation between emotion-dysregulation and problem-solving $r(39) = .060$, $p = .719$.

Regression

To further explore the effect of task difficulty and time with the task on children's help-seeking, emotion-regulation, emotion-dysregulation, and problem-solving behaviors, I conducted 4 multiple hierarchical linear regressions. Participants' dummy codes were entered on step 1 to control for, and understand the role of, individual differences among participants. Task dummy codes were entered on step 2 to control for, and understand the role of, task differences in eliciting each behavioral response. Steps 3 and 4 entered task type (i.e., possible or impossible) and time interval (1 to 4) respectively to test the hypotheses that the behaviors of interest were influence by the possibility of solving the problem and time spent with the task.

The hierarchical regression model of help-seeking accounted for 32.8% of the variance. Individual difference among participants accounted for 9.4% of the variance and task differences accounted for an additional 20.5% of the variance. Consistent with the aforementioned result, help-seeking was more common for the impossible task variations (β = -.089, p =.003, ΔR^2 = 0.8%). Finally, children decreased their help-seeking over intervals (β = -.147, p < .0005, ΔR^2 = 2.1%).

The hierarchical regression model of emotion-regulation accounted for 15.2% of the variance. Individual difference among participants accounted for 7.9% of the variance and task differences accounted for an additional 6.1% of the variance. Emotion-regulation was slightly less common for the possible task variations (β = -.084, p =.012, ΔR^2 = 0.7%). Finally, children increased their use of emotion-regulation over intervals (β = .075, p =.027, ΔR^2 = .5%).

The hierarchical regression model of emotion-dysregulation accounted for 21.6% of the variance. Individual difference among participants accounted for 19.7% of the variance, supporting the previously mentioned results that the tendency to become emotionally-dysregulated is a somewhat

dispositional trait that children carry with them across tasks. Task differences accounted for an additional 4.7% of the variance. There were no significant differences in emotion-dysregulation based on task difficulty (β = -.049, p = .125, ΔR^2 = .2%). Finally, children became more emotionally-dysregulated over intervals (β = .015, p < .0005, ΔR^2 = 1.3%).

The hierarchical regression model of problem-solving accounted for 23.4% of the variance. Individual difference among participants accounted for 16.1% of the variance, again suggesting that the tendency to try multiple unique problem-solving approaches is to some extent a feature of the child. Task differences accounted for an additional 9.9% of the variance. Problem-solving was no different between possible and impossible task variations (β = .019, p = .213, ΔR^2 = 0%) . Finally, children decreased their use of unique problem-solving approaches over intervals (β = -.125, p < .0005, ΔR^2 = 1.5%).

Table 1

Hierarchical Multiple Regression Analysis Predicting Help-Seeking, Emotion-Regulation, Emotion-Dysregulation, and Problem-Solving From Condition and Interval

	Help-seeking		Emotion-Regulation		Emotion-Dysregulation		Problem-Solving	
Predictor	Δ R^2	β	Δ R^2	β	Δ R^2	β	Δ R^2	β
Step 1	0.094**		0.079*		0.197**		.161**	
Pcpt								
Step 2	0.205**		0.061**		0.047**		.099**	
Task								
Step 3	0.008**		0.007		0.002		0.000	
Condition		-0.089*		-0.084*		-0.049		0.019
Step 4	0.021**		0.005		0.013**		.015**	
Interval		-0.147*		0.075*		0.114**		-0.125**
Total R^2	0.328**		0.152*		0.216**		.234**	
n	39		39		39		39	

Note. Participant number and task were dummy coded.

p <.05* and p <.001**

DISCUSSION

The aim of this study was to investigate preschool children's problem-solving, emotion-regulation, emotion-dysregulation, and help-seeking on frustrating problem-solving tasks that were either difficult or impossible for them to complete independently. I sought to explore the relationship between these concepts, specifically looking at emotion-regulation as a problem-solving strategy. Children in this study, as expected based on prior literature (e.g., Stansbury & Sigman, 2000), exhibited a wide range of behaviors indicative of emotion-regulation. Children were almost equally likely to use physical distractions (38%), verbal distractions (36%), and cognitive reappraisals (26%). Children exhibited emotion-dysregulation in the form of dispositional cognitive reappraisals (7%), repeated rule breaking (23%), physical or verbal frustration (35%), and giving-up (36%). Help-seeking was ubiquitous among children, with the average child seeking help almost 14 times during the study (.57 help/interval * 4 interval/task * 6 task). The most common way for children to seek help was by looking at the experimenter (53%), followed by specific requests for help (30%) and requests for help in the form of a question or statement that implied that the task was too difficult for the child complete on his or her own (17%). Finally, problem-solving attempts were frequent, 97% of the children engaged in at least six unique problem-solving approaches over the course of the study. On 93% of the 2-minute tasks, children tried at least one problem-solving approach.

Children sought help from the experimenter more often and utilized more emotion-regulation when it was impossible to achieve their goals than when it was merely unlikely. Similarly, children exhibited slightly more emotion-dysregulation when attaining their goal was impossible. Children sought help less and were slightly less emotionally-dysregulated immediately after they were presented with a problem than after they had been trying for some time to solve the problem independently. It was surprising that children, on average, demonstrated more help-seeking towards the beginning of each task. It was expected that children would seek help more towards the end of the task as they

recognized the difficultly and had worked for some time to solve it independently. Future research could focus solely on the first interval of each task and explore, in depth, children's first behaviors after they are presented with a task. Perhaps they attempt one or two problem-solving approaches immediately, and then resort to help-seeking quickly, but still after independent problem-solving has been attempted. The current analysis would miss these effects due to the fact that all behaviors in the first 30-seconds were collapsed into one score. Children seeking help only after they have attempted to solve the problem independently is considered by some to be the most optimal way to seek help (e.g., Puustinen et al., 2008). Children in this study seemed to have a desire to solve the problems independently if they could, before seeking help. This has implications for teachers and caregivers, suggesting that it is okay to allow children struggle through problems before providing them with the solution.

Individual differences contributed a significant proportion of variance in all behaviors of interest. However, problem-solving and emotion-dysregulation were most affected by individual differences. This suggests that the tendencies to try many problem-solving approaches or to become emotionally-dysregulated are dispositional qualities that children carried across situations. Of the total variance accounted for in children's problem-solving (23%), a substantial portion of this was due to individual differences (16.1%). Similarly, of the total variance accounted for in children's tendency to become emotionally-dysregulated (21.6%), 19.7% was due to individual differences. This means that those children who attempted the most (or least) problem-solving approaches when their goal was possible also attempted the most (or least) when their goal was impossible. Similarly, those who were the most (or least) emotionally-dysregulated when their goal was impossible were also the most (or least) when it was simply improbable. Children's behaviors also differed across tasks, suggesting that these behaviors are at least partially contextually dependent. Emotion-dysregulation, the behavior most affected by individual differences, was the least dependent on context, with only 4.7% of the

variance being accounted for by task. Of the total differences accounted for in children's help-seeking behavior (32.8%) a considerable percentage (20.5%) was due to the task.

Surprisingly, children did not become exceedingly more emotionally-dysregulated as they struggled with each task. It is possible that children would have become more dysregulated had the tasks been more frustrating or if they had lasted longer. Children's problem-solving sophistication and emotion-regulation strategy use were unrelated. This was unexpected because by definition, problem-solving situations involve an obstacle to a goal; therefore, it makes sense that one would have to regulate their emotions before being able to generate problem-solving options. If the tasks had been more frustrating, it is possible that I would have seen a stronger effect of difficulty on the amount of emotion-regulation required to continue problem-solving. The results comparing emotion-regulation and problem-solving would have been marginally significant if the data had been analyzed with a one-tailed *t*-test. That would have been possible because of the directional hypothesis; however, I chose to remain more conservative given the large number of analyses in this study.

Children in this study demonstrated a wide range of behaviors, some of which differed depending on if the problem was solvable or not. This was in line with previous research which suggests that frustrating problems leave fewer resources available for children to produce other behaviors (e.g., Zimmerman & Stansbury, 2003). The finding that children sought help less frequently on tasks that were possible, but very challenging, for them to solve suggests that preschool-aged children are accurate in their perceptions of their abilities on a given task, which corresponds to previous findings (e.g., Rohrkemper & Bershon, 1984). This lends support to the idea that children have a desire to solve problems on their own if possible before resorting to help-seeking (e.g., Grobman & Muller, 2007). The fact that the only noteworthy age affect found was in help-seeking tends to go against previous research that found that preschool is a time of dramatic advances in problem-solving (e.g., Hudson & Fivush, 1991) and emotion-regulation (e.g. Stansbury & Sigman,

2000). Perhaps if I had been able to fully exploit the sophistication of each emotion-regulation strategy or evaluate domain-general problem-solving approaches there would have been more developmental differences. However, because the frequency of emotion-regulation behaviors was fairly low and that these tasks elicited only domain-specific strategies, I was unable to evaluate them in that way.

Despite not having any specific predictions, it is interesting to note that there were no differences by preschool, specifically in emotion-regulation. Previous research suggests that being from a low SES family contributes to poorer emotion-regulation (e.g., Martini, Root, & Jenkins, 2004). I would have expected children from the lower SES school (categorized by the number of children on free or reduced lunch) to demonstrate less emotion-regulation, and possibly more emotion-dysregulation than children from the higher SES school. This was not the case. It is possible that differences in emotion-regulation or emotion-dysregulation that are influenced by SES emerge later than preschool, or only emerge in certain contexts. This seems unlikely because effects of SES on children's emotion-regulation have previously been found in preschool children (e.g., Hill et al., 2006). Because each preschool group was from one particular teacher, I did not have a random sample of children from each of the SES backgrounds. It is also possible that characteristics of the particular school or teacher have helped these children to overcome the negative effect of low SES on emotion-regulation.

This study's failure to find a difference in emotion-regulation between pre-schools suggests that factors beyond SES can compensate for the usually-found SES difference. As aforementioned, emotion-regulation appears to be a more situational trait, dependent on context, and emotion-dysregulation appears to be more dispositional, a trait that children carry with them across situations. That emotion-regulation does not, at least in the current study, seem to be a stable characteristic in children suggests that additional guidance may help children improve their regulatory abilities, this is

in line with a suggested intervention from Feng et al., (2008), in which they suggest that parenting interventions focused on training caregivers to model positive emotion-regulation techniques may improve children's emotion-regulation abilities. Perhaps educators and caregivers may be effective at providing additional emotion-regulation guidance for children from lower SES backgrounds.

One limitation of the current study is the relative infrequent occurrence of many of the behaviors. Despite making impossible versions of each task, they did not seem to be that stressful, and children did not become very frustrated. Each task lasted only two-minutes, and was over before the children could become too upset. If more frustration had occurred, we may have seen more emotion-regulation and emotion-dysregulation behaviors. Perhaps utilizing different tasks or making the reward for successfully completing the task more desirable would have elicited more frustration. I would like to explore this possibility in the future by making more emotionally arousing problem-solving situations. I would also like to explore variables that may have accounted for individual variance in children's performance. For example, being verbal is part of help-seeking and emotion-regulation, seeing that children are often taught to "use their words" when they become upset. Perhaps children with poorer language abilities demonstrate more emotion-dysregulation than children with better language abilities.

Children's use of problem solving, emotion-regulation, emotion-dysregulation, and help-seeking is related to many sources. Some are dispositional and others depend on the circumstances; some are children's first reactions and others are children's delayed response. Children seem to have a desire to struggle with problems on their own before seeking help and this suggests that parents and other caregivers can challenge children to the limits of their abilities. Future research can further illuminate the role of individual difference and problem solving situations in shaping children's on-going cognitive and emotional development.

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APPENDIX A: SCRIPT

Pull cloth: "[Child's *name]*, do you like to blow bubbles? Well, this is Mitz (show them the toy dog) and he can blow bubbles out of his mouth. Would you like to see him blow bubbles? Ok, well I am going to place him over here on this cloth. All you have to do, is pull this cloth in to bring Mitz towards you. But you can't cross this line here. And be careful, because if he falls over, you have to start over again." If the child appears not to understand the directions, demonstrate by slightly pulling in the cloth.

Puzzle task: *"[Child's name]*, do you like to do puzzles? I have a really cool puzzle here, would you like to try it? Alright, try to do as much of this puzzle as you can" Put the puzzle pieces on the ground for the child. With the impossible puzzle, dump the pieces into a pile. With the possible, take all pieces off of the puzzle board and set them in a pile next to the board
(it is important that they are in a pile because this will allow the child to set them each individually aside if they want- as a comparison strategy for turning all the pieces over with the impossible puzzle.

Bean bag toss game:, "*[Child's name]* in this game, your job is to toss as many of these bean bags as you can into the circle over there (show the hoop). But you have to do this without crossing this line on the floor here, do you see it? (show the child the line on the ground). Try to get as many bean bags as you can in the hoop." Place the bean bags in a pile on the ground next to the child's feet.

Ring toss game: *[Child's name]* in this game, your job is to try and toss as many rings onto that peg over there as possible *(*show them the peg and demonstrate how ring should land on it; be sure not to demonstrate throwing in any way, just place the ring on the peg). You have to get as many as you can without crossing this line on the floor here, do you see it? (show the child the line on the

ground). Try to get as many rings on the stick as you can." Hand the child one ring and place the rest on the ground next to his/her feet.

Toy out of reach on shelf: "[*Child's name]* do you like playing with airplanes? Well I have an airplane here, and all you have to do is get it off of this shelf and you can see how far you can throw it. For the impossible condition, place the shelf on the wall very high, to a point where there is no way the child could reach it. For the impossible condition, have the child demonstrate for you how high they can jump, and place the shelf one half inch above their highest jump.

Toy in locked box: "*[Child's name*] do you like to play bowling? Well I have a bowling game here, would you like to play with it? Good. But first, do you know what this is? (show child the lock from the opposite condition e.g., if child is in possible condition, demonstrate lock use with impossible lock). This is a lock. We use it to keep things we don't want anyone else to get into safe. Try and open it (have the child try and pull the lock open), see you cant open it. But, when you get the magic numbers lined up here with the magic word, the lock will open (have the child pull the lock open once you have positioned the right combination). See, now you try. All you have to do is the the magic numbers lined up here with the magic word and you can open the box and play bowling.

* When the child seeks help:

* If they glance at me, and do not speak: make an encouraging facial expression

* If they say 'help' or something generic: "oh I know its hard! But keep trying your best. Why don't you keep working on it and try and think of a specific way I could help you. Let me know in a few minutes if you still need help."

* If they make a specific request after this: "That is a great idea! I will definitely help you with that in just a minute! Why don't you try for (*enter approximate time left)* and then I will do that for you!"

APPENDIX B: CODING MANUAL

Orientation for Coder

Before you begin, you should familiarize yourself with the general codes so that you have an idea what kinds of things you are looking for. Additionally, before each specific task you should familiarize yourself with the task-specific codes.

A trial starts the moment I finish saying "Go ahead" (or something similar); you may here the beep of the stopwatch starting. Though children may be slow to stop, you are only coding up to the 2 minute mark. I think it would be good to watch the entire 30 s interval first, then rewind and begin again. Before each task, read the notes on the cover sheet to see if anything strange happened during the task; some of the notes (about things the kids did) are just on there for me so that I could make the manual so don't code off of the sheets, but look over them for context.

Be sure to pay attention to the directions below explaining how to decide when an instance of a code is separate from another instance. If an instantaneous code happens at a boundary, count it just for the earlier interval (e.g., throw object) but if a prolonged-process code happens at a boundary (e.g., jumping continuously) then count it in both intervals (details for each code follow). Watch for me to stop the timer in case you can't hear the beep, this will signal the end of a trial.

If a child does not do a behavior within an interval, put a '0', if the task ends early (because the child gives up or completes it) leave the cell blank because this is missing data!!

General – Help-Seeking.

Help_hard: Asking a question/making a statement that implies that the task is too hard (e.g., "how can I get that if I am not tall enough?", "The airplane's too high for me." "I can't open it", "I can't get the pieces to fit"). Each question should be counted at '1' regardless of whether or not the child

works on the task in between. If they ask the same question multiple times, each time counts as an instance.

Help_request: Did the child directly ask for help or ask for help using words specific to the task (e.g., "Can you help me?" "You do it.", "How do I get the airplane?", "What numbers is it?") Each question should be counted at '1' regardless of whether or not the child works on the task in between.

Help_look: Did the child look to the experimenter for help? (this does not include looks for praise e.g., if a child makes a bean bag and looks to me-since a lot of times you cannot see the hoop on the video I tried to say 'good job' when this is the case). One sure sign of help-seeking is if they look between the experimenter and the task rapidly. Another possibility is a prolonged look at the task followed by a prolonged look at me. If they are looking at me or the goal while simultaneously reaching for the other (i.e., goal, me), that counts as a help_look). Be conservative with this code, so you don't include merely looking around the room and happening upon me. Only choose it if it really looks like the child is looking for help. The look has to have intent to look at me. I they look at me and I think you won't be able to tell that they looked at me (bc of camera angle or whatever), I will look at the camera and nod. **Another example of this would be if the child is saying 'I can't' or 'it's hard' while looking at me.**

* **Comments**: If child does something you see as help-seeking but the event isn't coded that way, add a comment about it. For example, if a child hands me the lock-box and says "you do it," it's coded above, but if they just tug me without saying anything, it could be an uncoded instance of help-seeking.

General – Emotion Regulation/Dysregulation

Er_Distraction: Did the child start conversation with experimenter about something other than the task? e.g., "Look at that barn over there!" I have a sister at home. Its' consider the same

conversation count as long as it's a continuous discussion without other task efforts , no matter how many different topics are discussed. If the child starts a conversation, then works on the task some more, then starts another conversation this is 2. If a child is talking with me while simultaneously working on the task, it doesn't count.

Er_look_away: Did the child avert his or her gaze from the task for about 5 seconds or physically move away from the task e.g., looking at other things in the room, staring at the ground, walking around or walking to another toy. It's considered the same act as long as they do not attempt the task again. It doesn't have to be exactly a 5 second interval but it should be close; the shorter the look then more clear it must be that the child is looking away to distract him or her-self from a difficult goal. **A blank stare that's part of shutting down doesn't count because in this case, looking away, means looking <u>to</u> something else. If the child appears to be distracted and looking at something specific although still doing a task operator (e.g., jumping) thing would be counted as a look away. Note that if the child is looking away from goal but NOT looking to something else, this would be coded as er_give_up.**

** be sure to note this in the notes section (e.g., child looked away but continued to throw bean bags, giving up evidenced by _____)

Er _situation: Did the child give an explanation for why they couldn't do something that is, external, unstable or local e.g., I should get this game at home and then I would be good, I could do it if only I had more practice. I can't do it because my hands are too little or I'm too short.)? Each phrase should count as 1

Er_disposition: Did the child given an explanation for why they couldn't do something that was internal, stable and global e.g., "I'm dumb", "I'm bad at games" or "I'll never be able to do something like this"

"I'm bad at games. *sigh* I'll never be able to do this." – clearly 2

"I'm bad at games; I'll never be able to do this." - 2 (b/c can be two sentences)

"I'm bad at games and I'll never be able to do this" – 2 (b/c can be two sentences.)

"I'm always going to be bad at games like this." – clear 1

Each statement should be counted. In the examples above, to be considered 1 vs. 2 statements-rule: if you can easily break the statement into 2 sentences (e.g., by removing 'and') then it should be counted as 2 statements; however, if you cannot break it into 2, even though it may express both ideas, then it is counted as 1.

Er_cheating: Did the child repeatedly break the rules of the game? e.g., Repeatedly crossing the line in bean bag toss after being told not to (in an attempt to be successful at the game).

er_frust: Did the child show signs of frustration (frustration can be either verbal (e.g., grunting) or physical (e.g., stomping)) Did the child cry or whine? Be careful to pay attention to the difference an 'oh man' after a failed attempt and serious frustration. With frustration is really about losing control "oh man" in a disappointed tone doesn't count but "oh man" in an angry tone counts. **Each separate instance of frustration should be counted. One definite way to know is if the child works on the task in between frustration episodes. However, if the child has one long rant of frustration that lasts a good bit of time, this would be counted as one. If they get frustrated, then do something else (besides work on the task or continue to be frustrated) then show frustration again, this would be two counts.**

Er_give_up: Did the child express that they wanted to play a different game or did they give up? E.g., just stand there and not work on the task or say or do anything. Say "I want to play a different game". Each statement they make about wanting to quit should be counted as 1. This is not the same as 'distraction', for a child to be coded as giving up, they have to shut-down, this is a loss of any affective expression generally with a blank stare. Anything that falls under the code of

er_change_ game does not count, this is wanting to play a diff game because this is too hard, not wanting to change the rules of this game. **If the child appears to have shut down but continues to work on the task, this would still be counted as give_up. One example would be if the child is throwing bean bags or jumping for the plane without looking at their goal for a prolonged period of time (not just throw one bag while looking down). If the child is staring blankly this would be the code, however if the child appears to be looking at something (distracted by it) while throwing, it would be a look away.**** be sure to note this in the notes section (e.g., child gave up but continued to Throw bean bags, giving up evidenced by _____)

If the child says 'I cant' or 'Its hard' in a normal voice while not looking at me, we are not going to code this as anything. However, there are 2 caveats to this rule.

If the child says these while looking at me, this will be a help_look

If the child says these in crying/whiney voice, this will be er_frust

APPENDIX C: PROBLEM-SOLVING OPERATORS

Problem-Solving Operators

Pull cloth to retrieve toy

Pull with two-hands on knees

Pull very slowly

Pull over head

Pull with one hand while standing

Pull with two hands while standing

Pull while squatting

Hard pull

Pull with foot

Toy in locked box

Random number turning on lock

Pulling hard on the lock

Inspecting the box (hinges, lock ect)

Attempting to open the box by pulling on the hinges

Shaking the box

Trying to take the lid off of the box without opening the lock

Bean bag game

Throw overhand

Throw underhand

Throw multiple at once

Sit down to throw

Ring toss game

Throw underhand

Throw sidearm

Throw ring with a forward pushing motion (two hands)

Throw overhand

Roll the ring

Throw multiple at once

Puzzle

Turn all pieces over

Spread pieces out

Randomly fitting together two pieces (that don't fit together)

Playing with the pieces (without fitting them together)

Picks up a piece, puts it in place, then removes it and gets a new piece

Toy out of reach on shelf

Jump with both arms up

Jump with one arm up

Run from afar and jump

Jump using wall as brace

Small jump

Bend knees, big jump

Try to climb the wall

Jump while making swiping motion

Attempt to reach while standing on tip-toes

Reach flat footed

Sustained jumping sequence

VITA

Courtney M. Snyder was born in Denver, Colorado, in September, 1985, to parents Lisa and Tim Snyder. She graduated from Sequoyah High School in Vonore, Tennessee, in 2003. Courtney began college at East Tennessee State University in the fall of 2003. In her third year of the undergraduate program, she began to work with Dr. Wallace Dixon as an undergraduate lab assistant in his child development lab. Her main duties included recruiting participants, conducting experiments, coding data, and reviewing the literature. During her time in Dr. Dixon's lab, Courtney became a lab manager and presented one of her independent projects at the International Conference of Infant Studies (ICIS) in Kyoto, Japan. In 2007, she received a Bachelor of Science degree in psychology and was the inaugural recipient of the Johnia Hope Berry psychology scholarship for undergraduate excellence. Courtney moved to Louisiana in the summer of 2007 to pursue a doctorate in developmental psychology from Louisiana State University with Dr. Kevin Grobman.

Currently, Courtney is the lab manager for Dr. Kevin Grobman's perplexing situations laboratory where the focus is on problem-solving development throughout infancy and childhood. To date, Courtney has presented five posters for conferences, three of which she was first author. These posters were given at the following conferences: biennial meeting of the International Conference on Infant Studies, Kyoto, Japan; the annual meeting of the LSU Women and Gender Studies program, Baton Rouge, Louisiana; biennial Conference on Human Development, Indianapolis, Indiana; and two at the biennial meeting of the Society for Research in Child Development, Denver, Colorado.