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Relations between Preschool Children's Planning Ability, Self-Regulation and Early Literacy Skills

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Abstract

Thirty preschool children (18 boys, mean age = 54 months, *SD* = 6.82, range = 39 to 67 months) were recruited from a local University preschool center. Experimenters visited the preschool on one occasion and administered planning and inhibitory control tasks. Teachers' reported on children's temperament and data regarding early literacy skills. Consistent with expectations, teacher-rated attention focusing and inhibitory control were associated with better observed inhibitory control. Results unexpectedly showed that higher observed inhibitory control and lower teacher-rated anger/frustration, sadness, high intensity pleasure, and impulsivity, and higher teacher-rated inhibitory control and soothability were associated with a greater number of trials needed for successful completion of the two planning tasks. Perhaps children with better inhibitory control and lower overall difficulties in temperament were more likely to persist to completion in the face of task complexity.

Introduction

This study examined planning ability in early childhood relation to children's observed and teacher reported self-regulatory abilities and early literacy skills. Planning is a metacognitive or higher order complex cognitive skill that involves the anticipation, delineation, and organization of future-oriented actions toward achieving a goal (DeLoache, Miller, & Pierrotsakos, 1998; Friedman, Scholnick, & Cocking, 1987; Gauvain, 2001; Siegler, 1998). Planning relies on the ability to suspend action and delay gratification, which leads to increased opportunity to reflect on the activity and formulate strategies for future actions (Ellis & Siegler, 1997). The skills associated with planning ability emerge early and have a protracted developmental course associated with development of the prefrontal cortex, which continues to develop through adolescence and early adulthood (Hughes & Graham, 2002; Johnson, 2005; Wilding, Munir, & Cornish, 2001). Children advance from rudimentary planning in the first years of life, to devising simple plans in advance of action and an increased understanding of what planning is and when it is required in the preschool years, to increased competence in planning several steps in advance, the ability to suspend action, and engage in reflection during middle childhood (see Friedman & Scholnick, 1997). Furthermore, with increasing age, children have greater experience and opportunities to engage in planning during everyday activities (Gauvain, 2001).

The development of planning skills is critical for mature social and cognitive functioning and becomes increasingly important throughout childhood for managing school related demands and the ability to balance various activities, such as completing homework assignments, family and chore responsibilities, and recreational activities that require children to behave in planful ways (Blair, 2002). In short, these are cognitive skills that, at least in part, form the basis for self-regulated learning, a characteristic particularly important in the classroom setting (Blair, 2002; Bransford, Brown, & Cocking, 1999). Thus, children's planning ability, even in the preschool years, may have important implications for children's transition to formal schooling.

Preschool children are still undergoing rapid developmental change in the areas of the brain, such as the frontal lobes, that may facilitate the ability to engage in self-regulated learning, such as memory, attention, self-regulation, and higher order cognitive skills like planning (Blair,

2002). When preschool children transition to formal schooling, they will also be faced with increasing cognitive and behavioral demands and academic success relies in part on children's ability to regulate their behavior to be consistent with the behavioral expectations of the classroom (Perry & Weinstein, 1998). The ease with which children are able to negotiate and adapt to these expectations during this transitional period has long-term implications for academic success (Ladd, 1996).

In assessing school readiness, teachers tend to value behaviors that reflect higher order or metacognitive skills that enable self regulated learning such as attentiveness, motivation, and the ability to follow directions and not be disruptive. In fact, teachers value these capabilities more than specific academic skills, such as knowing the alphabet or being able to use a pencil (Blair, 2002). Thus, teachers appear to have expectations that competent students will be able to regulate their attention and behavior in the classroom. In the preschool context children's learning experiences are setting the stage for their eventual transition to formal schooling. Children who have difficulty with metacognitive skills, like planning, may thus be at a disadvantage in this process of preparation. The current study will examine individual differences or characteristics of children, such as self-regulatory ability, that may influence both children's ability to plan and the acquisition of skills that prepare them for formal schooling.

Planning ability is considered to be an important aspect of what has been referred to as *executive function* (Brophy, Taylor, & Hughes, 2002; Hughes & Graham, 2002; Zelazo, Carter, Reznick, Frye, 1997). Executive function or control processes include effortful, higher order psychological processes involved in the conscious control of thought and action, goal-directed responses, and self-regulatory ability, such as attention flexibility and inhibitory control (e.g., ability to redirect a strong habitual response). Research on deficits in executive control processes has largely been conducted in the area of developmental psychopathology. Not well understood are the connections between executive control processes and *normative* child development. The proposed study is specifically interested in examining children's planning ability and the self-regulatory aspects of executive function. This study will focus on relations between observed and teacher reported inhibitory control, observed planning ability, and teacher reports of children's literacy skill development.

Inhibitory control is considered to be a dimension of temperament and individual differences in this control process can be identified as early as the first year (Rothbart & Posner, 2001). Inhibitory control involves the ability to withhold a response, interrupt a process that has already begun, avoid interference with ongoing activity, or delay a response (Tamm, Menon, & Reiss, 2002). Inhibitory control is evident within the second half of the first year of life and, in part, forms the basis for the ability of young children to comply with adult directives, delay gratification, and manage their own impulses (Fox & Calkins, 2003). Thus, deficits in inhibitory control may be associated with poorer performance on planning tasks in early childhood (Brophy et al., 2002), which in turn may be associated with a lower degree of school readiness as assessed by teachers.

We were also interested in examining child emotionality as an aspect of temperament that may be associated with children's ability to successfully engage in complex cognitive activity. Emotionality has the potential to interfere with children's ability to engage effectively in complex cognitive tasks by interfering with the focusing of attention and maintenance of motivation (Frijda & Mesquita, 1998), which are critical to such cognitive activities. This may be particularly true for young children who are still undergoing brain development in areas that are associated with self-regulatory capacity (Johnson, 2005). We were specifically interested in

negative and positive emotionality. Research has demonstrated that individuals with a tendency toward experiencing and expressing negative emotions such as anger and frustration tend to be less effective at emotion regulation (Fox & Calkins, 2003) and in processing information (Cummings & Davies, 1995). Evidence from neuroscience suggests that negative emotion results in a deactivation of the frontal areas of the brain associated with higher order cognitive functioning, such as planning, as well as the ability to regulate attention and behavior (Davis, Bruce, & Gunnar, 2002). Consistent with these findings, children prone to negative emotionality may display greater difficulty with planning and inhibitory control. Children prone to negative emotionality may also display greater difficulty in their interactions with others and in the classroom setting. On the other hand, positive emotionality may foster interactions with others. Less is known about the role of positive emotionality in relation to cognitive activity, thus relations in this regard will be explored in the current study.

Hypotheses

This study of planning ability, temperament and literacy development in preschool children examined relations between areas of executive functioning and school readiness. It was expected that children who showed higher levels of planning skill development would also show a higher level of inhibitory control. Furthermore, children who were perceived by teachers to be higher in self-regulation were also expected to have a higher level of performance on the planning and inhibitory control tasks. Children rated by teachers as having more difficulty with negative emotions were expected to perform poorly on observed planning and inhibitory control tasks. Observed planning and inhibitory control and high levels of teacher rated self-regulation and low levels of teacher-rated negative emotionality were predicted to coincide with higher letter recognition scores. Levels of positive temperament in participating children and how it related to task completions and teacher ratings were also explored.

Method

Participants

Thirty preschool aged children (18 boys) were recruited from the University of North Florida Child Development and Research Center (CDRC). Teachers at the CDRC reported on children's temperament. The mean age of the children was 54 months (*SD* = 6.82, range = 39 to 67 months). Information pertaining to literacy skill development, specifically letter recognition, collected by the CDRC was also gathered. Due to the age restriction of the letter recognition inventory, literacy scores were only obtained for participants who met the age restrictions (N= 22).

Measures

Child temperament. Teachers completed the Child Behavior Questionnaire-Short Form (Rothbart, Ahadi, Hershey, & Fisher, 2001). For the current study we were only interested in 8 subscales (a total of 47 items) that were theoretically expected to relate to planning and observed inhibitory control. We specifically examined both negative and positive emotionality including *anger and frustration* (amount of negative affect related to interruption of ongoing tasks; 5 items, alpha = .867); *approach and positivity* (amount of excitement and positive anticipation for expected pleasurable activities; 5 items, alpha = .642); *smiling and laughter* (amount of positive affect in response to changes in stimulus intensity; 6 items, alpha = .469); *high intensity pleasure* (amount of pleasure or enjoyment related to situations involving high stimulus intensity; 6 items, alpha = .784); and *low intensity pleasure* (amount of pleasure or enjoyment related to situations involving low stimulus intensity; 7 items, alpha = .668). We also examined regulatory capacity including *attentional focusing* (tendency to maintain attentional focus upon task-related

channels; 6 items, alpha = .698); *inhibitory control* (capacity to plan and to suppress inappropriate responses; 6 items, alpha = .732); and *impulsivity* (speed of response initiation; 6 items, alpha = .712).

School readiness. Information about children's early literacy achievement as assessed and on record at the UNF CDRC. The Alphabet Letter Reocgition Inventory (ALRI) is a locally developed inventory that assesses children's ability to recognize and name upper and lowercase letters of the alphabet when not presented in alphabetical order (FIE @UNF, 2006). Teachers administered the ALRI with each child inidividually. The children's scores represent the number of letters correctly identified for both upper and lowercase letters. Since the ALRI is only administered in the beginning of the school year and the age restriction of the inventory indicates that children must be at least 48 months old, not all children who participated in this study were tested. The sample of children tested for literacy skill (N= 22) did not encompass all subjects tested for the planning and inhibitory control tasks.

Observed inhibitory control. There were two tasks referred to as “go-no go” tasks designed to assess the children’s capacity to inhibit a dominant response (see Murray & Kochanska, 2002). The first task involved turn taking. The child and experimenter took turns in building a tall, vertical tower with 20 wooden blocks after the experimenter explained and demonstrated the meaning of taking turns. The experimenter did not automatically take their turn and deliberately waited with a block in their hand until the child explicitly stated that he or she was giving the experimenter a turn. The turn taking task was videotaped and children received scores that ranged from 10 (no turns taken) to 20 (alternated every turn).

The second task was a Simon Says type task. Children were instructed to perform movements commanded by a bear puppet, such as “touch your nose”, but not those commanded by a frog puppet. There were five trials for each puppet. All trials were videotaped and children were assigned a score for the bear trials that range from 0 (failure to move) to 3 (full correct movement) and for the frog trials ranging from 0 (full correct movement) to 3 (full inhibition of movement) (see Murray & Kochanska, 2002).

Observed planning skills. Children participated in two planning tasks that involved sequencing and delivering five items to locations in a scene drawn on 40 x 60 in. (101.6 x 152.4 cm) foam board using a small toy vehicle (see Figure 1). In the first task, five cardboard letters (three orange, two blue) were delivered using a small, red plastic truck to houses in a village scene that contained a post office, an oval road, a one-way street sign, and five houses, three orange and two blue, aligned along the road. In the second task the delivery involved farm items. The scene contained drawings of five orchards (two with bushes, three with trees) and five animal pens (two sheep pens, three pig pens). Cardboard cutouts of the animals (two sheep, three pigs) were delivered to their locations using a plastic truck. To ensure that children planned in advance, children were instructed that only the next item to be delivered could be removed from the delivery vehicle at one time. Therefore, to accomplish the delivery in one trip, the items had to be loaded into the vehicle in reverse sequence, which required planning in advance. All planning tasks were videotaped.

Coding. The videotapes of the planning sessions were coded for nine different subscales of behavior. We first recorded whether the child successfully completed each plan (scores ranged from 0-2) and the number of trials the child required to complete the task. We also coded several child behaviors. Codes were rated on a scale of 1 (to a minimal extent) to 5 (to a great extent). To obtain reliabilities, three independent coders overlapped on 17% of the videotapes and effective reliability estimates (R_{est}) were calculated (see Rosenthal & Rosnow, 1991). The codes included

attention to instructions (the extent to which the child was attentive to the instructions given by the experimenter prior to beginning the task; R_{est} = .94), *followed task directions* (the extent to which the child performed the task according to instructions; R_{est} = .96), *on task* (the extent to which the child was on-task and remained engaged in the task; R_{est} = .96), *planning strategies* (the extent to which the child made statements about how best to solve the task; R_{est} = .98), *item location identification* (the extent to which the child identified the delivery locations and matched them with the items to be delivered before making a solution attempt; R_{est} = .96), *ease of task performance* (the extent to which the child appeared to understand the task and completed the task with minimal difficulty; R_{est} = .94), *frustration* (the extent to which the child was frustrated with the task; R_{est} = .90), *positive affect* (the extent to which the child displayed positive affect and maintained positive interaction with the experimenter; R_{est} = .98), and *negative affect* (the extent to which the child displayed negative affect or negative reactions toward the experimenter; R_{est} = .90).

Paired sample t-tests were conducted on the codes across the two planning tasks to determine whether the scores were similar enough across the two tasks to warrant combining scores. There were significant differences for only two of the codes: ease of task performance, $t(26) = 2.39$, $p < .05$, and followed directions, $t(26) = 2.20$, $p < .05$. Means indicated that children increased their ease of task performance and the degree to which they followed directions from the first to the second task. Because of the overall similarity of scores across the two planning tasks, to reduce the number of variables the codes were averaged across the two tasks for a single score for each code.

Procedure

Letters of information and consent were distributed to parents through the CDRC. Only children with parental consent participated in the study. Two experimenters (one female, on male) visited the CDRC and administered two planning tasks and two inhibitory control tasks in counterbalanced order. Midway through the session children were given a break with a snack. Teachers that knew the participating children best were recruited to complete the Child Behavior Questionnaire. All teachers were invited to a dinner banquet at the completion of the study as compensation for their participation.

Results

Preliminary analyses included correlations between child gender, child age and observational variables. It was found that child gender was not correlated with any observational variables. Child age was found to be correlated with observed planning ability, older children displayed better planning, paid more attention to the instructions, planned in advance, and stayed on task (*r*s ranged from .42 to .53, *ps* < .05). Correlations between child gender and age and temperament were also run. Girls were rated by teachers as displaying higher levels of low intensity pleasure, ($r = .46$, $p < .05$). No relations were found with age. Correlations between child gender and age and letter recognition were run on subjects that were administered the ALRI. Boys were found to perform better in both upper ($r = .62$, $p < .05$) and lower letter recognition, ($r = .55$, $p < .05$) and older children in general, performed better in both upper, ($r = .57$, $p < .05$), and lower letter recognition, ($r = .59$, $p < .05$).

To test the hypothesis that children who showed higher levels of planning skill development would also show a higher level of inhibitory control, intercorrelations among planning and observed inhibitor control were examined (Table 1). Children who were better able to inhibit their behavior during the Simon Says task were also less likely to solve the planning task, made more solution attempts, and used slightly less planning in advance. Children who

took more turns appropriately during the block building task were more likely to follow directions, more likely to locate the delivery locations before making a solution attempt, and were less frustrated with the task.

To test the hypothesis that children who were perceived by teachers to be higher in self-regulation were also expected to have a higher level of performance on the planning and inhibitory control tasks, intercorrelations were examined among planning and teacher-rated temperament variables (Table 2). Children rated by teachers as high in anger/frustration made fewer attempts to solve the planning task, were less likely to remain on task. Children rated by teachers as high in approach and positivity made fewer solution attempts. Children rated by teachers as high in impulsivity were less likely to attend to instructions, follow directions, remain in task, displayed more frustration with the task. Children rated by teachers as high in inhibitory control were more likely to follow directions, remain on task, less likely to display frustration with the task. A number of trends were seen with regards to teacher-rated temperament, especially with attention focusing. Children rated as higher in attention focusing were more likely to solve the task, follow directions, remain on task, and display less frustration with tasks. Children rated by teachers as having more difficulty with negative emotions were expected to perform poorly on observed planning and inhibitory control tasks.

To test the hypothesis that observed planning and inhibitory control, high levels of teacher rated self-regulation and low levels of teacher-rated negative emotionality would be associated with higher letter recognition scores, correlations were run between observed inhibitory control and teacher-reported temperament (Table 3). Children who correctly performed the actions in response to the bear were rated by teachers as slightly lower in high intensity pleasure and higher in low intensity pleasure. Similar to above, being lower in emotionality resulted in better task performance. Children who correctly inhibited their actions in response to the frog were rated by teachers as slightly lower in anger and frustration. Children who appropriately took turns during the block task were rated by teachers as higher in attention focusing and higher in inhibitory control.

Finally, to explore associations between levels of positive temperament, planning, inhibitory control and teacher-rated temperament, partial correlations, controlling for gender and age, between letter recognition and planning were conducted. Children who displayed better planning did not perform as well on letter recognition. Specifically children that attended to instructions and remained on task had lower letter recognition scores. Children that displayed more frustration with the planning task performed better in lowercase letter recognition. Partial correlations, controlling for gender and age, between letter recognition and observed inhibitory control yielded no significant results. There were also no significant associations between letter recognition and teacher rated temperament after controlling for age and gender.

Discussion

The aim of this study was to measure a) relationships between observed planning ability and inhibitory control, b) teacher-rated self regulation skills and observed planning and inhibitory control, c) teacher-rated negative emotionality and observed planning and inhibitory control, and d) observed planning and inhibitory control, teacher rated self-regulation, teacher rated temperament and letter recognition scores in preschool aged children. Relations with teacher-rated positive emotionality were explored as well. This was done in an effort to establish relations between planning ability, self-regulation and early literacy skill development in preschool aged children.

On the basis of the correlational analyses, we found that children who performed better on one of the observed inhibitory control tasks (Simon Says) were less likely to solve planning tasks, made more solution attempts, and used slightly less planning in advance. Also, inhibitory control as assessed by this task was not related to teacher-rated temperament. These findings contradict previously reported studies (Brophy et al., 2002), and did not support our hypotheses. However, we did find that children who took turns appropriately during the block building task, another index of inhibitory control, were more likely to follow directions, more likely to locate the delivery locations before making a solution attempt, and were less frustrated with the planning tasks. Furthermore, children who took turns appropriately and were perceived by teachers to be lower in overall emotionality, higher in regulatory capacity, and lower in impulsivity displayed better planning skills. These findings are consistent with previous research indicating that planning and regulatory capacity are part of an executive function system and that these two capacities inform and influence on another (Brophy et al, 2002; Hughes & Graham, 2002; Zelaz et al., 1997).These findings also indicate that emotionality may play a part in the development of these capacities.

It is unclear why the findings with the Simon Says task were inconsistent with all other findings. It may be that the Simon Says task was more complex than the turn-taking task in that it placed greater demands on children's memory capacity and required children shift between engaging in and inhibiting behavior. Though the planning task also required a recall of rules, it differed from the Simon Says task in that there was no need to shift between engaging in and inhibiting activity and children had several opportunities to solve the planning task. Children of this age are in the midst of a developmental transition with regard to memory capacity and cognitive and behavioral flexibility which may have contributed to the unexpected pattern of relations with the Simon Says task. Noteworthy, however, is that overall, planning was associated in expected ways with the observational turn taking task and teacher-rated temperament.

An additional aspect of our study worthy of mention is the unexpected patterns of relations between planning and letter recognition. Children who displayed better planning did not perform as well on letter recognition. There were also no significant correlations between letter recognition, observed inhibitory control and teacher-rated temperament. This perhaps may have been due to the differences in cognitive skills used between each task. The observed inhibitory control tasks drew upon executive functioning and specifically required that children utilize working memory and engage in self-regulation. In the observed tasks, the children were given instructions for each task prior to participation, allowing them to store this knowledge for immediate recall. However, the alphabet letter recognition inventory required long-term recognition memory. Recognition of lower and upper case letters of the alphabet requires the children to activate different processes in the brain than are used for working memory. Long-term memory (LTM) differs from working memory in many different ways, one of which is location of storage in the brain. While working memory utilizes neural pathways in the prefrontal cortex, located in the frontal lobe, LTM is generally agreed by researchers to reside in the hippocampus, located in the temporal lobe. These are two distinct areas of the brain, both of which have specific means of being tested (Willingham, 2006). Our results pertaining to observed planning, inhibitory control and letter recognition as measured in the current study, may actually be mediated or moderated by children's memory capacity, which is limited and undergoing gradual development in early childhood. Since memory development was not tested in comparison with teacher-rated temperament and observed inhibitory control and planning, this

may account for some of the unexpected results. Further research with larger sample sizes and perhaps additional indices of memory capacity needs to be conducted and the associations found in the current study should be interpreted cautiously.

Limitations and Future Research

The findings reported here should be interpreted with caution due to certain limitations to the study. First, it should be noted that the sample size was severely restricted. This limited sample makes generalization of our results to the population difficult. Due to the decreased power of our study, results in turn are subject to an increased chance of making Type I errors, that is, the failure to find a significant relation where one exists. Examination of the correlation tables indicates that for several associations there were effect sizes that, with a larger sample size, would have reached significance. In addition we are encouraged that many of the correlations were in expected directions.

Furthermore, the ALRI used to assess literacy development in participating children was restricted in administration. This particular literacy test is administered in the beginning of each academic year and is only administered to children meeting the age requirement of 48 months. Unfortunately, only twenty-two children of our sample population fit the criteria for the ALRI administration. With such a restricted sample size, generalization of our results is limited at best.

Another point of concern involves the time constraints applied to task completion for the children. Due to the limited amount of testing time per child, each child was allowed only 10 trials to complete each of the planning ability tasks. Unfortunately, those children unable to complete the tasks within the set limit of trials would discontinue the task and be noted as timing out. This limited the amount of data used to run analyses. The planning ability tasks were originally developed to incorporate three different deliveries instead of two. Given that the primary focus of our study was to observe planning ability and its relations to self-regulation and literacy skill development, and that all children were able to attempt the first two deliveries, we consider our decision to eliminate the third delivery from analyses sufficient.

Future studies would benefit from a larger sample size. We also recommend the additional measures of literacy skill assessment, such as the School-Home Early Language and Literacy test (SHELL), an oral language and development battery that also includes vocabulary, comprehension and early literacy measures (Snow, Tabors, Nicholson & Kurland, 1995) as well as a memory test, such as the Children's Memory Scale (Cohen, 1997), an individually administered instrument which evaluates learning and memory. This may open up new relationships between literacy development and executive functioning. Lastly, providing subjects with an unlimited trial amount time will add additional data on observed planning ability. By doing this, a better understanding of planning ability and its relationship to inhibitory control and literacy skill development may be seen.

Conclusions

In conclusion, the current study has demonstrated positive relationships between observed inhibitory control and planning ability, similar to previous research (Brophy et al., 2002). Additionally, patterns of relations were found between teacher-rated negative emotionality, namely anger/frustration, and deficits in observed planning and inhibitory control. Our study also demonstrated unexpected negative associations between literacy skill development and observed planning ability. No relations were found between literacy development and observed inhibitory control. The results reported in this study do not fully correspond with all previous studies; however, they do support our hypothesis that observed planning ability is positively associated with observed inhibitory control. Also supported are the

hypotheses that high levels of teacher-rated self-regulation skills would be positively associated with observed planning and inhibitory control and high levels of teacher-rated negative emotionality would be negatively associated with observed planning and inhibitory control. With regards to literacy skill development, restrictions in sampling may have been a factor in the unexpected results obtained. Future studies will possibly yield more clarification on this area of study.

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Table 1

Correlations between Observed Planning and Observed Inhibitory Control

	Simon Says Task		Block Building
	Correctly Performed Action	Correctly Inhibited Action	Number of Turns Taken
Solved Task	-0.14	-0.34†	0.23
Number of Attempts	0.21	0.57**	-0.07
Attended to Instructions[a]	-0.22	-0.03	0.01
Followed Directions	-0.17	0.04	0.42*
Stayed On Task[a]	-0.18	0.13	0.16
Planned in Advance[a]	-0.18	-0.37†	0.16
Found Locations	-0.09	-0.29	0.36†
Frustrated with Task	0.13	0.05	-0.49**
Positive Affect	-0.15	0.02	0.28
Negative Affect	0.09	0.07	-0.12

† $p < .10$; * $p < .05$, ** $p < .01$

[a] Controlled for age

Table 2

Correlations between Emotionality and Regulatory Scales from the CBQ and Observed Planning

	Anger/ Frustration	Approach/ Positivity	Smiling/ Laughter	High Intensity Pleasure	Low Intensity Pleasure[b]	Impulsivity	Attention Focusing	Inhibitory Control
Solved Task	0.01	0.16	-0.10	0.17	0.33†	-0.24	0.33†	0.25
Number of Attempts	-0.41*	-0.37*	0.15	-0.30	0.00	-0.10	-0.01	0.16
Attended to Instructions[a]	-0.24	-0.20	-0.14	-0.18	0.15	-0.51*	0.30	0.37†
Followed Directions	-0.22	-0.11	-0.07	-0.25	0.29	-0.45*	0.32†	0.44*
Stayed On Task[a]	-0.38*	-0.27	-0.08	-0.28	0.22	-0.50*	0.36†	0.48*
Planned in Advance[a]	-0.12	-0.11	-0.05	-0.19	0.16	-0.33†	0.19	0.26
Found Locations	-0.16	-0.14	-0.33†	-0.12	0.24	-0.18	0.13	0.15
Frustrated with Task	0.18	0.17	0.09	0.28	-0.34†	0.49**	-0.33†	-0.50**
Positive Affect	0.00	-0.04	0.08	-0.03	0.03	-0.14	-0.06	0.10
Negative Affect	0.09	-0.04	0.10	-0.14	-0.07	0.19	-0.23	-0.21

† $p < .10$; * $p < .05$, ** $p < .01$

[a] Controlled for age

[b] Controlled for gender

Table 3
Correlations between Emotionality and Regulatory Scales from the CBQ and Observed Inhibitory Control

	Simon Says Task		Block Task
	Correctly Performed Action	Correctly Inhibited Action	Took Turns Appropriately
Anger/Frustration	-0.22	-0.34†	-0.02
Smiling/Laughter	-0.06	0.15	-0.13
Approach/Positivity	-0.10	-0.32	-0.03
High Intensity Pleasure	-0.34†	-0.27	-0.03
Low Intensity Pleasure[a]	0.48*	0.32	0.04
Impulsivity	-0.09	-0.17	-0.22
Attention Focusing	0.02	0.16	0.45*
Inhibitory Control	0.12	0.12	0.36*

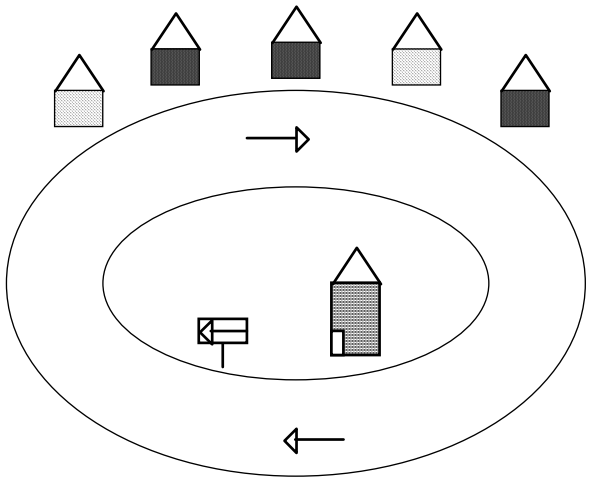
† $p < .10$; * $p < .05$
[a] Controlled for gender

Table 4
Partial Correlations, Controlling for Gender and Age, between Letter Recognition and Observed Planning

	Upper Case Letter Recognition (*df* = 18)	Lower Case Letter Recognition (*df* = 18)
Solved Task	0.15	-0.04
Number of Attempts	-0.43†	-0.36
Attended to Instructions	-0.40†	-0.42†
Followed Directions	-0.36	-0.38
Stayed On Task	-0.46*	-0.49*
Planned in Advance	-0.02	-0.01
Found Locations	-0.13	-0.17
Frustrated with Task	0.36	0.42†
Positive Affect	-0.12	-0.27
Negative Affect	-0.21	0.03

† $p < .10$; * $p < .05$

Figure 1. Diagrams of mail delivery and farm delivery tasks.

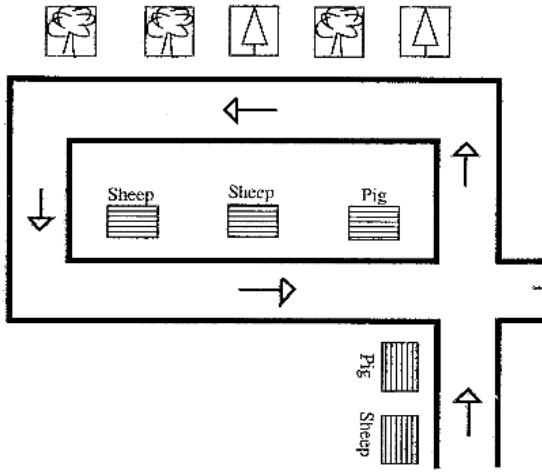


= Blue House

= Orange House

= Post office

Mail Delivery Task



Farm Delivery Task