Need for Cognition, Intelligence, and Aging

Heather Brooke Edwards

Faculty Advisor: Dr. Robin West

Abstract

This study examined the constructs of need for cognition and intelligence (using the constituent crystallized and fluid abilities that comprise overall intelligence) in relation to one another and over aging. Fifty young-old adults (54-69 years old) and 55 old-old adults (70-92 years old) were tested on a variety of measures, of which need for cognition, digit symbol (a measure of fluid intelligence), and vocabulary (a test of crystallized intelligence) were identified as outcome variables. The results suggest that need for cognition is significantly correlated to crystallized intelligence, need for cognition remains stable over aging, and fluid intelligence is best predicted by age.

My aging related research experience includes participation in a lab investigating beliefs and goals of individuals ranging from college age to elderly. Responsibilities in the lab include administering memory measures (e.g., the BTACT, the TICS) and other tasks over the telephone to old adults. As well, I have volunteer experience in the psychiatric inpatient unit at Shands Hospital. The majority of the patients in the unit are elderly, a large proportion of which suffer from some type of dementia. Interactions with these patients range from one-on-one conversations to participation in recreational group therapy sessions. Lastly, this research was done as a senior thesis. Dr. West was the supervisor. I began the literature review in early summer 2006 and finished the project in December of 2006.

Imagine a world of equal opportunities; everything from genetic endowment to all aspects of one's environment evidencing no biases. Then alter one factor, an individual's internal motivation to seek out challenging cognitive stimulation, in psychological terms, one's need for cognition. What implications would this one construct have for how that person would learn and function in daily life? Would it affect intelligence, as measured by both inherent abilities and culture-specific acquired knowledge? Additionally, what does the variance of such a construct mean for intelligence over the developmental lifespan? Such questions are not only personally interesting but also at the crux of understanding why cognitive decline in old age is neither a uniform nor universal phenomenon.

Need for cognition, a term originated by Cacioppo and Petty (1982), was defined as "the tendency of an individual to engage in and enjoy thinking" (as cited in Tidwell, Sadowski, & Pate, 2000). Initially studied in persuasion literature, need for cognition has as yet to illicit a cohesive and empirically supported literature base referencing its relationship to intelligence and cognitive functioning. Given such research limitations it is important to examine need for cognition and intelligence as individual constructs, as well as consider the available, though incomplete, associations evidenced in the current research.

The primary focus of the need for cognition literature has been the elaboration likelihood model of persuasion proposed by Cacioppo and Petty (1986). This model states that individuals high in need for cognition process arguments via a central route in which facts are carefully considered, whereas those individuals low in need for cognition act as cognitive misers, utilizing a peripheral route in which available heuristics (such as speaker status and argument delivery) are employed to evaluate arguments rather than factual quality (as cited in Dickhäuser & Reinhard, 2006). Thus, need for cognition is not tantamount to intellectual capacity but rather reflects a motivational aspect to acquire knowledge.

More recently, need for cognition research has included applications to the study of individual differences. Dickhäuser and Reinhard (2006) explored need for cognition's role in self-concept. Their results indicated that participants high in need for cognition made use of specific self-concepts (e.g., an individual's self-concept in math, as a specific domain of function) in assessing their expectancies of success, whereas those low in need for cognition relied on general self-concepts (e.g., overall appraisal of self). However, under particular conditions, expectancies of success were independent of the level of need for cognition. In particular, inducing high cognitive load (e.g., asking participants to remember a complex string of numbers while performing a second task) or high relevance (e.g., instructing participants that their self-ratings and actual performance will be compared) seemed to induce participants to employ specific self-concepts in assessing their expectancies of success, regardless of their need for cognition scores (Dickhäuser & Reinhard, 2006). Such studies point to need for cognition as a relatively stable dispositional construct; though its specific influence is neither independent nor invariant to situational factors (see also Cacioppo, Petty, Feinstein, & Jarvis, 1996).

Strengthening the view that need for cognition represents a dispositional trait, personality factors have been related significantly to need for cognition. Such research largely came about as a result of studies which discovered a negative correlation between need for cognition and age. Scholars assumed that what is cognitively important, and thus likely to be preserved through practice in old age, may differ from abilities which are intellectually required during young adulthood, when the acquisition of knowledge is paramount (Stuart-Hamilton & McDonald, 2001). Thus, in demonstrating a relationship between need for cognition and age, researchers incited further inquiry into possible covarying factors, including personality. For instance, Brown (2006) demonstrated that once personality factors are accounted for, the correlation between need for cognition and age is actually negligible. Further, using the NEO-PI-R as a personality measure and the Paced Auditory Serial Addition Task as a measure of persistence (a component of need for cognition), Brown (2006) discovered that both the openness to experience and conscientiousness domains of personality significantly predicted whether an individual was high or low in need for cognition. Likewise, Sadowski and Cogburn (1997) found a significant correlation between need for cognition and openness to experience, and a significant correlation between need for cognition and conscientiousness. These findings are consistent with the notion that individuals who score high in the openness to experience domain of personality tend to exhibit an increased level of curiosity and by extension a greater degree of tolerance, which explains their higher scores on need for cognition measures (Sadowski & Cogburn, 1997).

Interestingly, a link has also been made between personality and other intellectual abilities, suggesting, indirectly, a possible link between need for cognition and intelligence. Research by Baker and Bichsel (2006) reveals a relationship between cognitive functioning and the five factor personality domain of openness to experience. Specifically, three groups were delineated: young adults, older adults who were cognitively comparable to the younger adult group. and older adults who were cognitively superior to both groups. The measures consisted of the Big Five Personality Inventory and the Woodcock-Johnson III Tests of Cognitive Abilities. Results indicated that to fully understand the proposed relationship between intelligence and personality, one must examine the connection from a dynamic as well as developmental life-span perspective. For instance, crystallized intelligence was reliably predicted by the domain of openness to experience, but only for young adults (Baker & Bichsel, 2006). As a consequence of such parallel findings suggesting that need for cognition and intelligence are both related to a third variable (namely the openness to experience domain of personality), one can infer that need for cognition and intelligence may be related to each other.

Though the relationship between need for cognition and intelligence has been rarely examined directly and the findings lack extensive replication, a relationship between need for cognition and intelligence (both broadly defined and specifically conceptualized) has been examined in past research. For instance, need for cognition has been shown to be positively, but modestly correlated with broadly defined intelligence measures (Cacioppo et al., 1996). In addition, knowledge, as measured by a fact-specific multiple-choice test, was found to correlate significantly with need for cognition. Likewise, need for cognition and verbal ability were correlated significantly (Tidwell et al., 2000). These results suggest that need for cognition is at least somewhat important to the accumulation of knowledge (Tidwell et al., 2000). Likewise, it has been demonstrated by Stuart-Hamilton and McDonald (2001) that need for cognition correlates significantly with Piagetian tasks.

The relative lack of research literature examining the connection between need for cognition and intelligence, and some indication that developmental differences may be important for this relationship, drives the current research. This work explored the relationship between need for cognition and intelligence in aging. Before discussing specific hypotheses, it is important to review the intelligence literature, specifically as it applies to aging. Intelligence, broadly conceptualized, is characterized by four primary aspects: plasticity, the malleable or trainable nature of intelligence; multi-dimensionality, the multiple factors that make up intelligence; multi-directionality, the numerous avenues along which intelligence can develop; and inter-individual variability, the differences and changes in intelligence among individuals and across age (Sternberg & Berg, 1987). In looking at age-related patterns, Horn (1982) theorized the existence of a two component model of intelligence comprised of both crystallized and fluid abilities. Crystallized intelligence is culture sensitive and represents the expanse of knowledge and experience accumulated; it is inclusive of such primary abilities as verbal comprehension and concept formation, and measured by such indices as vocabulary tests and factually specific knowledge exams (Horn, 1982). Where crystallized abilities represent the pragmatics of intelligence, fluid abilities represent the mechanics of intelligence (Li, Lindenberger, Hommel, Aschersleben, Prinz, & Baltes, 2004). As such, fluid intelligence is relatively culture-insensitive and indicative of first-order abilities like induction (i.e. one's ability to reason from the specific to the general). The Digit Symbol Substitution Test (DSST) from the Wechsler Adult Intelligence Scales (WAIS and WAIS-R), for example, is a task that predominantly taps fluid abilities through its presentation of novel stimuli and its requirement for rapid comprehension of relational patterns (Horn, 1982).

Given that intelligence has been broken down into crystallized and fluid abilities, one should examine these respective processes over the developmental lifespan to fully understand an integrated and comprehensive view of intelligence. A general consensus in the literature points to fluid intelligence decline beginning in early to middle adulthood while crystallized intelligence continues to improve throughout adulthood until an asymptotic peak is reached in late adulthood; the opposing direction of decreasing fluid ability. Furthermore, increasing crystallized ability over adulthood has a compensating quality which accounts for the relatively stable nature of overall intelligence across the lifespan. Researchers also exhibit relative unanimity in regards to commonly-established timing principles of intellectual development. Specifically, age-related decrements in psychometric intelligence measures of fluid abilities should be understood, on an individual basis, as neither a uniform nor universal phenomenon, although studies do suggest a general trend of cognitive decline beginning to surface around age sixty, with widespread decrements occurring by age seventy-four (Schaie, 1996). Such broad cohesion, however, is not evident when the multi-faceted correlates, reasons, modifiers, and investigational approaches of intelligence are examined.

First, many correlates of intelligence have been established in the developmental literature of cognitive functioning. Correlational findings by Schaie (1996) indicate negative relationships among age and attitudinal flexibility beginning approximately at age fifty-three and followed at age sixty by similar differential relationships with motor-cognitive flexibility and psychomotor speed. In addition, given the same constructs of attitudinal and motor-cognitive flexibility and psychomotor speed, gender was found to be a contributing factor; women exceeded men on measures of psychomotor speed, and men surpassed women on tests of attitudinal and motor-cognitive flexibility, at all ages (Schaie, 1996). Other research of a meta-analytical nature purports a significant correlation among age and the Digit Symbol Substitution Test (DSST, a task of fluid abilities) of the Wechsler Adult Intelligence Scales, confirming typically reported correlations. The same findings were upheld independent of years of education (which exhibited no relationship with DSST scores when the differences between the age groups were taken out) and year of measurement (Hoyer, Stawski, Wasylyshyn, & Verhaeghen, 2004).

Secondly, the intelligence research offers a multifaceted and diverse litany of reasons to explain the generally observed age-related decline in cognitive functioning. One common cause thought to account for the findings is a decline in psychomotor and perceptual speed that occurs beginning in middle adulthood, with particular decrements seen after age sixty (Schaie, 1996). Likewise, theories of disuse and lack of practice have gained notoriety as possible culprits (Schaie, 1996). Other ideas have ranged from physiological deterioration of the substrates that contribute to intelligence to working-memory difficulties and the inability to inhibit certain responses (Cavanaugh & Blanchard-Fields, 2006).

Various modifiers may possess qualities to postpone, negate, or even call into question true age decline in intellectual abilities. Such modifiers include cohort (or generational) differences, educational achievement, socioeconomic status, personality factors, health, and lifestyle. As one might expect, factors such as a complex work environment, high educational attainment, high socioeconomic status, flexible attitudinal style, satisfaction with life accomplishments, and good health (free from complications like cardiovascular disease), all increase the likelihood of avoiding cognitive decline in late adulthood (Cavanaugh & Blanchard-Fields, 2006; Schaie, 1994). Given that, it is also possible that high need for cognition may be related to maintenance of intellectual function in late life.

Warranting further consideration in the intelligence and aging literature are cohort differences in cognitive functioning which have incited and consequently produced a great deal of research literature that at least partially explains the observed decrease in intellectual abilities in later life. Due to better educational opportunities, improved nutrition and healthcare, and other similar advances, researchers have discerned that more recent cohorts tend to outperform older cohorts on a variety of intellectual indices (Cavanaugh & Blanchard-Fields, 2006). For example, Schaie (1996) notes a variety of performance domains that have been significantly altered in recent decades. Such findings incorporate generational trends which have allowed for appreciable performance increases for young adult women over the past thirty-five years on spatial orientation tasks, and the virtual disappearance of gender disparities in numeric capabilities. In addition, despite the fact that more recent cohorts evidence mean performance levels above earlier cohorts, the magnitude of the differences is decreasing (Schaie, 1996). Such phenomenon, which are not the result of age related decline, can be classified as either a positive cohort difference (where less recent cohorts show lower performance than more recent cohorts) or a negative cohort difference (which favors less recently born cohorts even after taking into account possible decrements in abilities). Examples of positive cohort differences include verbal memory, inductive reasoning, and spatial orientation, whereas verbal and numeric competencies and perceptual speed exhibit a concave pattern putting the baby-boom generation at the lowest level (Schaie, 1996).

Finally, the last aspect that requires consideration in the intelligence and aging literature is that of the differing approaches and perspectives from which it can be studied; the largest division being the methodological choices of cross-sectional and longitudinal design and the findings each supports.

Generally speaking longitudinal data produces less pronounced age changes than cross-sectional data (Schaie, 1996). For instance, practically no decline in verbal ability occurs between young adulthood and older adulthood in the longitudinal research and only modest decline (up until approximately age eighty) is observed in regards to inductive reasoning, verbal memory, and spatial orientation (Schaie, 1996). However, negative cohort trends can reverse this principle, making age differences more prominent when using a longitudinal design, as is the case with perceptual speed and numeric ability (Schaie, 1996). Given that cross-sectional data represents age differences and longitudinal data represents age changes it becomes important to examine the findings of each.

Cross-sectional research by Schaie (1994) supports a young adulthood peak of inductive abilities, spatial orientation, perceptual speed, and verbal memory, with linearly increasing age disparities thereafter. Likewise, though fluid abilities have been found to decline earlier than crystallized abilities, the decrement is steeper for crystallized abilities beginning in the late seventies. Also observed in the same cross-sectional literature is a gender trend that indicates an earlier decline in fluid abilities for females and crystallized abilities for males. The longitudinal research by Schaie (1994), on the other hand, demonstrates linear decrement only for perceptual speed with the other abilities exhibiting an asymptotic pattern, peaking at age fifty-three and only moderately decreasing thereafter. In an effort to integrate the disparate data, Schaie (1994) reasons that the cross-sectional studies overestimate age-related decline before age sixty when negative cohort gradients are observed, and underestimate it when positive cohort differences are found.

Of similar importance to the expansion of research literature in terms of methodology to the understanding of intelligence and aging is the extension of primary theories that assimilate fluid and crystallized intelligence within a developmental structure. For example, one primary theory, relying on literature that supports cognitive intervention and training in the improvement of fluid abilities in old age, suggests that adults adapt to their environments. In effect, then, the retention of traditionally valued abilities (which psychometric tests measure) in the “new” environment may not be as efficacious or efficient given the nature of skills required for their day-to-day living (Sternberg & Berg, 1987). A second theory incorporating fluid and crystallized intelligence within a developmental framework poses an interplay between fluid and crystallized abilities. Crystallized and fluid intelligence are thus viewed as constituent processes which interact over the lifespan to either constrain or support one another. For instance, it is thought that during emerging adulthood the strength of fluid abilities serves to further the acquisition of knowledge, in turn increasing crystallized intelligence. Conversely, with aging, the decline of fluid abilities is thought to place limitations on the expression of crystallized intelligence. Thus, fluid and crystallized abilities are most intertwined and co-dependent on one another in early and very late adulthood (Li et al., 2004).

Given the reviewed literature on need for cognition, intelligence, and aging, two primary hypotheses have been generated to test in the current project. The hypotheses include: first, that need for cognition should be more highly correlated to crystallized intelligence than to fluid intelligence. This hypothesis stems from the demonstrated direct association between need for cognition and a fact-specific multiple-choice test (Tidwell et al., 2000), as well as Piagetian tasks (Stuart-Hamilton & McDonald, 2001), both crystallized measures. Second, need for cognition is trait-like and thus relatively invariant between age groups, a hypothesis resulting from need for cognition's significant correlation to a stable dispositional trait (i.e. the openness to experience domain of personality). Given the fact that it should be relatively stable, there is no expectation that the aging process will result in significant changes.

Method

Participants

Initially, 107 participants were identified for this study. However, two participants were dropped from further analyses due to problems with skewness and kurtosis on the vocabulary scale (no such problems occurred with any other outcome variable). Of the resulting 105 subjects, 50 were young-old adults (54-69 years, M = 62.7, SD = 4.4; 37 women and 13 men) and 55 were old-old adults (70-92 years, M = 76.6, SD = 5.1; 46 women and 9 men). Approximately 95% of the sample identified themselves as Caucasian, 2% as Hispanic, 2% as African American, and 1% as Asian. The mean education of the sample was 15.8 years with a standard deviation of 3.1 years; education ranged from 8 years to 25 years.

The old-old and young-old adults did differ in terms of education, with young-old adults having, on average, more years of education than old-old adults, $F(1, 103) = 4.13$, $p < .05$; old-old education range = 8–25 years, $M = 15.2$, $SD = 3.3$; young-old education range = 10-22 years, $M = 16.4$, $SD = 2.8$. The mean self-reported health score, based on a Likert scale of "excellent health" (1) to "very poor health" (10), for the sample was 2.7 with a standard deviation of 1.5; health values ranged from 1 to 9. The difference for old-old and young-old adults in terms of health was significant, $F(1, 103) = 3.91$, $p = .051$; old-old health range = 1-9, $M = 3.0$, $SD = 1.7$; young-old health range = 1-6, $M = 2.4$, $SD = 1.2$.

Overall Design

Participants were interviewed in groups over a duration of one and one-half hours. Measures included the following (in order of administration): the Metamemory in Adulthood Questionnaire (Dixon, Hultsch, & Hertzog, 1988), list recall, name-face recall, story recall, the Memory Self-Efficacy Questionnaire (Berry, West, & Dennehy, 1989), the Digit Symbol Substitution Test from the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981), a demographic information questionnaire, a second trial of each of the memory tasks (e.g., list, name-face, and story recall) with a strategy questionnaire (adapted from Camp, Markley, & Kramer, 1983), the General Self-Efficacy Scale (Jerusalem & Schwarzer, 1992), the Need for Cognition survey (Cacioppo, Petty, & Kao, 1984), the SF-36 health assessment (Ware & Gandek, 1994), and the Shipley Vocabulary Scale (Shipley, 1953). A subset of the administered measures has been identified for the purpose of this study, which include demographic information, the Digit Symbol (a test of fluid abilities), Need for Cognition survey, and Vocabulary scale (a test of crystallized abilities).

The Digit Symbol Substitution Test from the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981), which has average subtest reliability coefficients that exceed .80 (Wechsler, 1997), consists of filling in symbols corresponding to numbers, given an initial number-symbol pairing template. Participants see a number-symbol pairing template (the numbers one through nine, each paired with a unique symbol). They also see a series of ninety-three grids (one grid being a top box with a number one through nine and a bottom box which is blank). They are told: "Now look down at the samples where the boxes have numbers in the top part, but the squares at the bottom are empty…You are to put in each of the empty squares the mark that should go there." The participants are then directed to fill in as many squares as they can (in sequential order and without omitting any), to keep working until told to stop, and to work as rapidly as they can without making mistakes. The participant is then given 90 seconds in which to fill in the girds with the corresponding symbol for each number.

The Need for Cognition survey, with a Cronbach's alpha equal to .90 (Cacioppo, Petty, & Kao, 1984), encompasses 18 statements for which the participant rates how characteristic that quality is of themselves (see Appendix). The response choices are on a Likert scale and include "not at all true", "hardly true", "not sure", "moderately true", and "definitely true". The statements are general in nature and center around the degree to which a participant prefers, enjoys, and seeks out "thinking" situations or tasks. For example, item number one states "I would prefer complex to simple problems". Likewise, item number five states "I try to anticipate and avoid situations where there is likely some chance I will have to think in depth about something".

The Shipley Vocabulary Scale, with an internal consistency split-half reliability of .87 (Shipley, 1953), is a forty item multiple-choice measure that requires participants to select a word that means the same thing as a target to-be-defined word. The instructions state that the participants are to underline the correct word and if they do not know the correct choice, they are to guess. A sample is also provided. The forty items are organized on a single line with the target word in capital letters, followed by four answer choices. For instance, item five reads: "REMEMBER swim recall number defy". The correct response in this example is "recall". The prompting vocabulary ranges in difficultly (i.e. from target words such as "TALK", "PERMIT", and "COUCH", to "JOCOSE", "LISSOM", and "TEMERITY").

Results

An initial analysis was conducted to examine the impact of gender and its possible interaction with age on all dependent variables: need for cognition, vocabulary, and digit symbol. There were significant main effects for gender for the Need for Cognition survey (explained below). An Age Group X Gender interaction was significant only for the digit symbol, $F(1, 103) = 9.18, p < .01$; old-old females performed better than old-old males on the digit symbol measure of fluid abilities (a relation that held even when health and education were added as covariates, $F(1,103) = 11.62$, $p \leq .001$). Therefore, gender was included as a factor in all subsequent statistical tests.

Predicting Intelligence

A linear regression was run with vocabulary score as the dependent variable and need for cognition score as the independent variable to test hypothesis one. Need for cognition level was found to significantly predict crystallized intelligence (operationalized via vocabulary score), $F(1, 103) = 17.895$, $p \leq .000$, adjusted $R^2 = .140$, $\beta = .385$ (see Figure 1). To further understand the influence of need for cognition, relative to other variables, a second analysis was performed in which age and gender were added to need for cognition as predictors. The results indicated that age ($\beta = .040$, $p > .5$) and gender ($\beta = .015$, $p > .5$) did not significantly contribute to the prediction of crystallized abilities when need for cognition ($\beta = .394$, $p = .000$) was taken into account, with an adjusted $R^2 = .125$ for the model, $F(3, 101) = 5.93$, $p \leq .001$. A final analysis was carried out including the digit symbol, as a measure of fluid intelligence. The impact of each factor was considered with all other factors covaried (need for cognition, gender, age, and the addition of the digit symbol). Gender ($\beta = .016$, $p > .5$), age ($\beta = .031$, $p > .5$), and digit symbol ($\beta = -.018$, $p > .5$), did not significantly predict crystallized abilities when need for cognition ($\beta = .397$, $p = .000$) was present in the model, $F(4, 100) = 4.41$, $p = .003$. Multi-collinarity diagnostics were run for all of the above regressions; all tolerance levels were acceptable.

Similarly, an initial linear regression was run with digit symbol scores as the dependent variable and need for cognition score as the independent variable. Need for cognition level was not found to significantly predict fluid intelligence (operationalized via the digit symbol), $F(1, 103) = 3.81$, $p > .05$, adjusted $R^2 = .026$, $\beta = .189$. A second analysis was performed in which age and gender were added to need for cognition as predictors. The results indicated that age ($\beta = -.483$, $p \leq .000$), but not need for cognition score ($\beta = .136$, $p > .10$) or gender ($\beta = .065$, $p > .25$), significantly predicted fluid abilities, with an adjusted $R^2 = .245$ for the model, $F(3, 101) = 12.24$, $p \leq .000$, when all other variables were considered. A final analysis was conducted in which all the variables were entered simultaneously so that the impact of each factor was considered with all other factors covaried (need for cognition, gender, age, and the addition of vocabulary score). The analysis yielded the following results: age ($\beta = -.482$, $p = .000$) significantly predicted fluid abilities when all other variables were considered, $F(4, 100) = 9.097$, $p = .000$; need for cognition ($\beta = .142$, $p > .10$), gender ($\beta = .065$, $p > .25$), and vocabulary ($\beta = -.015$, $p > .5$) did not significantly predict fluid abilities, when all other variables were taken into account. Multi-collinarity diagnostics were run for all the regressions above; all tolerance levels were acceptable. Thus, hypothesis one was confirmed, crystallized intelligence is predicted only by need for cognition (of all the variables considered), while fluid intelligence is not significantly predicted by need for cognition, but rather by age.

Need for Cognition

A univariate analysis of variance (ANOVA) was conducted with need for cognition as the dependent variable; the factor in the model was age group. As expected (after adding gender as a covariate) need for cognition scores did not significantly differ between young-old and old-old adults, confirming hypothesis two. Because the two age groups differed significantly on self-rated health and years of education, a second analysis was conducted to control for any contribution of health status or education level. In this model, the dependent variable was need for cognition; the factor in the model was age group; health score and years of education were added as covariates. The results were the same as the initial analysis: as expected, need for cognition scores did not significantly differ between young-old and old-old adults, even when gender, health and education were covaried.

Discussion

Until recently the research literature has been relatively incomplete and inconclusive regarding the relationship between need for cognition and intelligence. The current study has served to support, clarify and expand upon the direct and indirect associations between need for cognition and the fluid and crystallized abilities that comprise overall intelligence. In addition, the current study has provided evidence to strengthen and qualify contemporary research when evaluating the individual constructs of need for cognition, crystallized intelligence, and fluid intelligence, specifically as each applies to differing age groups. The primary results of this study include: crystallized intelligence is best predicted by need for cognition; fluid intelligence is best predicted by age; need for cognition is invariant between young-old and old-old adults.

Need for Cognition and Intelligence

Through regression analyses, the main hypothesis of this study was supported; need for cognition significantly predicts crystallized intelligence (measured using vocabulary score), but not fluid intelligence, even after taking into account the effects of gender, age and the converse outcome measure (digit symbol and vocabulary, respectively). The confirmation of this hypothesis extends the definitional characteristics of need for cognition originally expounded in 1982 by Cacioppo and Petty (i.e., need for cognition is "the tendency of an individual to engage in and enjoy thinking"; as cited in Tidwell, Sadowski, & Pate, 2000). The motivational component inherent in the construct suggests that individuals higher in need for cognition will seek out cognitive stimuli and in so doing increase their knowledge base. Further, because acquired information is a factor of crystallized intelligence, it stands to reason that those individuals who are higher in need for cognition level will also be higher in crystallized intelligence. These results confirm research by Tidwell et al. (2000), in which fact-specific tests and verbal ability correlated significantly with need for cognition, as well as Stuart-Hamilton and McDonald (2001), in which need for cognition correlated significantly with Piagetian tasks.

Specifically, the current research project demonstrated a Pearson correlation between need for cognition and crystallized abilities equal to .385 (when gender, age, and digit symbol were covaried). The Pearson correlation between need for cognition and fluid abilities equaled .189 (when gender, age, and vocabulary score were covaried). Thus, the strength of the correlation between need for cognition and crystallized intelligence is moderate in terms of psychological findings (in which any one outcome variable is typically affected by many factors). Interpretation of the Beta coefficient suggests that approximately 15% of the variability in crystallized intelligence can be explained by need for cognition.

As previously discussed, the relationship between need for cognition and crystallized intelligence flows logically from preceding research and reasonable deduction and inference of the constructs involved, however, need for cognition's association with fluid intelligence has been, to my knowledge, absent in the psychological literature. Despite this lack of current research, it stands to reason that because fluid intelligence represents an intrinsic, non-learned aspect of intelligence it should not (as this study confirms) be affected by need for cognition level. On the other hand, this research project substantiates a plethora of previous data in which fluid intelligence is predicted by age. For instance, Schaie (1996) discovered widespread decrements in cognitive functioning occurring by age seventy-four, an age that happens to be close to the mean age of 70 for the adults in this sample. Thus, this research serves to support the overall concurrence among psychologists that old-old adults will, for reasons still undetermined though widely speculated, demonstrate lower fluid abilities than their young-old adult counterparts.

In addition to examining need for cognition in relation to intelligence, this research investigated the stability of need for cognition between age groups, hypothesizing that the aging process does not alter need for cognition level (i.e., that there is no significant difference between young-old and old-old adults' need for cognition scores). It stands to reason that if need for cognition is related to stable personality features, it would remain stable with age. Strengthened by this study's univariate analysis of variance which revealed no significant difference between young-old and old-old adults in terms of need for cognition level, such results extended past research which showed the stability of need for cognition. Need for cognition was previously linked to the stable personality domain of openness to experience (Sadowski & Cogburn, 1997; Brown, 2006), and research by Dickhäuser and Reinhard (2006) implicated need for cognition as a dispositional trait related to self-concept.

The relatively stable nature of need for cognition across young-old and old-old adults gives rise to implications not only for the aging literature but also for the intelligence literature. Most clearly, the invariance (and implied maintenance) of need for cognition throughout aging suggests a positive, non-declining aspect to aging, a process which is often viewed as encompassing only deterioration of functioning. More importantly, however, is need for cognition's constancy when viewed in relation to its prediction of crystallized intelligence. If aging does not significantly alter an individual's need for cognition, and crystallized intelligence is best predicted by need for cognition, then it follows that old-old adults who are high in need for cognition may experience less cognitive decline with aging than their old-old adult counterparts who are low in need for cognition. Further, because overall intelligence is comprised of crystallized and fluid abilities and age is the best predictor of fluid abilities (e.g., with aging there is a decline in fluid abilities), it is likely that individuals higher in need for cognition will experience less overall intellectual (crystallized plus fluid abilities) decline with aging. In effect, because individuals high in need for cognition tend to be higher in crystallized intelligence (as compared to their same-age peers low in need for cognition), and because there is no evidence to suggest unequal fluid intelligence decline with aging as a function of need for cognition, it is reasonable to assume that less cognitive decline will occur with aging in individuals that are high in need for cognition.

There are qualifications that must be made to the conclusions brought about by the demonstrated invariance of need for cognition, namely, the sample for this study ranged in age from 54 to 92 years and thus did not include young and middle-aged adults for whom need for cognition level may vary (especially during the years when education is prioritized). Similarly, the sample did not include a representative number of adults at the extreme high end of the age spectrum, a group of adults who, for various reasons, may function at a significantly lower level and experience a comparatively rapid decline in abilities over a given time period.

Summary

This study examined the individual constructs of need for cognition, fluid, and crystallized intelligence, as well as the relationship between these constructs and their relationships to age. In general, the hypotheses of this study were supported. The analyses reveal first that need for cognition is best predicted by (and consequently influences) crystallized intelligence, adding to and expounding on current research linking the “motivational” aspect to the applied aspect of learning. As a corollary of the previous hypothesis, age was the sole predictor of fluid intelligence among the variables analyzed here, supporting a wide array of existing literature and data. Second, need for cognition level is not altered by the aging process (insofar as this study examined young-old and old-old adults); extending the contemporary research on the conceptualized trait-like nature of need for cognition.

Limitations

The conclusions reached by this research should be qualified by the limitations it contains. The primary limitation of this research is the methodology employed. Also to be considered is the representativeness of the sample and thus the subsequent generalizability of the results.

The data used for this study was cross-sectional rather than longitudinal in nature and thus may have overestimated age changes. Also, the cross-sectional design of the study could mislead what true and significant relationship exists between variables by falling subject to a cohort problem. Using some combination of cross-sectional and longitudinal design would likely produce the most valid and reliable results.

The other principal limitation of this study is in the make-up of the sample. The demographics and characteristics of the sample weaken the overall external validity. Issues with the demographics of the sample arise from the fact that it was primarily composed of Caucasian individuals, mostly female, and all living in a developed Western culture, attributes that make it unwise to generalize the conclusions to other races or cultures. Similarly, the individuals in the study may not represent the average adult by virtue of the fact that they were motivated to participate in and complete a research study on memory.

Future Study

Given the results of this research it is evident that the future course of study on need for cognition and intelligence is one that should include further data on the role of aging and cohort contributions and the differing definitions of intelligence. For instance, it would be prudent to explore the stability of need for cognition over the entire developmental lifespan (exploring children, adolescents, young adults, middle-age adults, and the very elderly, as well as the two groups, young-old and old-old adults, examined in this research) and the implications that stability (or instability as it may be for age groups other than young-old and old-old adults) has for intelligence, both globally and specifically defined as crystallized and fluid abilities. Along the same lines, using a longitudinal design in future research would provide a more accurate account of age-related changes. Likewise, future research should strive to take into consideration cohort or generational differences in their data, models, analyses, and subsequent conclusions. By taking historical trends into account one would advance the understanding not only of the individual constructs of need for cognition and intelligence, but also of the true relationship that exists between them.

In addition, the research base warrants further investigation employing the differing definitions of intelligence. Researchers often break down intelligence into constituent crystallized and fluid abilities, as this research has done, but this classification is by no means universal or concrete in its correctness. For instance, intelligence has also been broken down into multiple domain specific units, such as verbal intelligence, numerical intelligence, and the like, or even into factors such as creativity and other such constructs not traditionally considered a component of “intelligence”. Thus, future researchers could examine need for cognition’s relationship with intelligence that is defined in a multitude of ways to better get at the core of the underlying association.

References

Baker, T. J., & Bichsel, J. (2006). Personality predictors of intelligence: Differences between young and cognitively healthy older adults. *Personality and Individual Differences, 41,* 861-871.

Berry, J. M., West, R. L., & Dennehy, D. (1989). Reliability and validity of the Memory Self-Efficacy Questionnaire (MSEQ). Developmental Psychology, 25, 701-713.

Brown, P. J. (2006, April). Relation of Need for Cognition to Age, Personality, and Behavior. Paper presented at Washington University in St. Louis, St. Louis, MO.

Cacioppo, J. T., Petty, R. E., Feinstein, J. A., & Jarvis, W. B. G. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin, 119,* 197-253.

Cacioppo, J. T., Petty, R. E., & Kao, C. F. (1984). The efficient assessment of need for cognition. *Journal of Personality Assessment*, *48(3),* 306-307.

Camp, C. J., Markley, R. P., & Kramer, J. J. (1983). Spontaneous use of mnemonics by elderly individuals. *Educational Gerontology, 9,* 57-71.

Cavanaugh, J. C., & Blanchard-Fields, F. (Eds.). (2006). *Adult development and aging* (5th ed.). Belmont: Thomson Wadsworth.

Dickhäuser, O., & Reinhard, M. (2006). Factors underlying expectancies of success and achievement: The influential roles of need for cognition and general or specific self-concepts. *Journal of Personality and Social Psychology, 90(3),* 490-500.

Dixon, R. A., Hultsch, D. F., & Hertzog, C. (1988). The meta-memory in adulthood questionnaire. *Psychopharmacology Bulletin, 24,* 671-688.

Goodwin, R. D., & Gotlib, I. H. (2004). Gender differences in depression: The role of personality factors. *Psychiatry Research, 126(2),* 135-142.

Horn, J. L. (1982). The aging of human abilities. In B. B. Wolman (Ed.), *Handbook of developmental psychology* (pp.847-870). Englewood Cliffs, NJ: Prentice Hall.

Hoyer, W. J., Stawski, R. S., Wasylyshyn, C., & Verhaeghen, P. (2004). Adult age and digit symbol substitution performance: A meta-analysis. *Psychology and Aging, 19(1),* 211-214.

Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal process. In R. Schwarzer (Ed.), Self-efficacy: Thought control of action (pp. 195-213). Washington, DC: Hemisphere.

Li, S., Lindenberger, U., Hommel, B., Aschersleben, G., Prinz, W., & Baltes, P. B. (2004). Transformations in the couplings among intellectual abilities and constituent cognitive processes across the life span. *Psychological Science, 15(3),* 155-163.

Sadowski, C. J., & Cogburn, H. E. (1997). Need for cognition in the big-five factor structure. *The Journal of Psychology, 131(3),* 307-312.

Schaie, K. W. (1994). The course of adult intellectual development. *American Psychologist, 49(4),* 304-313.

Schaie, K. W. (1996). *Intellectual development in adulthood: The Seattle longitudinal study.* New York: Cambridge University Press.

Shipley, W. C. (1953). The Shipley Institute of Living Scale for measuring intellectual impairment. In A. Weidner (Ed.), *Contributions to medical psychology: Vol. 2. Theory and diagnostic methods* (pp. 751-756). New York: Ronald Press.

Sternberg, R.J., & Berg, C. A. (1987). Cognitive functioning: What are theories of adult intellectual development theories of? In C. Schooler & K. W. Schaie (Eds.), *Cognitive functioning and social structure over the life course* (pp. 3-23). Norwood: Ablex Publishing Corporation.

Stuart-Hamilton, I.., & McDonald, L. (2001). Do we need intelligence? Some reflections on the perceived importance of "G". *Educational Gerontology, 27,* 399-407.

Tidwell, P. S., Sadowski, C. J., & Pate, L. M. (2000). Relationships between need for cognition, knowledge, and verbal ability. *The Journal of Psychology, 134(6),* 634-644.

Ware, J. E., & Gandek, B. (1994). The SF-36 Health Survey: development and use in mental health research and the IQOLA Project. *International Journal of Mental Health, 23(2),* 49-73.

Wechsler, D. (1981). *WAIS-R: Wechsler Adult Intelligence Scale-Revised*. New York: Harcourt, Brace, Jovanovich.

Wechsler, D. (1997). *WAIS-III/WMS-III Technical Manual.* San Antonio: Psychological Corporation.

Appendix

The Need for Cognition Survey

DIRECTIONS: Please read the statements below and indicate how characteristic each statement is of you, using the following rating scale:

	Not at All True	Hardly True	Not sure	Moderately True	Definitely True
1. I would prefer complex to simple problems.	1	2	3	4	5
2. I like to have the responsibility of handling a situation that requires a lot of thinking.	1	2	3	4	5
3. Thinking is not my idea of fun.	1	2	3	4	5
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.	1	2	3	4	5
5. I try to anticipate and avoid situations where there is likely some chance I will have to think in depth about something.	1	2	3	4	5
6. I find satisfaction in deliberating hard and for long hours.	1	2	3	4	5
7. I only think as hard as I have to.	1	2	3	4	5
8. I prefer to think about small, daily projects to long-term ones.	1	2	3	4	5
9. I like tasks that require little thought once I've learned them.	1	2	3	4	5
10. The idea of relying on thought to make my way to the top appeals to me.	1	2	3	4	5
11. I really enjoy a task that involves coming up with new solutions to problems.	1	2	3	4	5
12. Learning new ways to think doesn't excite me very much.	1	2	3	4	5
13. I prefer my life to be filled with puzzles that I must solve.	1	2	3	4	5

	Not at All True	Hardly True	Not sure	Moderately True	Definitely True
14. The notion of thinking abstractly is appealing to me.	1	2	3	4	5
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.	1	2	3	4	5
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.	1	2	3	4	5
17. It’s enough for me that something gets the job done; I don’t care how or why it works.	1	2	3	4	5
18. I usually end up deliberating about issues even when they do not affect me personally.	1	2	3	4	5

Figure 1. Scatterplot of need for cognition and vocabulary score.