

ACCURACY OF CHILD EVENT FREQUENCY REPORTS

by

Shrija R. Dirghangi

A Thesis Submitted to the Faculty of

The Charles E. Schmidt College Science

in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

Florida Atlantic University

Boca Raton, Florida

August 2014

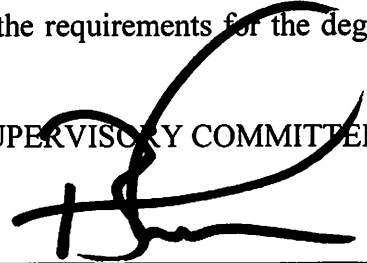
ACCURACY OF CHILD EVENT FREQUENCY REPORTS

by

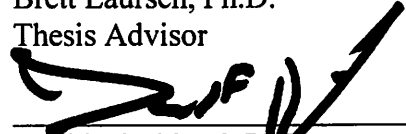
Shrija Dirghangi

This thesis was prepared under the direction of the candidate's thesis advisor, Dr. Brett Laursen, Department of Psychology, and has been approved by the members of his supervisory committee. It was submitted to the faculty of the Charles E. Schmidt College of Science and was accepted in partial fulfillment of the requirements for the degree of Master of Arts.

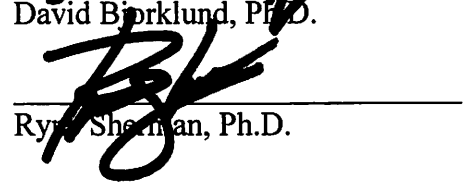
SUPERVISORY COMMITTEE:



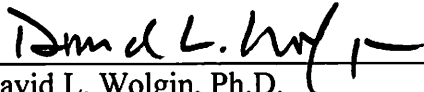
Brett Laursen, Ph.D.
Thesis Advisor



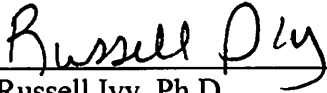
David Bjorklund, Ph.D.



Ryan Sherman, Ph.D.



David L. Wolgin, Ph.D.
Chair, Department of Psychology



Russell Ivy, Ph.D.
Interim Dean, The Charles E. Schmidt College of Science



Deborah L. Floyd, Ed.D.
Interim Dean, Graduate College

07/19/2014

Date

ACKNOWLEDGEMENTS

I wish to thank my committee members for all of their guidance, expertise, and support throughout this endeavor. Thanks to the teachers, students and administrative staff members at the A.D. Henderson School, without whose support, this project could not have been completed. Special thanks to my advisor, Brett Laursen, for his unfailing support and encouragement.

ABSTRACT

Author: Shrija Dirghangi
Title: Accuracy of Child Event Frequency Reports
Institution: Florida Atlantic University
Thesis Advisor: Dr. Brett Laursen
Degree: Master of Arts
Year: 2014

The current study assessed whether the accuracy of children's self-reports of events experienced differs as a function of age and how the question is asked. Additional factors like metamemory and distractibility were assessed. Primary-school students ($M = 7.7$ years) and middle-school students ($M = 9.7$ years) completed two different versions of an event frequency measure, two times, at one week intervals. In one of the measures of event frequency, no memory prompts were provided (uncued questionnaire condition), while in the other measure, recall categories for aiding recollections were provided (cued questionnaire condition). Participants' self-reported event frequencies for the cued and uncued questionnaires were compared with trained observers' event frequencies for the cued and uncued conditions. Older children reported event frequency more accurately than younger participants. Participants also reported events with greater accuracy with the aid of memory prompts than without, an effect that was especially strong among the younger children. Neither metamemory nor distractibility was accountable for the

differences within age groups. The findings suggest that age-related improvements in accuracy of event frequency across the transition into adolescence may, in part, be due to improvements in the ability to recall and recount those events in the absence of memory cues.

DEDICATION

To my mother, Suchitra Dirghangi, and father, Ramen Dirghangi, who have believed in me at every step in my life.

To my little brother, Tunir, for all his love and support.

To my best friends Alex and Ashley, without whose support this achievement would not have been possible.

To my adviser Brett Laursen, without whom I would not be where I am today.

ACCURACY OF CHILD EVENT FREQUENCY REPORTS

LIST OF TABLES	ix
LIST OF FIGURES	x
INTRODUCTION	1
SIGNIFICANCE OF EVENT FREQUENCY REPORTS	1
RETRIEVAL STRATEGIES FOR EVENT RECALL AND THEIR IMPACT ON ACCURACY	2
DEVELOPMENTAL DIFFERENCES IN EVENT FREQUENCY RECALL ABILITIES	4
MECHANISMS THAT ACCOUNT FOR AGE- RELATED IMPROVEMENTS IN EVENT RECALL.....	5
INDIVIDUAL DIFFERENCES IN CHILDREN'S MEMORY	7
QUESTIONNAIRE ATTRIBUTES AND EVENT FREQUENCY RECALL.....	8
AGE-RELATED DIFFERENCES IN IMPACT OF QUESTIONNAIRE ATTRIBUTES ON EVENT RECALL.....	12
HYPOTHESES OF THE CURRENT STUDY	14
METHOD	16
PARTICIPANTS.....	16

MEASURES.....	16
TEACHER REPORTS	16
SELF-REPORTS	17
OBSERVATIONS.....	18
PROCEDURE.....	19
PLAN OF ANALYSIS	20
RESULTS	22
PRELIMINARY ANALYSES.....	22
INACCURACY OF SELF- REPORTS	23
INACCURACY OF SELF-REPORTS WITHIN RECALL CATEGORIES	24
REPRIMANDED BY TEACHER.	24
WORKED TOGETHER WITH ANOTHER STUDENT.....	25
DIRECTION OF INACCURACY OF SELF- REPORTS	26
SUPPLEMENTAL ANALYSES.....	27
DISCUSSION.....	29
MEMORY PROMPTS IMPROVE ACCURACY	29
AGE RELATED CHANGES IN EVENT FREQUENCY	33
AGE RELATED IMPROVEMENTS IN REPORT ACCURACY: THE INTERPLAY BETWEEN MEMORY PROMPTS AND AGE	37
IMPLICATIONS.....	39
LIMITATIONS AND AREAS FOR FUTURE RESEARCH	42

CONCLUSION	45
APPENDICES	49
APPENDIX A	49
APPENDIX B	49
APPENDIX C	49
APPENDIX D	51
APPENDIX E.....	52
APPENDIX F.....	53
APPENDIX G	54
REFERENCES	57

LIST OF TABLES

Table 1 Descriptive Statistics and Bivariate Correlations... ..	46
---	----

LIST OF FIGURES

Figure 1. Mean proportion of observed events inaccurately recalled by older (n=43) and younger (n=31) children in the cued and uncued questionnaire conditions	47
Figure 2. Mean proportion of observed events under-reported by older (n=43) and younger (n=31) children in the cued and uncued questionnaire conditions.	48

INTRODUCTION

Children's self-reports about the events they experience inform research in a number of disciplines. Yet the accuracy of these reports can be a source of concern. Several studies have focused on the age and the circumstances under which children are able to recall and report an experienced event. Older children recall more information, and answer questions more completely and with fewer errors, than younger children (Bruck & Ceci, 1999). Additionally, meta memory abilities, like the ability to monitor memory processes, significantly contribute to age related improvements in children's memory for events (e.g. Ornstein, Shapiro, Clubb, Follmer & Baker-Ward, 1997). Most of these studies assess the ability to provide a free narrative of events experienced. Less is known about recall on questionnaires, which often focus on the frequency of events experienced. The present study examines age differences in the accuracy of event frequency reports.

Significance of Event Frequency Reports

Many large-scale surveys are based on self-reports of the frequency of behaviors. For instance, the National Health Interview Survey (NHIS) examines how often people consume food items like broccoli in order to assess health consciousness and health rates. Similarly, the National Crime Survey assesses how often individuals are the victim of crimes like robbery, which is used to calculate national crime rates (Menon & Yorkston, 2000). Frequency reports are collected in the Monitoring the Future study to

assess adolescent behaviors like alcohol use, to estimate drinking rates and to inform social policy (Johnston, 2010). Questions like “How many disagreements did you have in the last week?” or “How often do you feel sad?” are central to the measurement of variables such as family conflict and depression. Thus, it is crucial that frequency reports are accurate representations of a respondent’s behavior.

Unfortunately, previous findings indicate that assessments of the frequency of behaviors are not wholly accurate. For instance, Menon (1993) describes systematic bias in frequency reports. Inaccurate reports, especially those that are confounded with measurement practices, threaten the foundation of research on event frequencies. Thus, it is crucial that scholars construct surveys in a manner that promotes accurate reports.

Retrieval Strategies for Event Recall and Their Impact on Accuracy

Accuracy of recall is directly tied to the retrieval strategies employed by the reporter or respondent. Retrieval strategies can be defined as the cognitive processes the respondent uses to determine the number of events that occurred (Blair & Burton, 1987). Strategies for event retrieval may be classified into three categories: experiential strategies, enumerative strategies, and semantic strategies. Experiential strategies are used when respondents identify and report current or very recent experiences that are available as trace memories. Experiential strategies require the least amount of cognitive effort. Enumerative strategies entail remembering and counting the frequency of events. Enumeration can take one of two forms: *episodic recall*, wherein all events that fit the target category are remembered and counted (Williams & Durso, 1986), and *extrapolation*, wherein the frequency of a subset of events is remembered and used to estimate a total number of events (Brown, 2002). Episodic recall provides accurate

reports provided that events are salient and infrequent. As the number of events to be enumerated increases, the chance that some will be forgotten and hence unreported also increases (Burton & Blair, 1991). Underreporting is also a problem when episodic recall is applied to events, regardless of their frequency. In contrast, enumeration and extrapolation yield accurate estimates for events that occur on a regular basis (Brown, 1995). When extrapolation is employed, events that do not occur at fixed intervals may be misreported. The third category of event frequency strategies are semantic strategies, which do not rely on the recollection of events but instead involve accessing the number of events occurrence directly from memory. This may be feasible for participants who keep a running tally of events (e.g., the number of promotions or marriages), but it is only accurate for events that are very salient and rare. Maintaining a tally of events becomes cumbersome and error-prone when event totals rise.

The choice of a retrieval strategy has important implications for the accuracy of frequency reports. In general, when asked to report on the frequency of events, respondents try to balance effort against accuracy, such that answers tend to reflect the most accurate response with the least cognitive effort (Burton & Blair, 1991). As a first step, respondents attempt to retrieve the information directly from memory; failing that, enumeration strategies are employed (Menon, Raghurir, & Schwarz, 1995). However, enumeration requires effortful processing and so when counting becomes cumbersome, it may eventually be abandoned in favor of estimation, which produces faster but lesser accurate reports. For these reasons, surveys are often constructed to reduce the cognitive effort associated with enumeration, encouraging respondents to count rather than

estimate. To this end, surveys may be constructed with some form of memory aid designed to reduce the cognitive burdens associated with enumerating event frequencies.

Developmental Differences in Event Frequency Recall Abilities

The accuracy of event frequency reports is related to the cognitive abilities of the respondent (Laursen, Denissen, & Bjorklund, 2012). When answering questions about the frequency of events, respondents are expected to comprehend the request and retrieve the information. Age related improvements in the availability and use of retrieval strategies may alter the accuracy of event reports. It follows that age differences in reports of event frequencies may reflect differences in the recall strategies employed and the accuracy of these strategies, as opposed to differences in the number of events experienced.

Unfortunately, little is known about factors influencing accuracy of frequency reports, especially among young respondents, whose memory strategies for event recall may undergo important changes with age.

Developmental improvements in children's memory have been recorded. Word lists are often employed to measure age-related differences in memory. Most previous studies looking at frequency reports assessed the ability to recall specific items in a list or the number of times a particular item was presented. These studies addressed age differences in automatic processing abilities, which occur without effortful processing, and hence require few cognitive resources (Laursen et al., 2012). For example, children aged 8- 12 and young adults were asked to attend to the frequency of words presented (Hasher & Chromiak, 1977). There were no age differences in the accuracy of frequency estimates. Similar studies found no age related differences in children ranging in age from kindergarten to fifth grade (Lund, Hall, Wilson, & Humphreys, 1983). The degree

to which these results generalize to memory for events in non-laboratory settings is not clear, however, because the recollection tasks entail automatic processing, which may not reveal much about the nature of most event memories.

Unlike studies that focus on the recollection of words from lists, age differences have been documented in recall of the frequency of personal events that are governed by deliberate memory processes (Schneider, 2010). Event memory is a form of autobiographical memory, which includes our recollections of personal events. Memory for daily events improves across the school years, as children are better able to form narratives of experiences. Research on eyewitness testimony indicates that older children answer more questions correctly and with greater detail than younger children (Roebbers & Schneider, 2001). Age related differences in event recall have been found for children's immediate and delayed recall of details about a physical examination (Baker-Ward, Gordon, et al., 1993).

Mechanisms that Account for Age- Related Improvements in Event Recall

Several mechanisms have been proposed to account for improvements in event recall. With age, memory strategies improve, the ability to monitor the source of the information being recalled improves, children know more about the events being recalled, and children know more about their own memory processes (Laursen et al., 2012). Each will be described in turn.

With age, a greater number of recall strategies become available to children, which they are able to use more effectively (Schneider, Kron-Sperl, & Hunnerkopf, 2009). Young children rarely use organizational or rehearsal strategies to facilitate memory performance and even when employing a memory strategy, the performance of

young children does not necessarily improve, an error known as a utilization deficit (Miller, 1994). Utilization deficits are more common in younger children than in older children (Bjorklund, Miller, Coyle, & Slawinski, 1997). With age, children are better able to use strategies to organize information during encoding as well as during retrieval (Bjorklund, Dukes, & Brown, 2009). As their use of these strategies increases, so does memory performance.

Additionally, young children lack the ability to monitor the source of the information. Source monitoring abilities include the awareness of the contextual details or origins of the information (Laursen et al., 2012). One consequence of source monitoring difficulties is that young children are more likely than older children to report performing an action that they only witnessed (Foley, Ratner, & Gentes, 2010). Similarly, young children are more likely than older children to report that they personally witnessed or experienced an event that they only heard about (Principe, Kanaya, Ceci, & Singh, 2006). Both types of errors result in overestimates of event frequencies.

There are age related increases in children's knowledge about the objects or events being remembered. As children know more about what they are remembering, they are better able to use effective memory strategies for storage and recollection (e.g., Bjorklund, 1987). For instance, one study that tested children's memory for aspects of a physical exam six weeks after a check-up found that when children had prior knowledge about the events to be remembered, they were better able to encode, retain and retrieve information (Ornstein et al., 1997).

Finally, one of the most important mechanisms accounting for age-related improvements in memory for events is metamemory competence. Metamemory, defined

as "knowledge about the process of storing as well as retrieving information" is an important factor in children's event memory recollections (Geddie, Fradin, & Beer, 2000). Developmental improvements in metamemory abilities have been documented, including knowledge about one's own memory processes as well as knowledge about the event to be remembered (Schneider, 2010). There is evidence that metamemory improves dramatically around ages 7 and 8 (Bjorklund & Douglas, 1997). Metamemory and memory performance are correlated, suggesting that children's knowledge of their memory processes may contribute to their performance on memory tasks (Schneider, 2010). Other evidence suggests that as children's knowledge about the facts of memory increases with age, their use of memory strategies increases (Schneider, 2010). Deficits in young children's understanding of memory processes may increase the variability of event reports (Brown & Pipe, 2003). For instance, preschoolers and early school-age children overestimate their ability to recall events (Shin, Bjorklund, & Beck, 2007). Young children lack knowledge about the link between memory strategy use and improved memory performance (Justice, Baker- Ward, Gupta, & Jannings, 1997). Differences between younger and older children's knowledge about memory processes and strategies are reflected in age related differences in metamemory.

Individual Differences in Children's Memory

Individual differences have been identified in children's ability to produce and use memory strategies. Individual differences in children's working memory have been linked to individual differences in memory performance (Bjorklund, 2010). Working memory includes the ability to pay attention to the task at hand, inhibit responding, and resist interference from unrelated events. Poor working memory skills often accompany

distractibility. Distractibility is characterized by lack of attention to one's surroundings, poor attention span, restlessness, and a tendency to respond to irrelevant environmental stimulation (Ladd & Profilet, 1996). For young children, the ability to pay attention to events may be one of the most important factors that contribute to individual differences in recall. Distractibility can limit attention given to events and surroundings, interfering with event encoding, which can make accurate retrieval and reporting difficult (Ornstein & Haden, 2002). Hence, children who are easily distracted, may evidence poor encoding of events due to their inability to attend to important information. Thus, high levels of distractibility interfere with encoding and retrieval accuracy, in general and when it comes to event recall abilities.

Questionnaire Attributes and Event Frequency Recall

Question content shapes the accuracy of event reports. Previous studies have found that frequency reports vary as a function of questionnaire properties such as the recall period or measurement scale employed (Bless, Bohner, Hild & Schwarz 1992; Schwarz, 1999; Winkielman, Knauper & Schwarz, 1998). The structure and format of a questionnaire informs the respondent's choice of retrieval strategy, which in turn, shapes the accuracy of the report. For instance, when questionnaires provide clear instructions to count and report the frequency of events, respondents are encouraged to use enumerative strategies, as opposed to instructions that call for approximate values, where respondents are encouraged to use estimation strategies (Schimmack, 2002).

The time frame for recall, or the reference period from which participants are requested to recall events, shapes the response provided. Longer time frames are less likely to elicit enumeration strategies than shorter time frames. When time periods for

recollection are brief, there are usually limits on the number events experienced, making counting a feasible retrieval strategy (Blair & Burton, 1987). When time periods for recollection are lengthy, there is the potential for many events to occur, making counting burdensome, impractical and inaccurate. Reference periods can also affect responses in unintended ways. Participants look to the reference period for clues about the investigator's expectations. Long time frames are often interpreted as requests for rare events, whereas short time frames are understood to be requests for mundane and common events. As a consequence, long recall periods elicit reports of rare and significant events, and short recall periods elicit reports of frequent and mundane events (Winkielman, Knauper, & Schwarz, 1998). The shorter the time period for recall, the more events per unit of time are reported. Taken together, the accuracy of reports should decline as the time period for recall increases, because the tendency to underreport events grows.

Mindful of the many factors that may interfere with accurate event recall, scholars have taken steps to structure questionnaires in a manner that increases the use of enumeration and improves the accuracy of reports. One such strategy involves the provision of memory prompts. Memory cues can be defined as recall aids included in questionnaires to facilitate recollection. A questionnaire without memory prompts (i.e. uncued) requires free recall. A questionnaire with memory prompts involves guided recall. Cued questionnaires prime participants to recall events in response to the provision of memory prompts

Decomposition is one form of cued memory prompts used to improve the accuracy of recall. Decomposition breaks down vague categories of events into specific

subcategories, asking respondents to report the frequency of specific types of events. For instance, instead of inquiring about the number of times a participant dined out, a decomposed questionnaire might inquire about the number of times a participant dined out on specific occasions (e.g., business, family), mealtimes (e.g., breakfast, lunch), days (e.g., Monday, Tuesday), or restaurant types (e.g., Mexican, Italian). Decomposed questions ask about the frequency of sub-categories of events (How many times did you dine out on Monday? How many times did you dine out on Tuesday?) which are then summed, as opposed to a generic question about a global category of events (How many times did you dine out last week?). Decomposed questions provide quicker (Reiser, Black, & Abelson, 1985) and more accurate (Menon, 1997) event frequency estimates than questionnaires without cues. Decomposition encourages enumeration, which results in improved accuracy so long as the subcategories are sufficiently narrow to capture a limited number of non-overlapping events. (Menon, 1997; Blair & Burton, 1987; Sudman & Schwarz, 1989). In the absence of memory cues, participants may be inclined to guess about event frequency, because there may be too many to accurately count and because the mental effort to do so may not be worth the investment.

The practice of decomposition affects the accuracy of regular and irregular events in different ways. Regular events follow a periodic temporal pattern, making it easy to predict their next occurrence. Irregular events do not arise on a schedule, making them difficult to predict. When reporting the frequency of regular events, respondents rely on estimation strategies based on the general rate of occurrence, because this requires less mental effort than enumeration. In these circumstances, decomposition interferes with the estimation procedure, potentially forcing participants to break events into subcategories

that do not match event patterns. As a consequence, decomposition may decrease the accuracy of reports of regular events (Menon, 1997). In contrast, irregular behaviors are typically not estimated, particularly if they are low frequency events. In these circumstances, decomposition improves the accuracy of reports because it facilitates enumeration within individual categories. Thus, decomposition improves the accuracy of reports about irregular behaviors, but it may impair the accuracy of reports about regular behaviors (Menon, 1997).

Memory cues help to eliminate errors arising from forgetting, but also from misplacing an event in time (Sudman & Bradburn, 1974). Telescoping occurs when participants attribute an event from an early time period to the time period for recall. Insofar as the prompt provides cues to the timing of an event, over-reporting can be avoided. There are some circumstances, however, in which decomposition decreases the accuracy of event reports. According to the category split model (Fiedler & Armbruster, 1994), estimates of regularly occurring events that are poorly represented in memory regress to the mean. Thus, estimation strategies (as opposed to enumeration strategies) promote underestimation of high frequency events and overestimation of low frequency events. As a consequence, summed frequencies from decomposed categories amplify inaccuracies compared to frequencies obtained without cues. To test this model, reports of the frequency of telephone calls made by participants were compared against phone records (Belli, Schwartz, Singer, & Tallarico, 2000). Decomposed questions increased over-reporting of phone call frequencies. In contrast, phone call frequencies were underreported when no memory cues were provided.

The present study builds on research examining the degree to which memory prompts improve the accuracy of frequency recall (Menon, 1997). College students recorded three types of regularly occurring events (washing hair, having dinner and attending class) and three types of irregularly occurring behaviors (drinking water from a fountain, snacking and greeting friends at work) in diaries immediately after their occurrence. At the end of the week, participants completed separate questionnaires reporting the frequency of each event. Some responded to cued questionnaires, others responded to uncued questionnaires. The results indicated that decomposition promoted enumeration, which facilitated more accurate recall of event frequency. Irregularly occurring events were more likely to be inaccurately reported, than regularly occurring events, but the recall of the former was significantly improved by provision of decomposed cues, whereas the recall of the latter was not improved by the provision of decomposed cues.

Age-Related Differences in Impact of Questionnaire Attributes on Event Recall

Little is known about how age related changes in memory may be affected by the use of memory cues in event frequency questionnaires. We know that among adults, the impact of questionnaire format on event frequency responses is minimized for events that are well represented in memory (Menon et al., 1995). This suggests that age differences in memory may amplify the impact of questionnaire format on the accuracy of frequency reports. One study suggests how this might happen (Knauper, Schwarz, & Park, 2004). Older adults (Mean age= 76.2 years) and younger adults (Mean age= 35.3years) reported the frequency of everyday behaviors like consuming meat or buying birthday presents, using either a high frequency or low frequency response scale. The reports of older

adults' were more affected by response scale properties than those of younger adults, probably due to the fact that age-related declines in memory performance make it difficult for the elderly to recall events. It follows that age-related limitations in memory make some age groups more susceptible to influence from questionnaire format than other age groups (Schwarz, 1999).

Might similar differences in children's event frequency reports be expected? Few studies have examined whether there are developmental differences in event frequency recall and whether these vary as a function of the provision of memory prompts. Young children, whose memory capacities are not fully developed, may especially benefit from decomposition. Decomposition should help young children compensate for retrieval deficits. Young children who have little use for memory strategies can profit from memory prompts. Presumably, older children are familiar with memory strategies and use tactics such as decomposition without prompting, so the provision of memory cues will have little impact on the accuracy of event reports. Findings from eye-witness testimony research are consistent with this premise. Age differences in the accuracy of young and older children's recall diminishes when young children are provided memory cues (Schneider, 2010). These findings did not address the topic of event frequency, but presumably the same processes are at work. If so, then differences in accuracy of cued and uncued event frequency reports should diminish across primary and middle school years.

One recent study addressed this topic. Reports about the number of disagreements experienced during the previous day were found to differ between elementary school and middle school children when memory cues were not provided, but these differences

disappeared when cues were provided (Dirghangi, Laursen, Puder, Bjorklund, DeLay, 2012). The assumption that age related improvements reflected more accurate reports could not be verified, however, because no measure of the actual frequency of the event conflicts was available. The present study addresses this gap by obtaining observed reports of events to be recalled by participants in different age groups.

Hypotheses of the Current Study

The present study was designed to investigate factors that influence the accuracy of event frequency recall. Recall accuracy is hypothesized to vary as a function of attributes of the child and attributes of the questionnaire. Specifically, the study will examine the accuracy of event frequency reports as a function of child age, child metamemory ability, and child distractibility using decomposed and undecomposed questionnaires.

Three hypotheses are considered. First, differences in the accuracy of children's event frequency recall were predicted on the basis of child age. Consistent with previous findings concerning age related differences in memory (Schneider, 2010), I expected older children (i.e., 4th and 5th graders) would provide more accurate reports of the frequency of events than younger children (i.e., 2nd and 3rd graders).

Second, differences in the accuracy of children's event frequency recall were predicted as a function of questionnaire format. Previous studies (Schuman & Presser, 1981) with adults have found that questionnaires with memory prompts resulted in more accurate reports of event frequency than questionnaires without memory prompts. I expected that responses to decomposed questionnaires would be more accurate than responses to undecomposed questionnaires.

Third, differences between cued and uncued questionnaires in the accuracy of event recall were predicted to vary as a function of age. Previous findings suggest that older participants, who have diminished memory capacity, are especially vulnerable to response scale properties (Knauper, Schwarz, & Park, 2004). Much the same is expected for young children. As a consequence, I predicted that differences between cued and uncued questionnaires in event frequency accuracy will be more pronounced in younger grade school children than in older grade school children.

Two confounding variables are considered. First, analyses will account for individual differences in metacognitive abilities. There are pronounced age-related differences in metacognitive abilities that may contribute to age-related trends in the accuracy of event frequency reports. To this end, analyses will include an assessment of metacognitive abilities as a covariate, to determine the degree to which memory strategies are responsible for age differences in memory performance across the two memory prompt conditions.

Second, analyses will account for individual differences in distractibility. There are proven age-related trends in distractibility that may contribute to age-related trends in the accuracy of event frequency reports. Analyses will include distractibility as a covariate, to determine the degree to which inattentiveness is responsible for age differences between memory performances in the two memory prompt conditions.

METHOD

Participants

Participants included 20 boys and 11 girls from the lower grades of elementary school ($M= 7.7$ years old, $SD= 0.56$) and 25 boys and 18 girls from upper grades of elementary school ($M= 9.7$ years old, $SD= 0.61$). Participants attend a suburban public school in the Southeastern United States. Students from the lower primary school (grades 2 and 3) were categorized into the younger age group. Students from the upper primary school (grades 4 and 5) were categorized into the older age group. Classroom teachers ($N= 8$) also participated.

Measures

Teacher reports

Metacognition and planning. Teachers completed the Junior Metacognitive Inventory (Sperling et al., 2002), which measured planning and organization for each student (Appendix A). The 3 items were rated on a scale ranging from 1(*low*) to 5(*high*). Item scores were averaged.

Distractibility. Teachers completed the distractibility subscale from the Child Behavior Scale (Ladd, 1996) which described attentiveness during class activities for each part student (Appendix B). The 3 items were reverse- scored. The items were rated on a scale ranging from 1(*low*) to 5(*high*). Item scores were averaged.

Self-reports

Metacognition and planning. Students completed the Junior Metacognitive Inventory (Sperling et al., 2002), which measured metamemory, academic planning and organization (Appendix C). The 12 items were rated on a scale ranging from 1 (*never*) to 3 (*always*). Item scores were averaged.

School Event frequencies. Students completed an event frequency questionnaire that was modeled on frequency measures used in previous studies (Winkielman et al., 1998). Each participant received a questionnaire with memory prompts at one assessment and a questionnaire without memory prompts at another assessment.

The questionnaire without memory prompts (Appendix D) asked participants to report the number of times each event occurred during the course of the school day: (1) reprimanded by the teacher; (2) worked together with another student in class; and (3) left the classroom. Participants were asked to report only events that occurred in the classroom. The number of events reported in each of the three categories was summed to create an uncued school event frequency score.

The questionnaire with memory prompts (Appendix E) asked participants to report the number of times the same three events occurred during the course of the school day. Each event category was accompanied by 2 to 4 specific prompts. Participants responded to 3 questions concerning the number of times they were reprimanded by the teacher: (1) leaving one's seat; (2) talking in class; and (3) disturbing others. Participants responded to 2 questions concerning the number the number of times they worked with other classmates: (1) an art project; and (2) a class assignment. Participants responded to 4 questions concerning the number of times they left the classroom: (1) to use the

bathroom; (2) drink water; (3) go to school office or sick room; and (4) run an errand for the teacher. Participants were asked to report only events that occurred in the classroom. The number of events reported in each of the three categories was summed to create a cued school event frequency score.

Observations

School event frequencies. Two research assistants observed classrooms to record the frequency of the school events recalled by students. Inter-rater reliability was calculated on the basis of approximately 20% of observations. Observers recorded the number of times each of three events occurred for each child: (1) reprimanded by the teacher; (2) worked together with another student; and (3) left the classroom. The coding sheet is presented in Appendix G. Inter-rater reliability between the two observers for the total number of school events observed was high (Kappa= 0.84). Inter rater reliability was good for each of the event categories: (1) reprimanded by the teacher (Kappa= 1.00); (2) worked with another student (Kappa=0.82); and (3) left the classroom (Kappa= 0.87).

Inaccuracy of self-reports. A self-report inaccuracy score was calculated for each participant in the uncued and cued conditions, overall and for the three event categories separately. A score of 0 reflected perfect agreement, greater scores reflected more inaccurate self-reports. The inaccuracy score represented the absolute difference of self-reported events frequencies minus observed event frequencies, divided by observed event frequencies: $|self - observed|/observed$. For instance, if the observer recorded 5 events and a participant recalled 3, the inaccuracy of self- report score would be $|5-3|/5$ or 0.40. Separate indices of self- report of inaccuracy were computed for the three categories:1) reprimanded by the teacher, 2) worked with classmates, 3) left the class room.

Direction of Inaccuracy of self-reports. A direction of inaccuracy of self-reports score was calculated to determine whether inaccuracy was due to under-reporting or over-reporting. Scores were calculated separately in the uncued and cued conditions, overall and for the three event categories separately (see calculation of inaccuracy of self-reports variable). The direction inaccuracy score represented the raw difference of self-reported events frequencies minus observed event frequencies, divided by observed event frequencies: $\text{self} - \text{observed} / \text{observed}$. A score of 0 reflected perfect agreement, greater scores reflected more inaccurate self-reports. Negative scores indicated that events were under-reported, whereas positive scores indicated that events were over-reported. For instance, if the observer recorded 5 events and a participant recalled 3, the direction of inaccuracy of self-report score would be $(5-3)/5$ or -0.40 . Separate indices of direction of inaccuracy of self-reports were computed for the three categories: 1) reprimanded by the teacher, 2) worked with classmates, 3) left the class room.

Procedure

All students in two classrooms in the 2nd through 5th grades were invited to participate. Parent consent and child assent was required for participation. The overall participation rate was 54.0% (lower primary school= 50.0%, upper primary school= 58.0%).

Observers were trained to record event frequencies in observing non-participating classrooms from the same school. Inter-rater reliability (Kappa= 0.80) was established before data collection began.

Classrooms were observed on two separate occasions, approximately 7 to 14 days apart (M= 8.1 days). Students were observed for the entire 6 hours that they were in the

classroom. Students were not observed during lunch, recess, or physical education. Events that happened outside the class were neither recorded by observers nor reported by participants. Students were observed unobtrusively. Seating charts with each student's name and seat location were used by observers to record the frequency of events experienced by each participant (See Appendix F).

Participants completed self-report questionnaires at the end of the school day. The order of the administration of the cued and uncued school event frequency questionnaires was counterbalanced. The investigator read questionnaires aloud to participants at the outset. Participants were instructed to only report events that occurred in the classroom. Teachers completed questionnaires within 1- 2 weeks after children completed the first set of questionnaires.

Plan of Analysis

To test the hypotheses that inaccuracy of self-reports varied with the type of questionnaire (cued or uncued) and the age group of the participant (older or younger), a repeated measures ANOVA was conducted. Memory prompt and age group were independent variables and inaccuracy of self-reports was the dependent variable. Next, to test the hypotheses that inaccuracy of self-reports within each of the three categories of events (i.e., reprimanded by teacher, working in pairs, and leaving classroom) varied with the type of questionnaire (cued or uncued) and the age group of the participant (older or younger), three separate repeated measures ANOVAs were conducted. Memory prompt and age group were the independent variables in each ANOVA. The dependent variables were the inaccuracy of being reprimanded by teacher

reported, the inaccuracy of working in pairs reported, and the inaccuracy of leaving the classroom reported.

To assess whether the direction of inaccuracy (under-reporting or over-reporting) varied as a function of questionnaire type (cued or uncued) and age group of the participant (older or younger), a repeated measures ANOVA was conducted. Memory prompt and age group were independent variables and direction of inaccuracy of self-reports was the dependent variable.

In separate supplemental analyses, metacognitive ability was added to the previous analyses as a covariate, to test whether differences in inaccuracy of self-reports were accounted for by metacognitive ability. This was repeated for the direction of inaccuracy of self-reports. Similarly, distractibility of the participant was added to the previous analyses as a covariate, to test whether differences in inaccuracy of self-reports and differences in direction of inaccuracy of reports were accounted for by distractibility.

RESULTS

Preliminary Analyses

Table 1 presents bivariate correlations between study variables. There were statistically significant correlations between the observed and reported number of events for participants in both the cued and uncued memory conditions. However, the association was stronger in the cued condition than the uncued condition, and the difference between these correlations was statistically significant, $Z = 2.87$, $p < .01$. Hence, the reports were more closely related to the observed number of events when prompts were provided. The numbers of observed events on the cued and uncued days were correlated positively, as were the number of reported events. There were no statistically significant differences in the magnitude of these correlations, $Z = 0.45$, $p = n.s.$ The teacher ratings of metacognition were negatively associated with teacher distractibility.

To rule out the possibility that number of observed events differed on days when cued and uncued questionnaires were administered, a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. The observed event frequency was the dependent variable. There were no statistically significant main effects or interactions between the variables.

Inaccuracy of self- reports

To test the hypothesis that inaccuracy of self-reports varied with the type of questionnaire (cued or uncued) and the age group of the participant (older or younger), a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. Inaccuracy of self- reports was the dependent variable. There was a main effect for memory prompt, $F(1, 70)= 55.35, p< 0.001$. A greater proportion of reports were inaccurate in the uncued condition ($M= 47.80, SD=20.04$) than in the cued condition ($M= 24.00, SD= 23.25$). There was also a main effect for age group, $F(1, 70)=16.46, p< 0.001$. Self- reports from the younger children ($M= 43.30, SD= 16.31$) were more inaccurate than reports by older children ($M= 28.50, SD=22.61$). Main effects were qualified by an interaction between memory prompt and age group, which was marginally significant $F(1, 70)=3.75, p= 0.06$. Neither the main effect of sex nor any interactions involving sex were statistically significant.

Follow up paired samples *t*- tests compared the magnitude of inaccuracy in cued and uncued conditions, separately for younger and older children. Differences were significant in both age groups, with higher rates of inaccuracy in the uncued than in the cued condition. The size of the effect was more than twice as great in the younger age group ($d= 1.66$) than in the older group ($d= 0.54$).

Follow up independent samples *t*-tests compared older and younger children on self- report inaccuracy, separately in cued and uncued questionnaire conditions. There were significant differences between younger and older children in the magnitude of inaccuracy in the cued condition ($d= 0.42$) and in the uncued condition ($d= 1.06$). In each

case younger children were more inaccurate than the older children. The magnitude of the difference in inaccuracies between older and younger children was more than twice as large in the uncued condition than in the cued condition. Figure 1 depicts the mean proportion of observed events inaccurately reported by younger and older children in the cued and uncued conditions.

Inaccuracy of self-reports within recall categories

Separate ANOVAs were conducted to examine age group and memory prompt differences in self-report inaccuracy within each of the three categories of recall.

Reprimanded by teacher. To test the hypothesis that inaccuracy of self-reports of teacher reprimanding varied with the type of questionnaire (cued or uncued) and the age group of the participant (older or younger), a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. Inaccuracy of self-reports for being reprimanded by teacher was the dependent variable. There was a main effect for memory prompt, $F(1, 70) = 6.45, p = 0.01$. A greater proportion of self-reports were inaccurate in the uncued condition ($M = 60.90, SD = 48.73$) than in the cued condition ($M = 40.50, SD = 51.00$). There was also a main effect for age group, $F(1, 70) = 7.70, p = 0.007$. Self-reports from the younger children ($M = 62.30, SD = 39.34$) were more inaccurate than self-reports from the older children ($M = 39.10, SD = 51.87$). Main effects were qualified by an interaction between memory prompt and age group, $F(1, 70) = 8.77, p = 0.004$. Neither the main effect of sex nor any interactions involving sex were statistically significant.

Follow up paired samples *t*- tests compared the magnitude of inaccuracy for self-reports of being reprimanded by teacher in the cued and uncued conditions, separately for younger and older children. There were no statistically significant differences in older age group. In the younger age group, there were higher rates of inaccuracy in the uncued than in the cued condition ($d= 0.86$).

Follow up independent samples *t*-tests compared older and younger children on self- report inaccuracy of being reprimanded by teacher, separately in cued and uncued questionnaire conditions. There were no statistically significant differences between younger and older children in the magnitude of inaccuracy for self- reports of being reprimanded by the teacher in the cued condition ($d= 0.06$). Younger children were more inaccurate than older children in the uncued condition ($d= 1.07$).

Worked together with another student. To test the hypothesis that inaccuracy of self-reports of working with another student varied with the type of questionnaire (cued or uncued) and the age group of the participant (older or younger), a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. Inaccuracy of self- reports for working with another student was the dependent variable. There was a main effect for memory prompt, $F(1, 70)= 9.82, p= 0.003$. A greater proportion of self- reports were inaccurate in the uncued condition ($M= 57.20, SD=34.96$) than in the cued condition ($M=33.40, SD= 54.17$). There were neither main effects nor interactions involving age or sex.

Leaving the classroom. To test the hypothesis that inaccuracy of self-reports of leaving the classroom varied with the type of questionnaire (cued or uncued) and the age

group of the participant (older or younger), a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. Inaccuracy of self-reports for leaving the classroom was the dependent variable. There was a marginally significant main effect for memory prompt, $F(1, 70) = 3.59, p = 0.06$. A greater proportion of reports were inaccurate in the uncued condition ($M = 42.50, SD = 30.21$) than in the cued condition ($M = 31.20, SD = 39.19$). There was also a main effect for age group, $F(1, 70) = 4.20, p = 0.04$. Self-reports from the younger children ($M = 43.10, SD = 25.22$) were more inaccurate than self-reports from the older children ($M = 30.60, SD = 39.56$). Neither the main effects of sex nor any interactions involving sex were statistically significant.

Direction of Inaccuracy of self-reports. To test the hypothesis that the direction of inaccuracy (under-reporting or over-reporting) varied as a function of questionnaire type (cued or uncued) and age group of the participant (older or younger), a 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted. Memory prompt was the within subject factor. Age group was the between subject factor. The direction of inaccuracy of self-reports was the dependent variable. There was a main effect for memory prompt, $F(1, 70) = 52.5, p < 0.001$. A greater proportion of reports were under-reported in the uncued condition ($M = 44.92, SD = 25.35$) than in the cued condition ($M = 19.08, SD = 24.16$). There was also a main effect for age group, $F(1, 70) = 16.81, p < 0.001$. Younger children under-reported ($M = 41.80, SD = 18.65$) events more than older children ($M = 24.40, SD = 25.91$). The interaction between memory prompt and age group was marginally significant, $F(1, 70) = 2.65, p = 0.10$.

Neither the main effects of sex nor any interactions involving sex were statistically significant.

Follow up paired samples *t*- tests compared direction of inaccuracy of self- reports in cued and uncued conditions, separately for younger and older children. Differences were statistically significant in both age groups, with higher rates of under- reporting in the uncued than in the cued condition. The magnitude of the difference was larger in the younger age group ($d= 1.43$) than in the older age group ($d= 0.57$).

Follow up independent samples *t*-tests compared older and younger children on the direction of inaccuracy of self- reports, separately in cued and uncued questionnaire conditions. There were statistically significant differences between younger and older children. Younger children under-reported events more than older children in the cued condition ($d= 0.42$) and in the uncued condition ($d= 1.06$). The magnitude of the difference in was more than twice as large in the uncued condition than in the cued condition. Figure 2 depicts the mean proportion of observed events under reported by younger and older children in the cued and uncued conditions.

Supplemental analyses.

Supplemental analyses were conducted to determine whether age group differences in the degree to which self- reports varied across cued and uncued conditions were a product of metamemory or distractibility. Separate 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVAs were conducted, with self- reported and teacher reported metamemory as covariates. Memory prompt was the within subject's factor. Age group was the between subject's factor. The magnitude of

inaccuracy was the dependent variable. The same pattern of statistically significant results emerged.

A 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted, with teacher reported distractibility as a covariate. Memory prompt was the within subject's factor. Age group was the between subject's factor. The magnitude of inaccuracy was the dependent variable. The same pattern of statistically significant results emerged.

Supplemental analyses were conducted to determine whether age group differences in the direction of inaccuracy of self- reports across cued and uncued conditions were a product of metamemory or distractibility. Separate 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVAs were conducted, with self- reported and teacher reported metamemory as covariates. Memory prompt was the within subject's factor. Age group was the between subject's factor. The direction of inaccuracy of self- reports was the dependent variable. The same pattern of statistically significant results emerged.

A 2 (sex) by 2 (memory prompt: uncued and cued) by 2 (age group: older and younger) ANOVA was conducted, with teacher reported distractibility as a covariate. Memory prompt was the within subject's factor. Age group was the between subject's factor. The direction of inaccuracy of self- reports was the dependent variable. The same pattern of statistically significant results emerged.

DISCUSSION

Previous studies have shown that making small changes to self-report measures of event frequency can lead to major changes in the results obtained (Schwarz, 1999). The current study examined how the accuracy of event frequency reports is affected by the child's age and the inclusion of memory prompts. Children's self-reports of being reprimanded by the teacher, of working in groups, and of leaving the classroom during a school day were compared with observations of the same events. The results indicate that memory prompts improved the accuracy of children's frequency reports of everyday events, especially for young children (ages 7 to 8 years). Metamemory and distractibility were not responsible for age –group differences

Memory prompts improve accuracy

Memory prompts are an important aid to event recall. In the current study, differences in the accuracy of younger and older children's event frequency reports were assessed using a decomposed self-report measure that included specific memory cues prompting recall for behaviors, and a non-decomposed self-report measure that did not have any memory cues. As expected, the reports of both younger and older children were more accurate when memory prompts were provided. This was true for all three behaviors assessed. Previous studies of conflict among adults and children indicated that questionnaires with memory prompts yielded greater estimates of interpersonal conflict than questionnaires without memory prompts (Dirghangi, Laursen, Puder, Bjorklund, &

DeLay, 2012), but these studies did not measure the actual rate of conflict so it was not clear if increased estimates translated into increased accuracy. The current findings confirm suspicions that failure to provide memory prompts leads to under-reporting. Put simply, reports about the frequency of these common events are more accurate for questionnaires with memory prompts than for questionnaires without memory prompts.

Strategies for encoding and recall were not specifically assessed, so I can only speculate as to why memory prompts improved the accuracy of frequency reports. Previous work suggests that memory cues provide important information about the context in which an event may have occurred, thus making the retrieval of information about event occurrence easier. For instance, cues can remind the respondent about the location of an event, or persons with whom the event was experienced. In addition, research with adults indicates that memory prompts improve recall accuracy by reducing the cognitive effort associated with enumeration, which promotes a counting strategy that is more accurate than estimation (Menon, 1997). Findings from the present study suggest that something similar may be at work among children. The finding that respondents reports converged on observer reports when memory prompts were provided lends support to the view that decomposed questions make it easier to recall and count events, and harder to forget them. I will consider each in turn.

Memory cues may encourage counting and discourage estimation. When cues are provided, a broad category is broken into subcategories. Presumably, it is easier to enumerate events within subcategories than with one broad category, because there are fewer events to be recalled and because the subcategories serve as memory aids. Memory cues thus promote counting by reducing both the number of events to be recalled and the

cognitive effort associated with remembering them. Confronted with a potentially large number of events, respondents may be tempted by estimation, which can be unreliable. Individual episodes that are neither distinct nor memorable are laborious to count. Respondents who turn to estimation strategies may decide to retrieve specific instances of event occurrence from memory and then extrapolate the rate of occurrence. Faulty base rate estimation of an event invariably leads to inaccurate total event frequency estimates (Laursen et al., 2012). Estimation does not systematically lead to over-reporting or under-reporting, only to inaccurate reporting.

Memory cues improve retrieval, which is another way of saying that they help to prevent forgetting. The accessibility of both memory- based information and contextual information is important to accurate retrieval. Contextual cues are especially salient when memory based information is not readily accessible (Menon, Raghubir, & Schwarz, 1995). In the present study, contextual cues appeared to enhance retrieval for respondents who were unable to access information about event frequency directly from memory. Memory cues provide confirmatory information too. Even when memory- based information about the frequency of events is accessible, cues help respondents verify the veracity of responses. Some memory cues may also help protect against recency effects, which can prejudice event counts that are biased in time (Menon, 1997). Memory cues that draw the respondent's attention to a variety of situations may prompt recall of events that are less accessible than those recently occurring.

When discussing whether decomposition improves recall, it is important to consider the regularity with which an event occurs. The time period between two occurrences of a regular behavior is less variable than the time period between the

occurrences of irregular behaviors. Hence, the more irregular a behavior, the more difficult it is to predict its occurrence. Menon (1997) found that among adults, decomposed questions improved recall accuracy of events that occurred at irregular intervals. Regular events can be easily recounted via estimation. This is not the case with irregular events, which are more accurately measured via enumeration. Hence, memory cues in the form of decomposed questions support counting, which improves the accuracy of the recall of events that do not arise at regular intervals.

All three behaviors assessed in the current study (i.e., being reprimanded by the teacher, working in groups, and leaving the classroom) presumably occurred at irregular intervals. None occurred on a schedule or with a particular periodicity. Participants who attempted to estimate the frequency of each behavior based on their base rate of occurrence, would have misreported events. Extending findings from adults (Menon, 1997), I found that cues improved the accuracy of child reports of all three irregular behaviors. The present study has the added advantage of employing a within subjects' design for the memory cue condition, which is a higher level of proof than the between subjects design that Menon (1997) employed, because in this case, the same participants reported about similar number of events, more accurately on the questionnaire with memory prompts than the one without prompts. In the between subjects design, different individuals reported on events in the two memory conditions, leaving open the possibility that accuracy of reports with memory prompts was an artifact of subject factors and not the memory cues provided. Thus, the within subjects design increases confidence in findings that indicate that memory prompts enhance accuracy of frequency reports.

Age related changes in event frequency

Frequency reports from older children (age 9- 10) were less inaccurate than those of younger children (age 7- 8). Previous studies have also documented increases in children's memory performance from childhood to early adolescence, especially in memory for facts and events (Schneider, 2010). Substantial improvements are found in children's explicit memory, such that after age 6 and continuing through elementary school, episodic memory is strengthened (Lloyd, Newcombe & Balcombe, 2011). Most previous studies of the development of children's episodic memory has relied primarily on free recall or paired associate learning tasks of verbal stimuli. The present study is unique in that it is one of the first to address questions regarding their memory for the frequency of experienced events. In this regard, the current study extends previous results to a novel memory task. As expected, older children were less likely to under- report event frequencies than younger children.

What accounts for age-related improvements in reporting accuracy? Again, because the current study did not measure input or retrieval strategies, I can only speculate as to what might be driving these apparent changes. Generally, age-related improvements in episodic memory are attributed to the acquisition of successive improvements in memory strategies and knowledge about these strategies (Schneider & Bjorklund, 1998). Superior metacognitive skills are often linked with superior cognition, and younger children display less knowledge of their cognitive processes than older children. One aspect of metacognition is metamemory, the knowledge about one's own memory. I hypothesized that metamemory skills may be responsible for age differences in the impact of questionnaire format on event frequency recall. Previous studies have found that

improvements in metamemory abilities contribute to related improvements in memory performance (Schneider, 1985). However, I found no evidence that metamemory improvements were responsible for age-related improvements in children's memory performance. Although null findings must be interpreted with caution, these findings are not the first to suggest that there is no association between metamemory and memory performance. For instance, Cavanaugh and Borkowski (1980), administered metamemory tests as well as memory tests to first, third and fifth graders. They found that despite improvements in memory performance and metamemory, better metamemory did not predict better memory performance. In a meta-analysis of empirical studies on the relation between metamemory and memory performance, Schneider (1985) found a modest correlation between the two variables. Some evidence indicates that metamemory is more important to the memory performance of older children (over 10 years of age) than to that of younger children (Hasselhorn, 1992, Schneider, 1998), which may help to explain the absence of an effect in the current study.

Null findings may also be a product of the metamemory task administered in the present study. Metamemory skills may be divided into two categories: *declarative metamemory*, which includes the relatively stable factual knowledge about memory, and memory strategies, and *procedural metamemory*, which includes subconscious skills like monitoring self-regulation during memory tasks (Flavell & Wellman, 1977). Declarative metamemory describes knowledge about characteristics of memory abilities (i.e., mnemonic self-concept), knowledge about the nature of memory tasks, and knowledge about memory strategies that could be useful. The procedural component of metamemory, on the other hand, pertains to memory monitoring and self-regulation

abilities, often used during memory tasks (Baker & Brown, 1984; Schneider & Bjorklund, 1998). Procedural metamemory relies on the child's ability to process information in an efficient manner with assistance from the executive control system. Given developmental improvements in executive functioning, some have suggested most age-related change in metamemory unfold in the area of procedural metamemory skills that rely on executive functioning (Baker & Brown, 1984). Unfortunately, the self- and teacher reported measures of metamemory used in the current study assessed knowledge of memory, use of memory strategies, and success with these strategies, all of which are part of declarative metamemory. Future studies attempting to explain age-related differences in event frequency accuracy should explicitly assess procedural metamemory skills like self-regulation or memory monitoring, perhaps using a memory monitoring task.

There are other sources of age related differences in the accuracy of children's memory for events experienced. Differences could be a product of encoding abilities. Encoding reflects the ability to process information quickly and efficiently, ignoring irrelevant information that may be competing for attention. Differences could be a product of retrieval abilities. Retrieval depends, in part, on the quality of information encoded, as well as on the way it is processed and stored. One factor such that affects encoding as well as recall is distractibility or inattentiveness. Previous studies have documented age related improvements in resistance to competing stimuli (Diamond & Taylor, 1996). Other studies indicate that children are better able to demonstrate focused attention with age (Lane & Pearson, 1982). I hypothesized that age differences in the accuracy of event frequency reports could be attributed, in part to decreased

distractibility. This hypothesis was not supported. The same pattern of results was found with and without controls for distractibility.

Although null findings must be interpreted with caution, it must be noted that the current measure of distractibility did not directly assess the child's ability to resist against interfering stimuli. Instead, teachers provided reports of classroom behavior, which may not adequately reflect the child's ability to attend to information. Hence, null findings may be because the measure of distractibility did not adequately tap into the underlying encoding and retrieval processes that are responsible for age-related improvements in event frequency reports. A measure of executive control may better explain these differences. The processes that regulate attention during encoding and retrieval of information underlie executive function or executive control. The executive control guides what is done with information one encounters as well as recalls from long term memory. Executive control is also closely related to other important information-processing skills like 1) working memory, the amount of information that can be held in one's short term memory at a time; 2) inhibition to unrelated stimuli; and 3) cognitive flexibility to switch between different tasks (see Zelazo et al., 2008). Hence, future studies could use measures of executive control that assess children's working memory ability or resistance to interference. This could better explain these age differences see here.

Finally, there may have been differences in the way in which younger and older children organized event information, and these differences may be related to ease of recall. Older children are more likely to use organizational strategies like clustering, wherein similar events or items are grouped into categories. Pre-school and early

elementary school age children do not typically organize information by categories or recall them in clusters (Schwenck, Bjorklund, & Schneider, 2009). Older children organize information by categories or meaning, which results in better retrieval (Best & Ornstein, 1986). The current study did not investigate organizational strategies, so it is not clear whether they contributed to age differences in event recall. Future scholars should assess if older and younger children use different organizational strategies in event frequency recall tasks, hence better explaining the age differences in event recall accuracy seen here.

Age related improvements in report accuracy: The interplay between memory prompts and age

There is reason to suspect that memory prompts may be more effective in some age groups than in others. Previous studies have shown that older and younger adults are differentially susceptible to measurement scale properties when reporting mundane and salient events (Knauper, Schwarz & Park, 2004). Older adults increasingly rely on scale properties to inform their judgments as their memory for events declines. Similar age differences in estimates about the frequency of mobile phone usage have been documented, such that younger adults' reports are more accurate than older adults' reports (Abeebe, Beullens, & Roe, 2013). Age group differences varied as a function of the way the questions were asked and the recall period employed. The present study is the first to determine if there are age related differences during childhood in the impact of questionnaire characteristics on frequency reports. The findings indicate that differences between cued and uncued reports were greater for younger children than for the older children. Younger children showed more improvement in the accuracy of frequency

reports when provided with memory cues compared to the older children. Older children's accuracy for event recall was also bolstered by memory prompts, but the difference between the cued and the uncued conditions was relatively small compared to that found among younger children.

Differences in memory strategies employed may be responsible for age differences in the degree to which memory cues promote accuracy of frequency reports. Memory strategies are deliberate cognitive operations that serve to achieve a goal, in this case, event frequency recall. Age related improvements in working memory, knowledge about the task at hand, and metamemory can be attributed to developmental as well as individual differences in children's use of memory strategies. Working memory and the successful use of memory strategies are associated; older children with better working memory have greater mental resources, enabling them to use memory strategies more effectively as they solve problems (Lehmann & Hasselhorn, 2007). Strategy use is also associated with knowledge about memory problems (Ornstein & Naus, 1985), which increases with age. Older children employ more memory strategies on cognitive tasks than younger children. However, younger children can be taught to use strategies, and their performance will improve. For instance, young children's performance on a memory test for words can be enhanced simply by telling them that rehearsing words can improve recall (Ornstein, Naus, & Stone, 1977). This implies that younger children have a strategy production deficiency: they can use strategies but they tend not to without prompting (Flavell, 1977). The current findings are consistent with this phenomenon, wherein recounting events within memory prompt categories is equivalent to the use of a recall strategy. Without memory prompts, older children were less inaccurate than

younger children. When memory prompts were provided, the performance of younger children improved dramatically. Some older children may have been using of memory prompts in the unprompted condition, but the findings suggest that young children were not.

These findings add to our understanding of frequency reports provided by children. First, the findings reveal that younger children's deficits in memory performance on the event frequency task may be based in retrieval deficits, since their performance can be bolstered by providing memory cues. Thus, young children can and do encode event frequencies, which can be accessed by providing appropriate memory aids during recall. Does this mean that deficits in retrieval alone account for the age differences between older and younger children's event frequency reports? If this were the case, then the performance of younger children would be as accurate as that of older children when prompts were provided. This was not the case. Younger children were still more inaccurate than older children. The findings suggest that memory prompts reduce the gap in the accuracy of frequency reports, but older children retain an advantage over younger children, perhaps because they can use the prompts better and more efficiently. Their superior performance could also be because of better encoding abilities and other age-related increments in cognitive, especially memory abilities (Schneider, 2010).

Implications

These findings have important implications for developmental scholars, researchers studying consumer behavior, clinicians, and policy makers who rely on event frequency reports. The results indicate that decomposed cues facilitate the accuracy of recall for behaviors that would otherwise be under-reported. This effect is especially

salient for younger children, whose recall is more susceptible to under-reporting without memory prompts. Concerns about the accuracy of event frequency reports are well founded, with considerable evidence that people often are poor judges of event frequencies. To cite one dramatic example, Menon (1993) found that the amount of inaccuracy associated with a frequency report may be as high as 130% for a behavior that was inaccurately reported. As noted by these authors, such enormous levels of inaccuracy in frequency estimates can prove costly for sales executives or marketing researchers, who rely on frequency reports for evaluating or promoting brands. In a similar vein, a study assessing self-reported mobile phone use found discrepancies between actual and reported number of calls (Abeele, Beullens, & Roe, 2013), which could be detrimental for epidemiological studies that assess effects of radio frequency radiation on health outcomes (Inyang, Benke, McKenzie, & Abramson, 2008). Similarly, decisions about the effects of mobile phone usage in psychological or sociological research warrant accurate assessment of such usage (Boase & Ling, 2013). Results from the present study indicate that concerns about self-reports are compounded by consideration of age.

The findings from the current study show that providing memory prompts to elementary school children can improve reporting in young children who are otherwise inaccurate in the recollection of mundane events. This has important implications for developmental scholars who assess age related increments in varied domains of children's experiences, like interpersonal conflict and depression, using self-reports that often do not include memory prompts. The finding that older children's reports on uncued measures is better raises the possibility that some of what appear to be age-related increases in experiences may instead be an artifact of changes in the ability to

recall experiences in uncued questionnaires. For instance, increases in interpersonal conflict as children reach adolescence are attributed to relationship changes during this period (Laursen & Collins, 1994). But in light of the current findings, it is possible that recall abilities are confound with relationship changes. Age-related differences in event frequencies were especially pronounced in the uncued questionnaires, implying that much of the increase in the reported frequency of events may be due to improvements in the ability to remember them. Other areas within developmental psychology may benefit from a similar examination of assumptions underlying age-related changes in event frequencies. These findings show that developmental changes in frequency reports cannot be divorced from developmental changes in recall abilities.

The findings have implications for clinical practitioners who depend on children's self-report of psychological events like depression, bullying, or exposure to violence. For instance, the Violence Exposure Scale for Children (VEX- R; Fox & Leavitt, 1996) is a self-reported measure assessing the frequency of violent events that elementary school children witness in a given recall period. Similarly, measures assessing the incidence of bullying behavior often call for estimates of how often a child was a victim of or a witness to bullying (see Fekkes, Pijpers & Verloove- Vanhorick, 2005). The Sleep Self-report (SSR; Owens, Maxim, Nobile, McGuinn, & MSall, 2000) is a retrospective sleep survey used for assessing frequency of sleep disturbances in elementary school students. All of these measures rely on the accuracy of children's self-reports of event frequencies. In the past, scholars have doubted the accuracy of such data, especially from younger children (Bruck, Ceci, & Hembrooke, 1998). The current results show that without memory prompts, events may be underreported, especially among young children. This

may result in inaccurate clinical assessments as some children may go undiagnosed. However, the good news appears to be that inaccuracy can be reduced substantially by including memory prompts to facilitate accurate recall of event frequency.

The finding that accuracy of reports is dependent on memory prompts is a double-edged sword. On the one hand, by including cues, scholars are empowered to enhance recall of events that respondents may have otherwise forgotten. On the other hand, by including cues, scholars may inadvertently bias respondents to think only about the instances of events that are enlisted as cues, as opposed to enhancing recall for all possible occurrences of events. This phenomenon whereby “cues given during recall are associated with poorer recall of items that are not cued in comparison to a control group that did not receive these cues” is called the part- list cueing effect (Menon, 1997; Lynch & Srull, 1982). Part-list cueing effects can be resolved by conducting exhaustive pilot tests in order to develop decomposition categories that capture a maximum number of domains of event occurrence without overlapping, which could result in over-reporting of events (Menon, 1997). Respondents may report an event more than once for similar categories. To avoid this, instructions on self- reports must direct respondents to count each event only once, under the best fitting category.

Limitations and areas for future research

This study is not without limitations, the first of which pertains to the cross-sectional nature of its design. Even though differences in the accuracy of event frequency reports were documented between older and younger school children, these differences can only be ascribed to developmental changes with a longitudinal design. Although I find age related differences in reporting accuracy, which supports the notion that

developmental phenomena are at work, I did not find anticipated age- related differences in metamemory or in distractibility, so I cannot rule out the possibility that the groups were not representative of the ages sampled.

A second concern is the extent to which the findings can be generalized to behaviors outside of the classroom. The current study compared objective frequencies of events with self- reported frequencies of the same events. For ease of measurement, events that occurred during the school day were assessed. Additional studies are needed that corroborate these findings with reports of events experienced at home and elsewhere. This may be especially important in furthering our knowledge about the accuracy of children's reports about psychologically significant events, such as the frequency of parent- child conflict. Emotional events, such as interpersonal conflict, receive special prominence in memory, probably due to greater attention bestowed upon these events during encoding as well as better memory consolidation for them afterwards, so it remains to be seen if age related differences in free event recall would still be found for emotionally salient events (Anderson, Wais, & Gabrieli, 2006).

Additionally, it is possible that some events may have been interpreted differently by respondents and observers, leading to discrepancies between actual and reported frequency of events. For instance, in a study assessing interobserver agreement in the measurement of parent- adolescent conflict, self- reports of conflict provided by adolescents and parents varied significantly from those of observers (Gonzales, Cauce, & Mason, 1996). In the present study, reporter biases could be incorrectly attributed to recall inaccuracy of events. The high levels of inter-rater reliability suggest that adults, at least, had a similar understanding of the events to be recounted. It remains to be seen if

child observers would agree. Additional studies obtaining both actual frequencies and reported frequencies of events from the respondents themselves will bolster these results. One way of obtaining the actual frequency of experienced events from respondents may be by using diaries.

The finding that memory prompts enhance reporting accuracy was explained in terms of memory strategy such that prompts promoting enumeration was a recall strategy. However, this study did not directly assess recall strategies. Hence, a next step could be to obtain self-reports of strategies that children used to report event frequency. Additionally, a measure of cognitive effort could be obtained, asking respondents to report how difficult the task of providing a frequency judgment was to test if prompts reduced the cognitive load of enumerating event frequencies. Also, the inclusion of an explicit measure of free recall abilities is an important next step. Improved memory is only one of several cognitive and interpersonal changes that take place during this time period. Few of these changes speak to the differences found between reports from cued and uncued questionnaires, but the absence of a plausible alternative explanation does not prove my position.

In the current study, a one day reference period was employed. Event frequency questionnaires often use longer reference periods (a week or a month), so it is not clear whether the findings generalize to other time frames. Presumably, memory prompts are even more important for longer reference periods because events over longer periods may be even less accessible to children. Future studies should assess whether decomposing questions improves event reports over extended periods of recall, especially among young participants.

Conclusion

Self-reports are a convenient means of obtaining information about the rates of occurrence of an event. The benefits of convenience, however, may be undermined by threats to the quality and accuracy of the reports obtained. The accuracy of event frequency reports is rarely suspected because the questions hold considerable face validity. The results indicating that answers to event frequency questions depend on how questions are asked should caution investigators, because the accuracy of the reports varies with questionnaire type as well as age. Even though these findings are specific to age-related accuracy in event frequency of everyday school events, the conclusions may be applicable to all manner of self-reported events that vary across childhood and into adolescence.

Table 1.

Descriptive Statistics and Bivariate Correlations.

Variable	1	2	3	4	5	6	M	SD
<i>Cued condition</i>								
1. Observer reported event frequency							7.62	2.35
2. Self- reported event frequency	0.78**						6.10	2.79
3. Observer reported event frequency	0.25*	0.20					8.08	2.36
4. Self- reported event frequency	0.19	0.32**	0.51**				4.36	2.27
5. Teacher reported metamemory	-0.39**	0.19	0.09	0.10			3.86	1.09
6. Self- reported metamemory	0.01	-0.12	0.01	-0.06	-0.08		2.22	0.34
7. Teacher reported distractibility	-0.19	-0.01	-0.08	0.01	-0.60**	0.03	2.28	1.10

Note. $N = 74$. Self- reported and teacher reported metamemory scores range from 1(*low*) to 5 (*high*).

Teacher reported distractibility scores range from 1(*low*) to 5 (*high*).

* $p < 0.05$, ** $p < 0.01$ two tailed

Figure 1. Mean proportion of observed events inaccurately recalled by older (n=43) and younger (n=31) children in the cued and uncued questionnaire conditions.

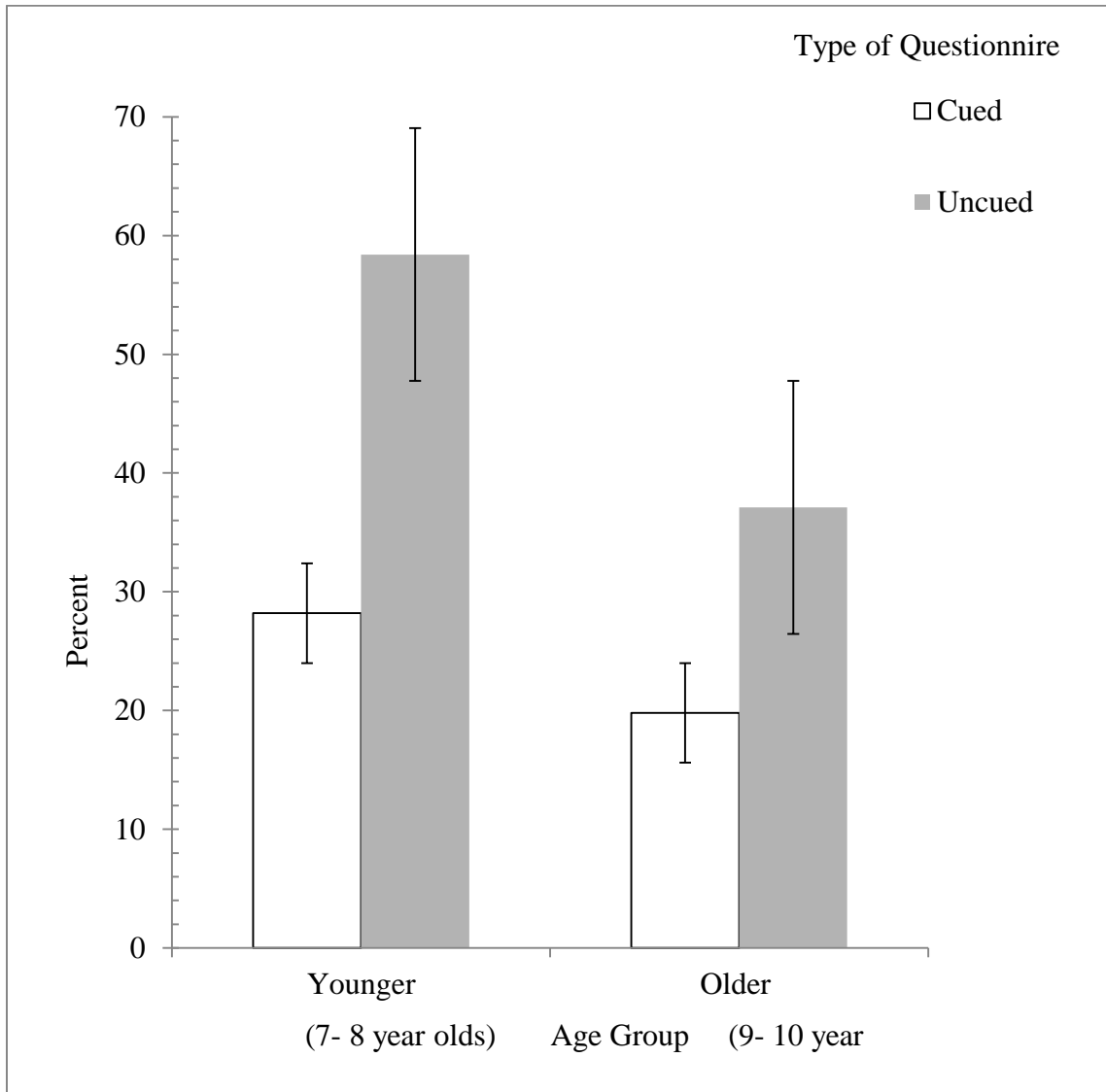
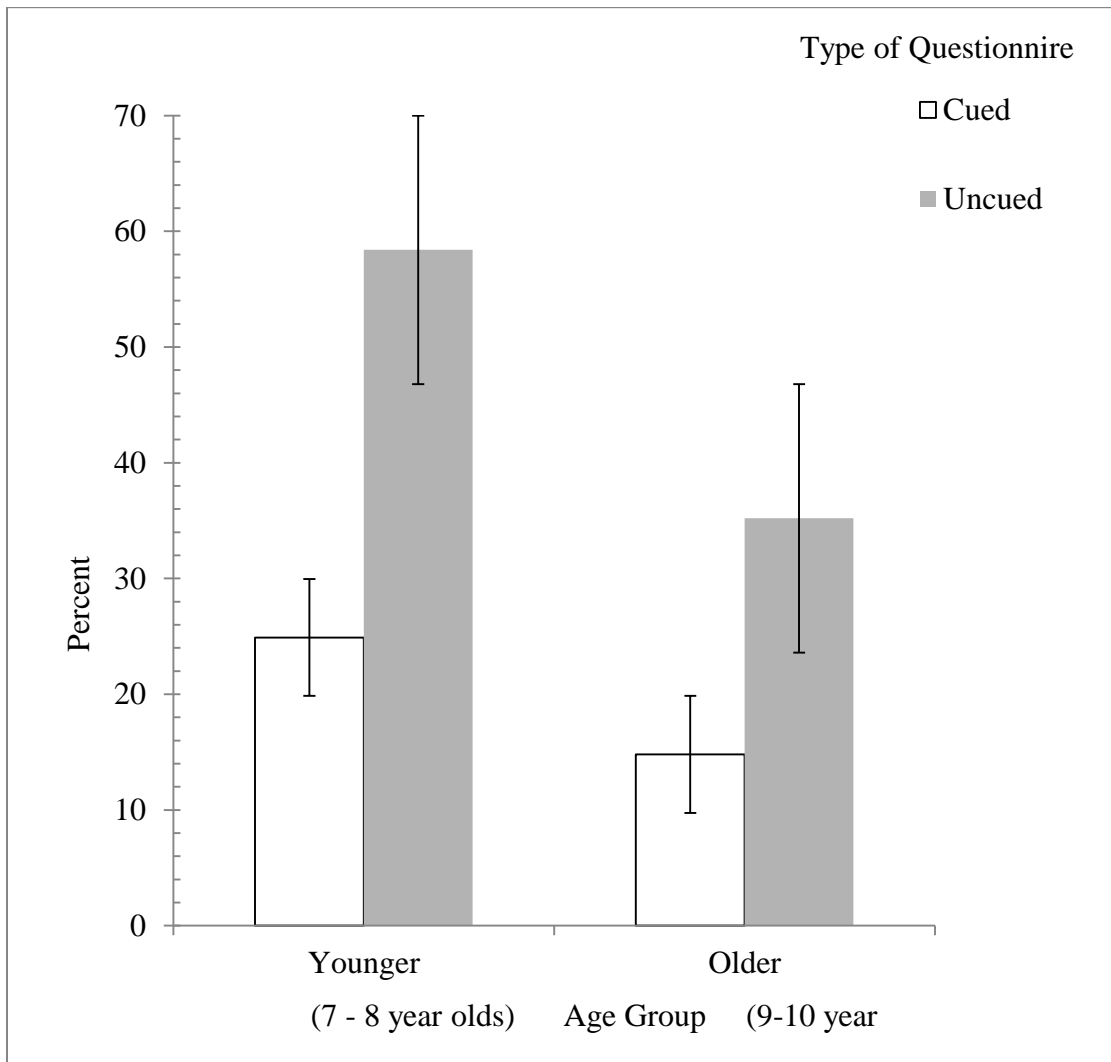


Figure 2. Mean proportion of observed events under-reported by older (n=43) and younger (n=31) children in the cued and uncued questionnaire conditions.



APPENDICES

APPENDIX A

Teacher reports of metacognitive ability

Metacognition refers to one's thinking about thinking or knowledge about knowing.

Listed below are some behavioral descriptors that would distinguish students who are HIGH and LOW in metacognition. Using the following scale from 1 - 5 where 1 signifies low and 5 signifies high, rate each student in your class regarding your best judgment of his or her level of metacognition.

Name: _____

1. Makes study plans	1	2	3	4	5
2. Judges own performance accurately	1	2	3	4	5
3. Asks questions to insure understanding	1	2	3	4	5

APPENDIX B

Teacher reports of student distractibility.

Listed below are some behavioral descriptors. Please rate the following students in your class on a scale ranging from 1(low) to 5(high).

Name: _____

- | | | | | | |
|---|---|---|---|---|---|
| 1. Keeps still in class | 1 | 2 | 3 | 4 | 5 |
| 2. Has good concentration, attention span | 1 | 2 | 3 | 4 | 5 |
| 3. Is attentive in class | 1 | 2 | 3 | 4 | 5 |

APPENDIX C

Meta memory Scale

We are interested in what you do when you study. For each sentence, please circle the answer that best describes you when you are doing schoolwork and homework.

1. I know when I understand something.

Never Sometimes Always

2. I can make myself learn when I need to.

Never Sometimes Always

3. I try to use ways of studying that have worked for me before.

Never Sometimes Always

4. I know what the teacher wants me to learn.

Never Sometimes Always

5. I learn best when I already know something about the topic.

Never Sometimes Always

6. I draw pictures or diagrams to help me understand while learning.

Never Sometimes Always

7. When I am done with my schoolwork, I ask myself if I learned what I wanted to learn.

Never Sometimes Always

8. I think of many ways to solve a problem and then choose the best one.

Never Sometimes Always

9. I think about what I need to learn before I start working.

Never Sometimes Always

10. I ask myself how well I am doing while I am learning something new.

Never Sometimes Always

11. I really pay attention to important information.

Never Sometimes Always

12. I learn more when I am interested in the topic.

Never Sometimes Always

APPENDIX D

School Event Frequency Questionnaire without memory prompts

How many times did the following things happen during class today?

- 1) You were scolded or punished by the teacher _____
- 2) You worked as a pair or group or participated in a group activity _____
- 3) You left the classroom during class _____

APPENDIX E

School Event Frequency Questionnaire with memory prompts

How many times did the following things happen during class today?

- 1) You were scolded or punished by the teacher in class
 - a) for talking in class _____
 - b) for leaving your seat _____
 - c) for disturbing others _____
 - d) other reasons _____

- 2) You worked as a pair or group or participated in a group activity in class.
 - a) on an art project _____
 - b) on a class task _____

- 3) You left class to
 - a) use the bathroom _____
 - b) drink water _____
 - c) go to the office or sick room _____
 - d) ran an errand for the teacher (helped teacher) _____

APPENDIX F

Seating chart in classroom for coding events

PT- Punishment for talking, PL-Punishment for leaving seat, PD- For disturbing others,

PO- Other reasons.

GArt- Group art work, GT- Group classwork

LR- Restroom, LW- Water break, LN- Office /Nurse, LE- Errand

Student ID 1
PT-//

Student ID 2
LE-/

Student ID 3
PD-//

Student ID 4
PT-/ PD-/

Student ID 5
LN-/

Student ID 6
PD-///

APPENDIX G

Observed School events frequency

Frequency of events	ID numbers from seating chart																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1) Teacher Reprimanding																		
1a) Talking																		
1b) Leaving seat																		
1c) Disturbing others																		
1d) Other reasons																		
2) Group activity																		
2a) Art Project																		
2b) Class Assignment																		
3) Left Class																		
3a) Restroom																		
3b) Water break																		
3c) Office or nurse																		
3d) Teacher errand																		

REFERENCES

- Abeebe, M. V., Beullens, K., & Roe, K. (2013). Measuring mobile phone use: Gender, age and real usage level in relation to the accuracy and validity of self-reported mobile phone use. *Mobile Media & Communication, 1*(2), 213-236.
- Anderson, A. K., Wais, P. E., & Gabrieli, J. D. (2006). Emotion enhances remembrance of neutral events past. *Proceedings of the National Academy of Sciences of the United States of America, 103*(5), 1599-1604.
- Baker, L., & Brown, A. L. (1984). Metacognitive skills and reading. In D. Pearson, M. Kamil, R. Barr & P. Mosenthal (Eds.), *Handbook of reading research*. (pp. 353-394). New York: Longman
- Baker-Ward, L., Gordon, B. N., Ornstein, P. A., Larus, D. M., & Clubb, P. A. (1993). Young children's long-term retention of a pediatric examination. *Child development, 64*(5), 1519-1533.
- Belli, R. F., Schwarz, N., Singer, E., & Talarico, J. (2000). Decomposition can harm the accuracy of behavioural frequency reports. *Applied Cognitive Psychology, 14*, 295–308.
- Best, D. L., & Ornstein, P. A. (1986). Children's generation and communication of mnemonic organizational strategies. *Developmental Psychology, 22*(6), 845- 853.

- Bjorklund, D. F. (1987). How age changes in knowledge base contribute to the development of children's memory: An interpretive review. *Developmental Review, 7*(2), 93-130.
- Bjorklund, D. F., & Douglas, R. N. (1997). The development of memory strategies. In N. Cowan (Ed.), *The development of memory in childhood*, (pp. 201-246). Hove, United Kingdom: Psychology Press.
- Bjorklund, D. F., Miller, P. H., Coyle, T. R., & Slawinski, J. L. (1997). Instructing children to use memory strategies: Evidence of utilization deficiencies in memory training studies. *Developmental Review, 17*(4), 411-441.
- Bjorklund, D. F., Dukes, C., & Brown, R. D. (2009). The development of memory strategies. In M. L. Courage & N. Cowan (Eds.), *The development of memory in infancy and childhood* (pp. 145–175). Hove, United Kingdom: Psychology Press.
- Bjorklund, D. F. (2010). Remembering on their own: The development of strategic memory. In H.-P. Trolldenier, W. Lenhard, & P. Marx (Eds.), *Das Gedächtnis entwickeln: Entwicklungs- und pädagogisch-psychologische Forschungen zum Gedächtnis (The development of memory: Research on memory in the fields of developmental and educational psychology)* (pp. 171–189). Göttingen, Germany: Hogrefe Verlag.
- Blair, E., & Burton, S. (1987). Cognitive processes used by survey respondents to answer behavioral frequency questions. *Journal of Consumer Research, 14*, 280-288.
- Bless, H., Bohner, G., Hild, T., & Schwarz, N. (1992). Asking difficult questions: Task complexity increases the impact of response alternatives. *European Journal of Social Psychology, 22*(3), 309-312.

- Boase, J., & Ling, R. (2013). Measuring mobile phone use: Self-report versus log data. *Journal of Computer-Mediated Communication, 18*(4), 508-519.
- Brown, N. R. (1995). Estimation strategies and the judgment of event frequency. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(6), 1539-1553.
- Brown, N. R. (2002). Encoding, representing, and estimating event frequencies: A multiple strategy perspective. In P. Sedlmeier & T. Betsch (Eds.), *Etc. frequency processing and cognition*, (pp. 37-53). New York: Oxford University Press.
- Brown, D., & Pipe, M. E. (2003). Individual differences in children's event memory reports and the narrative elaboration technique. *Journal of Applied Psychology, 88*(2), 195-206.
- Bruck, M., Ceci, S. J., & Hembrooke, H. (1998). Reliability and credibility of young children's reports: From research to policy and practice. *American Psychologist, 53*(2), 136-151.
- Bruck, M., & Ceci, S. J. (1999). The suggestibility of children's memory. *Annual review of psychology, 50*(1), 419-439.
- Burton, S., & Blair, E. (1991). Task conditions, response formulation processes, and response accuracy for behavioral frequency questions in surveys. *Public Opinion Quarterly, 55*(1), 50-79.
- Cavanaugh, J. C., & Borkowski, J. G. (1980). Searching for metamemory-memory connections: A developmental study. *Developmental Psychology, 16*(5), 441-453.

- Diamond, A., & Taylor, C. (1996). Development of an aspect of executive control: Development of the abilities to remember what I said and to “Do as I say, not as I do”. *Developmental psychobiology*, 29(4), 315-334.
- Dirghangi, S., Laursen, B., Puder, J., Bjorklund, D., & DeLay, D. (2012) *Self-reported interpersonal conflict varies with questionnaire format: Are age-related trends in disagreement what they seem?* Poster presented at the biennial meeting of the Society for Research on Adolescence, Vancouver, BC.
- Fekkes, M., Pijpers, F. I., & Verloove-Vanhorick, S. P. (2005). Bullying: who does what, when and where? Involvement of children, teachers and parents in bullying behavior. *Health Education Research*, 20(1), 81-91.
- Fiedler, K., & Armbruster, T. (1994). Two halves may be more than one whole: Category-split effects on frequency illusions. *Journal of Personality and Social Psychology*, 66(4), 633-645.
- Flavell, J. H. (1977). *Cognitive development*. (pp. 155- 172). Englewood Cliffs, NJ: Prentice Hall.
- Flavell, J. H., & Wellman, H. M. (1977). Metamemory. In R. V. Kail & J. W. Hagen(Eds.), *Perspectives in the development of memory and cognition*. (pp 3- 34) Hillsdale, NJ: Erlbaum.
- Foley, M. A., Ratner, H. H., & Gentes, E. (2010). Helping children enter into another's experiences: The look and feel of it. *Journal of Cognition and Development*, 11(2), 217-239.
- Fox, N. A., & Leavitt, L. A. (1996). Violence exposure scale for children-revised. Philadelphia: University of Pennsylvania.

- Geddie, L., Fradin, S., & Beer, J. (2000). Child characteristics which impact accuracy of recall and suggestibility in preschoolers: Is age the best predictor?. *Child Abuse & Neglect*, 24(2), 223-235.
- Gonzales, N. A., Cauce, A. M., & Mason, C. A. (1996). Interobserver agreement in the assessment of parental behavior and parent-adolescent conflict: African American mothers, daughters, and independent observers. *Child development*, 67(4), 1483-1498.
- Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of experimental psychology: General*, 108(3), 356-388.
- Hasselhorn, M. (1992). Task dependency and the role of category typicality and metamemory in the development of an organizational strategy. *Child Development*, 63(1), 202-214.
- Inyang, I., Benke, G., Mckenzie, R., & Abramson, M. (2008). Comparison of measuring instruments for radiofrequency radiation from mobile telephones in epidemiological studies: Implications for exposure assessment. *Journal of Exposure Science and Environmental Epidemiology*, 18(2), 134-141.
- Justice, E. M., Baker-Ward, L., Gupta, S., & Jannings, L. R. (1997). Means to the goal of remembering: Developmental changes in awareness of strategy use—performance relations. *Journal of experimental child psychology*, 65(3), 293-314.
- Knäuper B., Schwarz N., Park D. C. (2004). Frequency reports across age groups: Differential effects of frequency scales. *Journal of Official Statistics*, 20, 91–96.

- Ladd, G. W., & Profilet, S. M. (1996). The Child Behavior Scale: A teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Developmental psychology*, 32(6), 1008- 1024.
- Lane, D. M., & Pearson, D. A. (1982). The development of selective attention. *Merrill-Palmer Quarterly*, 317-337.
- Laursen, B., & Collins, W. A. (1994). Interpersonal conflict during adolescence. *Psychological Bulletin*, 115(2), 197-209.
- Laursen, B., Denissen, J., & Bjorklund D. F. (2012). Event frequency measurement. In B.Laursen, T. D. Little, & N. A. Card (Eds.), *Handbook of developmental research methods* (pp. 66-81). New York: Guilford
- Lehmann, M., & Hasselhorn, M. (2007). Variable memory strategy use in children's adaptive intratask learning behavior: Developmental changes and working memory influences in free recall. *Child Development*, 78(4), 1068-1082.
- Lund, A. M., Hall, J. W., Wilson, K. P., & Humphreys, M. S. (1983). Frequency judgment accuracy as a function of age and school achievement (learning disabled versus non-learning-disabled) patterns. *Journal of Experimental Child Psychology*, 35(2), 236-247.
- Lynch, J. G., & Srull, T. K. (1982). Memory and attentional factors in consumer choice: Concepts and research methods. *Journal of Consumer Research*, 9(1), 18-37.
- Menon, G. (1993). The effects of accessibility of information in memory on judgments of behavioral frequencies. *Journal of Consumer Research*, 20(3), 431- 440.
- Menon, G., Raghurir, P., & Schwarz, N. (1995). Behavioral frequency judgments: An accessibility-diagnosticsity framework. *Journal of Consumer Research*, 212-228.

- Menon, G. (1997). Are the parts better than the whole? The effects of decompositional questions on judgments of frequent behaviors. *Journal of Marketing Research (JMR)*, 34(3), 335-346.
- Menon, G., & Yorkston, E. A. (2000). The use of memory and contextual cues in the formation of behavioral frequency judgments. In A. A. Stone, J. S. Turkkan, C. A. Bachrach, J. B. Jobe, H. S. Kurtzman, & V. S. Cain (Eds.), *The science of self-report: Implications for research and practice* (pp. 63-79). Erlbaum: Mahwah, NJ.
- Miller, P. H. (1994). Individual differences in children's strategic behaviors: Utilization deficiencies. *Learning and Individual Differences*, 6(3), 285-307.
- Newcombe, N. S., Lloyd, M. E., & Balcomb, F. (2011). Contextualizing the development of recollection: Episodic memory and binding in young children. In S. Ghetti, & P. J. Bauer (Eds.), *Origins and development of recollection: Perspectives from psychology and neuroscience* (pp. 73–100). New York: Oxford University Press.
- Ornstein, P. A., Naus, M. J., & Stone, B. P. (1977). Rehearsal training and developmental differences in memory. *Developmental Psychology*, 13(1), 15- 24.
- Ornstein, P. A., Naus, M. J. (1985). Effects of the knowledge base on children's memory strategies. In H.W. Reese (Ed.), *Advances in child development and behavior*, (Vol. 19 pp. 113–148). New York: Academic Press.
- Ornstein, P. A., Shapiro, L. R., Clubb, P. A., Follmer, A., & Baker-Ward, L. (1997). The influence of prior knowledge on children's memory for salient medical experiences. *Memory for everyday and emotional events*, 83-111.

- Ornstein, P. A., Haden, C. A. (2002). The development of memory: Towards an understanding of children's testimony. In M.L. Eisen, G.S. Goodman, J.A. Quas (Eds.), *Memory and suggestibility in the forensic interview*, (pp. 29–61). Mahwah, NJ: Lawrence Erlbaum
- Owens, J. A., Maxim, R., Nobile, C., McGuinn, M., & Msall, M. (2000). Parental and self-report of sleep in children with attention-deficit/hyperactivity disorder. *Archives of pediatrics & adolescent medicine*, *154*(6), 549-555.
- Principe, G. F., Kanaya, T., Ceci, S. J., & Singh, M. (2006). Believing Is Seeing How Rumors Can Engender False Memories in Preschoolers. *Psychological Science*, *17*(3), 243-248.
- Reiser, B. J., Black, J. B., & Abelson, R. P. (1985). Knowledge structures in the organization and retrieval of autobiographical memories. *Cognitive psychology*, *17*(1), 89-137.
- Roebbers, C. M., & Schneider, W. (2001). Individual differences in children's eyewitness recall: The influence of intelligence and shyness. *Applied Developmental Science*, *5*(1), 9-20.
- Schimmack, U., (2002). Frequency judgments of emotions: The cognitive basis of personality assessment. In P. Sedelmeier and T. Betsch (Eds.), *Etc. frequency processing and cognition* (pp. 189- 204). New York: Oxford University Press.
- Schneider, W. (1985). Developmental trends in the metamemory-memory behavior relationship: An integrative review. *Metacognition, cognition, and human performance*, *1*, 57-109.

- Schneider, W., Bjorklund, D.F., (1998). Memory. In W. Damon, D. Kuhn, R.S. Siegler (Eds.), *Handbook of child psychology: Cognition, perception, and language*, 2, (pp. 467–521) New York: John Wiley.
- Schneider, W., Kron-Sperl, V., & Hünnerkopf, M. (2009). The development of young children's memory strategies: Evidence from the Würzburg Longitudinal Memory Study. *European Journal of Developmental Psychology*, 6(1), 70-99.
- Schneider, W. (2010) Memory development in childhood. In U. Goswami (Ed.), *Blackwell handbook of childhood cognitive development* (2nd ed., pp. 236- 256). London, UK: Blackwell.
- Schuman, H., & Presser, S. (1981). *Questions and answers in attitude surveys: Experiments in question form, wording, and context*. (pp. 297- 313). Thousand Oaks, CA: Sage.
- Schwarz, N. (1999). Self-reports: how the questions shape the answers. *American psychologist*, 54(2), 93- 105.
- Schwenck, C., Bjorklund, D. F., & Schneider, W. (2009). Developmental and individual differences in young children's use and maintenance of a selective memory strategy. *Developmental psychology*, 45(4), 1034- 1050.
- Shin, H., Bjorklund, D. F., & Beck, E. F. (2007). The adaptive nature of children's overestimation in a strategic memory task. *Cognitive Development*, 22(2), 197- 212.
- Sperling, R. A., Howard, B. C., Miller, L. A., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition. *Contemporary educational psychology*, 27(1), 51-79.

- Sudman, S., Bradburn, N., (1974). Response effects in surveys: A review and synthesis. *Monographs in social research. NORC.National Opinion Research Center* (16) (pp. 200- 230). Chicago:Aldine.
- Sudman, S., & Schwarz, N. (1989). Contributions of cognitive psychology to advertising research. *Journal of Advertising Research*, 29(3), 43- 53.
- Williams, K. W., & Durso, F. T. (1986). Judging category frequency: Automaticity or availability?. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12(3), 387.
- Winkielman, P., Knäuper, B., & Schwarz, N. (1998). Looking back at anger: Reference periods change the interpretation of emotion frequency questions.*Journal of Personality and Social Psychology*, 75(3), 719.

Zelazo, P. D., Carlson, S. M., & Kesek, A. (2008). The development of executive function in childhood. In C.Nelson & M.Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (2nd ed., pp. 553–574). Cambridge, MA: MIT Press.