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Validation of an Internet Search Strategies Assessment

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VALIDATION OF AN INTERNET SEARCH STRATEGIES ASSESSMENT

A Master's Thesis

Presented to

The Graduate College of

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In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Psychology

By

Joseph Wansing

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ABSTRACT

The internet has become the go-to place for those seeking information. The strategies that people employ when seeking information differ (Tsai, 2005), and critical thinking is related to these differences (Zhang et al., 2015). Although people use different strategies to find information on the internet, there are virtually no formal, easy to use tools for assessing these differences. Wansing and Wood (2020) developed the Internet Search Strategies Assessment (ISSA) for this purpose. A preliminary study revealed that the scale had four factors as hypothesized, but the measure did not correlate as well as expected with other theoretically related scales. This study used a multitrait-multimethod (MTMM) design with undergraduate college students (N=126) to further explore convergent and discriminant validity evidence for ISSA. A combination of implicit and explicit measures were used. Results provided some evidence supporting the construct validity for two of the hypothesized factors. However, the other two factors did not correlate well with any of the measures in the study.

KEYWORDS: internet search, critical-thinking, personality, implicit association test, factor analysis

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INTRODUCTION

The internet has become a go-to place for information. However, seeking information on the internet is not as easy as simply typing in a topic people want to know about in the search bar. While various search strategies exist for finding information on the internet, there are virtually no assessments of these search strategies. The current internet search assessments are time-consuming activities where people explore an open environment and are rated. The development of a paper and pencil assessment can shorten the time required and reduce the need for raters. The Internet Search Strategies Assessment (ISSA) is a new self-report assessment tool (Wansing and Wood, 2020) designed for this purpose. The assessment is a 16-item measure composed of four subscales - Scientific Sources, Argument Balance and Quality, Opinion Confirmation, and De-identified Search. During development, the authors found the scale had good reliability but did not correlate well with theoretically related measures, like the Epistemic Belief Index (EBI)). Tsai (2005) found that children who explored their learning environments scored higher on the EBI. Chiu (2013) found that internet epistemic beliefs were positively related to self-regulated learning. However, the ISSA did not correlate well with the EBI in the Wansing and Wood (2020) study, although scores on an ill-structured search task were correlated highly with epistemic beliefs (Zhang Ulyshen et al, 2015).

People with naïve epistemic beliefs treat information that contradicts their beliefs with biases (Chan et al, 2011). Chan, using 12 item version of the 32-item EBI, found that the EBI was related to thinking dispositions like Need for Cognition and Openness from the NEO-PI-R. Thinking dispositions drive how people view and approach problems, much like searching for

information on the internet. Furthermore, Chan found that the EBI predicted a significant part of critical thinking performance, and that critical thinking was related to epistemic beliefs. Facione (2000) said that critical thinking involves two components, the actual ability to think critically and the disposition or motivation to think critically. Both factors influence performance on a critical thinking assessment. Zhang (2002) found that Big 5 personality factors related to a person's thinking style. A thinking style is how one habitually thinks about the material after learning about it. The preference to think critically is related to the thinking styles one possesses (Zhang, 2002). Nosratinia and Sarabchain (2013) also found that critical thinking performance is correlated with Big 5 personality factors.

Neuroticism, Openness, Agreeableness, Conscientiousness, and Extraversion typically define the facets of Five Factor Personality Theory. Of these five, Agreeableness, Conscientiousness, and Neuroticism can be organized into a super-ordinate factor called Alpha, with Extroversion and Openness comprising separate factors (Digman, 1997). Conscientiousness is the best predictor of critical thinking, Openness is the second-best, and Neuroticism is the third-best (Nosratinia and Sarabchain, 2013). Cognitive ability is positively related to Neuroticism and Openness (Rammstedt, 2018). In addition, Rammstedt broke personality down into 60 facets and found that the curiosity facet of Openness was the highest correlate of intelligence (2018).

A part of the Openness factor is the Need for Cognition measure. Cacioppo (1996) described people high in need for cognition as naturally seeking, acquiring, thinking about, and reflecting on information to make sense of stimuli, relationships, and events in the world. Individuals low in need for cognition, relative to people high on cognition, are more likely to rely on others, heuristics, or social comparison processes to provide this structure. Need for

cognition's definition fits into the curiosity facet of Openness that Rammstedt found was highly correlated with cognitive ability (2018). In addition need for cognition was negatively correlated with closed-mindedness and the tendency to ignore or distort new information (Cacioppo, 1996). Need for cognition was positively correlated with basing judgments on empirical information and seeking out and scrutinizing information when solving a problem (Cacioppo, 1996).

Explicit (self-report) measures of personality attributes have been shown to be susceptible to contamination due to impression management and insightful self-knowledge artifacts (Greenwald and Banaji, 1995). Greenwald et al (1998) developed the IAT to measure one's automatic association between two concepts or categories. The IAT measures the strength of an association by recording reaction times on classification tasks (Lane et al, 2007). Greenwald et al. (1998) describe an IAT designed to assess attitudes toward flowers and insects. In the first block of 20 trials, participants classify words as flowers (e.g., tulip, rose, etc.) or as insects (e.g., ant, bee, etc.) by pressing the "E" or "I" key as the stimuli are presented one at a time on the computer screen. In a second block of 20 trials, evaluative words are classified as good (e.g., wonderful, beautiful, etc.) or bad (e.g., awful, nasty, etc.) by pressing the "E" key or "I" key. A category and attribute are then paired in the third block of 20 trials (flower + good and insect + bad). This is called a "compatible" block because the category and attribute are paired in the hypothesized manner. The fourth block uses the same sorting procedure as the third block, except it includes 40 trials and is called a "test" block. In the fifth block, the attribute categories shift sides, with "bad" being assigned to the left ("E" key) and "good" to the right ("I" key), and subjects practice classifying only attribute stimuli for 20 trials. The sixth and seventh blocks use the same sorting procedures as the third and fourth blocks, but with the reversed pairing of the category and attribute (flower + bad and insect + good). These are called "incompatible" blocks

because the category and attribute are paired in a non-hypothesized manner. The IAT score is based on the difference in mean response latencies for the compatible and incompatible blocks. As the difference in mean response latencies increases, the strength of association between the category and attribute increases in the hypothesized manner so that larger IAT scores represent a stronger relationship between the categories in the compatible (hypothesized) pairing (flower + good and insect + bad), versus the incompatible paring (flower + bad and insect + good). Please see Table 1 for a breakdown of the stimuli.

IATs have been constructed to assess a wide range of psychological attributes, including personality traits. Steffan and Koing (2006) developed IATs for all of the Big 5 personality factors. The IATs measures were correlated with behavior that people high in the given factors would exhibit (Steffan and Koing, 2006). Fleischhauer et al (2013) developed a need for cognition IAT. The IAT correlated with theoretically related behaviors (Fleischhauer, et al, 2013). IATs can be a better predictor of how someone will act when they have to make quick decisions without deliberating about the decision. When searching the internet, people are prone to make quick decisions about which site to visit; thus, IATs might be a better predictor of internet search behavior.

It is hypothesized that the ISSA will be differently related to critical thinking, epistemic beliefs, and explicit and implicit personality measures. More specifically, it is hypothesized that three of the four ISSA scales (Scientific Sources, Argument, and Search) positively correlate with *g* measures (Watson-Glasser and EBI) and personality attributes related to Experimental Openness (Need for Cognition and NEO-O), while the fourth ISSA scale (Opinion) should negatively correlate with these cognitive and personality attributes.

Table 1. Schematic Overview of the 7 Block Implicit Association Test

Block	Left ("E" Key)	Right ("I" Key)
1 (Practice)	Flower	Insect
2 (Practice)	Good	Bad
3 (Practice)	Flower + Good	Insect + Bad
4 (Test)	Flower + Good	Insect + Bad
5 (Practice)	Bad	Good
6 (Practice)	Flower + Bad	Insect + Good
7 (Test)	Flower + Bad	Insect + Good

METHODS

Sample

A proposal for this study was submitted for review to the Institutional Review Board (IRB) at Missouri State University and on March 9, 2021, was determined to be exempt from further review (Study#: IRB-FY2021-504; see Appendix A). Participants were recruited from the psychology department's online human subject pool system (i.e., SONA Systems). Students (N=123) self-elected to participate in this study and received participation credit through the SONA System. An a priori power analysis indicated that the sample size exceeds the size necessary for adequate power (.80), given a hypothesis of close fit (H_0: RMSEA=. 05) and the alternative hypothesis of poor fit (H_A: RMSEA= .10), according to tables provided by MacCallum, Browne, and Sugawara (1996).

Explicit Measures

Internet Search Strategies Assessment (ISSA). Wansing and Wood (2020) developed the ISSA to examine how people search for information on the internet. An exploratory factor analysis resulted in four factors, which were labeled: Scientific Sources, Argument Balance and Quality, Opinion Confirmation, and De-identified Search. A five-point Likert scale with alternatives ranging from 1 (This is something I would not do) to 5 (This is something I would certainly do) was used with each item. An example item for Scientific Sources, "I would look more at websites that seemed to be from researchers. An example from the Argument factor was, "I would try to find websites that gave both pro and con arguments." An example from the Opinion Confirmation factor was, "I would give more weight to news websites that I personally

agree with." An example question from the De-identified Search was, "I would turn off personalized search options in my browser." The Cronbach alphas for all the scales was exceeded α=.70. See Appendix B for the full scales.

Watson-Glaser (WGCTA). Developed by Goodwin Watson and Edward Glaser (1980). For this study, three of the subscales from the WGCTA were used. The first subscale, Inference, required participants to judge inferences based on scenarios they read. The second, Assumptions, required participants to rate whether an assumption was made when drawing a conclusion. The third required participants to judge whether a conclusion follows the information given in various scenarios. These subscales were chosen for inclusion in this current study because factor analytic studies have established that the WGCTA is unidimensional (i.e., it measures a single construct) and these are the three subscales that load highest on the general factor (Bernard et al., 2008). Further, the items for each of these subscales were taken from the short form of the WGCTA (1994). The overall WGCTA has been shown to have Cronbach alphas values in the mid .70s across multiple studies. See Appendix C for the full list of questions.

NEO Facet Scales. McCrae and Costa (1991) developed the NEO-PI-R to assess participants on the five factors of personality defined by Big Five theory, (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism). This current study employed three NEO factors most central to assessing construct validity of the ISSA; Openness, Agreeableness, and Conscientiousness. Two of these factors (Agreeableness and Conscientiousness) are components of “Super Factor Alpha” (Digman, 1997), which targets one’s maturity and degree of social integration. The third factor, Openness, is hypothesized to be related to one’s need for cognition and motivation to engage in critical thinking. The Cronbach alphas for the scales were .87, 86, .90. respectively. See Appendix D for the items.

Epistemic Belief Index (EBI). Schomer (1990) designed the EBI to measure how people view the certainty of knowledge and facts. The measure used in this study, a modified version of the EBI developed by Chan (2011), contains three subscales: Innate Ability, Certain Knowledge, and Simple Knowledge. A five-point Likert scale with alternatives ranging from "Strongly Agree" to "Strongly Disagree" was used with each item. Example items from the three subscales are; "Smart people are born that way", (Innate Ability); "If a person tries too hard to understand a problem, they will most likely end up confused", (Simple Knowledge); "Too many theories just complicate things." (Certain Knowledge). The Cronbach alphas for the scales are Innate Ability α=.67, Certain Knowledge α=.66, and Simple Knowledge α=.71. See Appendix E for the full scale.

Need For Cognition (NFC). Cacioppo and Petty (1982) designed the NFC to assess how likely someone is to engage in and enjoy effortful cognitive endeavors. Scale item responses were made on a five-point Likert scale with alternatives ranging from extremely uncharacteristic (1) to extremely characteristic (5). An example item from this scale is "I would prefer complex to simple problems". Prior research established strong scale reliability, with Cronbach alphas exceeding α=.80s across multiple studies. See Appendix F for the full scale.

Implicit Measures

NEO-PI-R -IATs. Steffens and Konig (2006) developed IATs based on Big Five Personality theory. The IATs utilized self versus-others categories paired with categories corresponding to the five factors. Of these IATs, Conscientiousness and Agreeableness were selected for use in this study. The Conscientiousness and Agreeableness IATs correlated with

their respective NEO-PI-R factors at .85 and .77, respectively. See Appendix G for the full stimulus list.

NFC-IAT. The NFC IAT was developed by Fleischhauer (2013). The IAT used a self-other contrast, with stimuli categories of “Cognitively Active” and “Cognitively Lazy”. The IAT correlated with NFC behavior. See Appendix H for the full stimulus list.

Procedure

Upon entering the testing room, participants were seated at desks with computers. The participants were then presented with an informed consent statement. The informed consent statement instructed participants to, "Think about their times when they had to look for information on the internet." See Appendix I for the full text of the informed consent statement. After participants agreed to participate, an email was sent out with the link to the study; the link opened the Millisecond software. The survey began with demographic questions, followed by the Watson-Glaser critical thinking appraisal. The subsequent five measures were a pattern of implicit and explicit measures in this order; Agreeableness IAT, Need for Cognition, Conscientiousness IAT, NEO-PI-R, and Need for Cognition IAT. The final two measures were the ISSA and EBI. Once the measures were completed, participants were thanked for their time and excused. By mixing the explicit measures and implicit measures, the researchers hoped to keep the participants cognitively engaged in the study. The data were analyzed using SPSS and the AMOS software package.

Data Analysis

Confirmatory factor analysis (CFA) model comparisons were used for the data analysis. Widaman (1985) developed a procedure to assess the convergent and discriminant validity evidence in a MTMM design. To do so, differences in the fit statistics of successive models are analyzed. The comparisons begin with a least restrictive model (Model 1), where all factors are free to intercorrelate. The following models impose different restrictions on the factors and are compared to Model 1.

The least restrictive model is displayed in Figure 1. This model has two freely correlated method factors (implicit and explicit) and three freely correlated trait factors (Super Factor-Alpha, critical thinking, and Openness). Model 2 is more restrictive in that it includes no trait factors and has freely correlated method factors (see Figure 2). Model 3 is more restrictive in that it contains two freely correlating method factors and perfectly correlated trait factors (i.e., a single trait factor) (see Figure 3). Model 4 has two uncorrelated method factors and three freely correlated trait factors (see Figure 4).

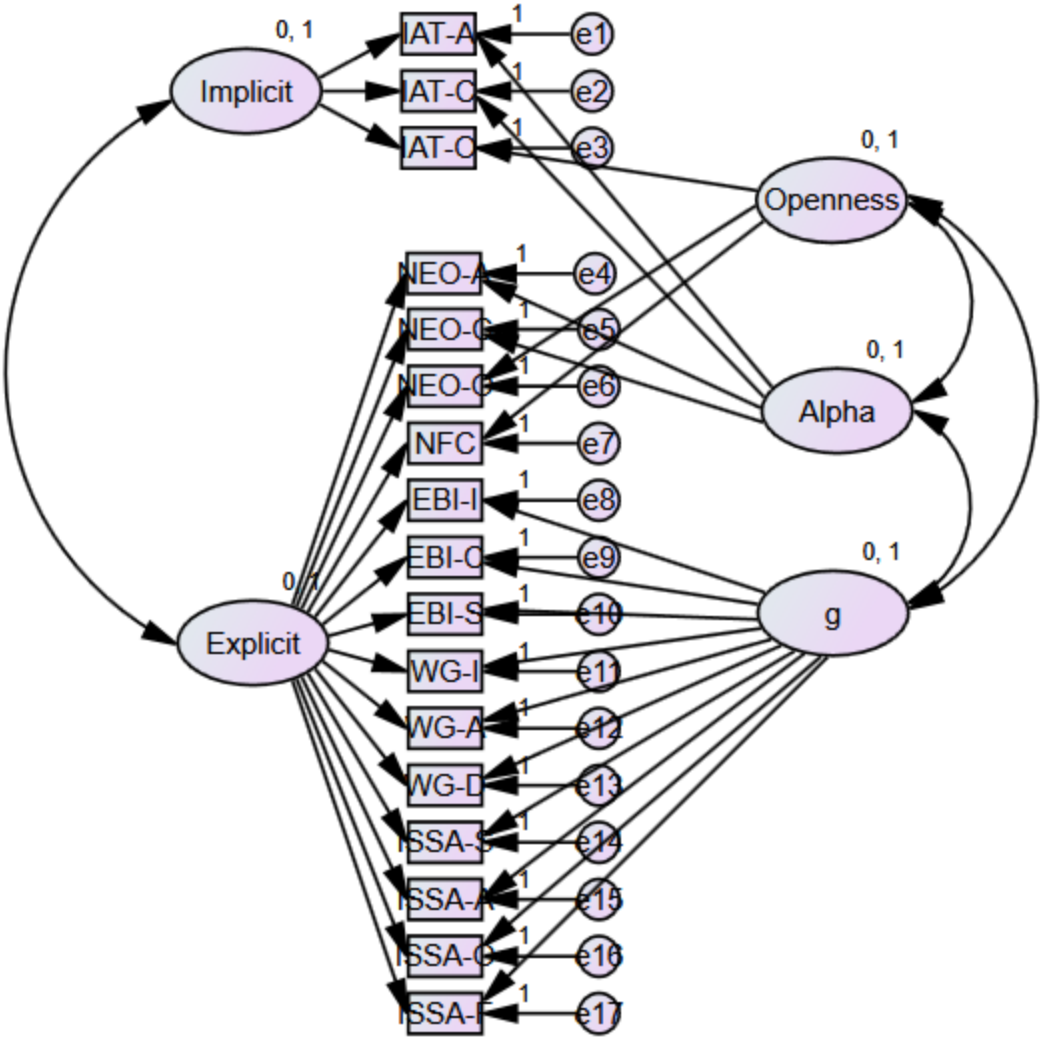

Figure 1. CFA Model 1: Two Freely Correlated Method factors and Two Freely Correlated Trait Factors

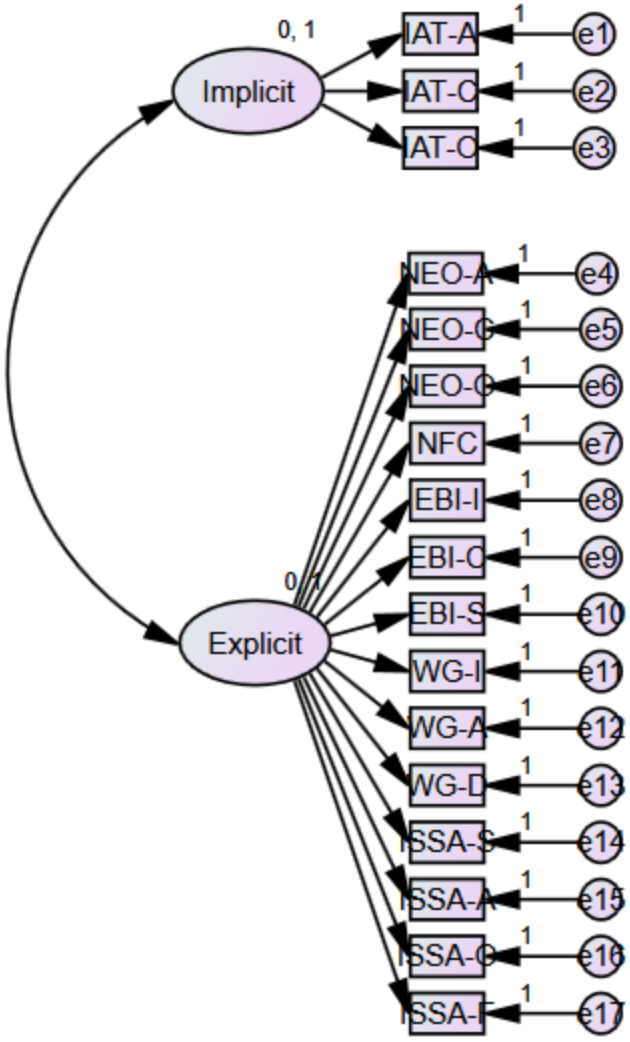

Figure 2. CFA Model 2: Two Freely Correlated Method Factors and No Trait Factors

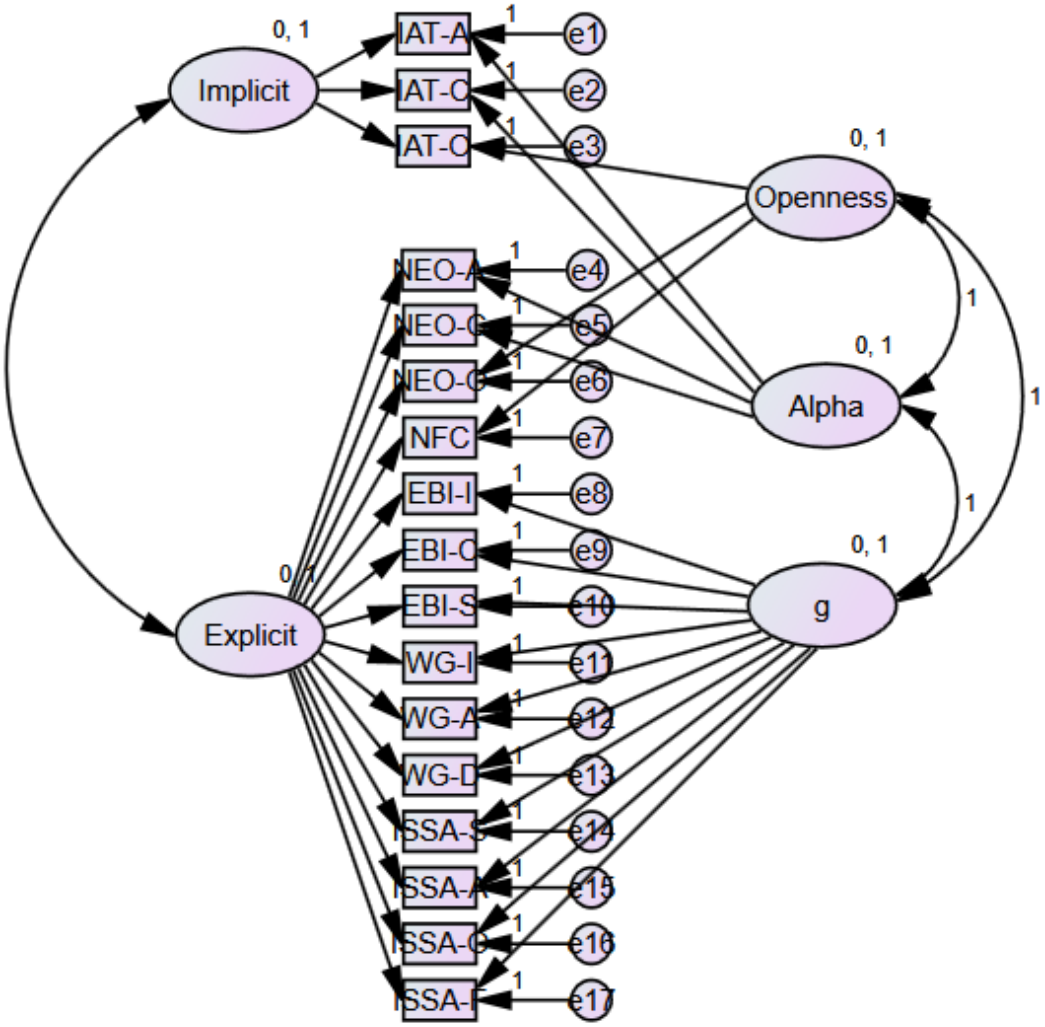

Figure 3. CFA Model 3: Two Freely Correlated Method Factors and Two Perfectly Correlated Trait Factors

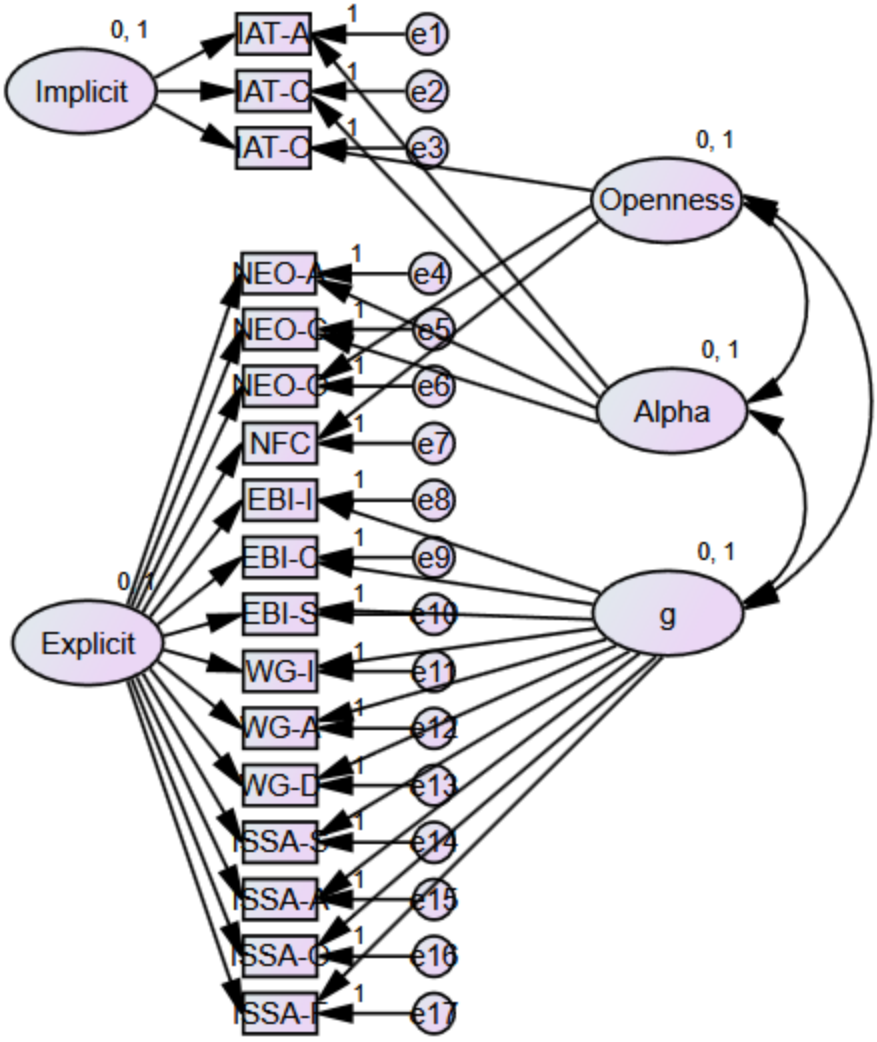

Figure 4. CFA Model 4. Two Uncorrelated Method Factors and Two Freely Correlated Trait Factors

RESULTS

Demographics

The final sample was composed of 123 participants. Data were cleaned by eliminating participants with excessive errors rates on one or more IAT measures. Of the 123 participants in the final sample, 89 identified as female (72.4%), 31 (25.2%) as male, and 3 (2.4%) as non-binary. The sample's racial/ethnic demographics were as follows: 1.6% Hispanic or Latinx, 2.4% American Indian or Alaska Native, 3.3% Asian, 3.3% Black or African American, 87% Non-Hispanic White, and 2.4% two or more. The age of the respondents ranged from 17-25, with the mean being 18.79 years old. Seven participants (5.7%) reported English as their second language.

Descriptive statistics for study variables are displayed in Table 2 and zero-order correlations for study variables are displayed in Table 3.

Test of Hypothesis

Nested CFA model comparisons are used to assess the convergent and discriminant validity of measures (Wildman, 1985). Model 1 is the initial model against which subsequent models are compared. This is the least restrictive model because it allows both method and trait factors to freely correlate. The model comparisons begin by contrasting Model 1 and Model 2 to assess convergent validity. Model 1 and Model 3 are contrasted to assess discriminant validity. Finally, Model 1 and Model 4 are contrasted to test whether the method factors are correlated.

The fit statistics for indicated that Model 1 described the relationships among variables in this study fairly well ($\chi^2_{(110)}$=151.14, CFI=.75, RMSEA=.055, 90%CI=.031, .076). The main

issue with model 1 was the relatively low CFI score, which was below the threshold of .90. However, the RMSEA was less than the .08 threshold for a good fit suggested by Bentler (1990) and Byrne (2010). A comparison of Model 1 and Model 2 to assess convergent validity was performed. The comparison of fit statistics revealed substantial degradation in the 2nd model's ability to describe the data. Since Model 2 did not specify trait variables, these results constitute convergent validity evidence-- i.e, the relationships among variables could not be described by method factors alone. Contrasting Model 1 and Model 3 can give discriminant-validity-related evidence. Model 3 has freely correlated method factors and perfectly correlated trait factors. Critical thinking and personality were reduced to one factor. The larger the difference, the greater the evidence of discriminant validity. Table 4 showed that the fit statistics for Model 3 were poor and did not achieve the thresholds established by Bentler and others. The final comparison was Model 1 with Model 4. The comparison showed small differences in fit statistics, which suggested that there was no common method variance between the implicit and explicit measures. Table 4 displays the fit statistics for every Model.

Table 5 displays the differential Goodness-of-Fit Statistics for nested model comparison. The results of the comparison of Model 1 to Model 2 provided support for convergent validity. More specifically, the CFI (.75) and RMSEA (.055) for Model 1 represented a better fitting model than the fit statistics for Model 2, CFI (.37), and RMSEA (.080). While the fit statistics for Model 1 are within recommendations made by Bentler (1990), the fit statistics for Model 2 fell well below these norms.

In contrasting Model 1 vs. Model 3 and Model 1 vs. Model 4, evidence for discriminant validity can be found. Model 1 to Model 3 results indicated that when personal factors are restricted to a single factor, the model did a poorer job of describing the relationship among

variables. The CFI (.75) and RMSEA (.055) for Model 1 represented a “good fit” while the CFI (.56) and RMSEA (.072) for Model 3 are both far outside the recommendations for a good fit. Finally, Model 1 and Model 4 comparison indicated similar fit statistics.

Table 6 displays the factor loadings for each of the study variables in Model 1: two method factors (explicit and implicit) and three personal factors (Factor-alpha, Openness, and Critical-thinking). These results suggested that only some of the indicator variables for each factor had significant loadings, which provides only modest support for construct validity of the measures. More specifically, the implicit measures did not load on to the trait factors in the hypothesized manner. In addition, the explicit measures did not load well onto their respective trait factors.

Table 2. Descriptive Statistics for Study Variables

Variables	N	Min	Max	Mean	SD	Alpha
Demographics						
Age	123	17	25	18.79	1.01	NA
Implicit Measure						
NFC	123	-0.31	1.15	0.51	0.32	0.36
Conscientiousness	123	-0.35	1.15	0.31	0.30	0.54
Agreeableness	123	-0.57	0.82	0.22	0.24	0.64
Explicit Measure						
EBI-I	123	4	16	8.81	2.59	0.62
EBI-C	123	5	19	10.25	2.39	0.53
EBI-S	123	7	20	13.80	2.34	0.60
NEO-O	123	10	45	26.56	6.23	0.70
NEO-A	123	14	48	31.86	6.28	0.80
NEO-C	123	15	46	31.82	6.65	0.83
NFC	123	37	84	56.15	10.10	0.84
WG-1	123	0	7	2.88	1.45	0.30
WG-2	123	0	8	2.39	1.73	0.58
WG-3	123	2	9	5.55	1.78	0.43
ISSA-SS	123	3	15	9.94	2.42	0.74
ISSA-A	123	8	20	14.85	2.61	0.68
ISSA-O	123	4	18	11.94	2.69	0.60
ISSA-S	123	5	18	11.25	2.78	0.58

Table 3. Zero-Order Correlations Based on Study Variables.

Variables	1	2	3	4	5	6	7	8	9
Implicit									
AG	-								
CON	.30**	-							
NFC	.23**	.33**	-						
Explicit									
EBI_I	.11	.07	.19*	-					
EBI_C	-.12	-.17	-.05	-.03	-				
EBI_S	-.03	.09	.08	.09	-.07	-			
NEO_O	.08	-.06	-.13	-.20*	-.22*	-.35**	-		
NEO_A	-.07	.01	-.04	-.13	.04	-.09	.04	-	
NEO_C	-.06	.21*	.11	-.10	-.05	.19*	-.27**	.28**	-
NFC	.04	-.04	.15	-.02	-.06	-.07	.38**	.09	.11
WG1	.09	-.12	.00	-.12	-.08	-.17	.22*	.13	-.02
WG2	.02	.10	.03	.03	-.02	.09	-.12	-.02	-.01
WG3	.15	-.14	-.07	-.03	.11	-.13	.07	.04	-.13
ISSA_SS	.06	.00	-.12	.09	-.13	-.15	.31**	.10	-.06
ISSA_A	-.03	-.02	-.11	-.12	-.02	-.03	.32**	.17	.01
ISSA_O	-.03	-.01	.02	.13	.02	.16	-.17	.12	.07
ISSA_S	-.03	.08	.08	.15	.12	.02	-.15	-.11	-.13

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3 continued

Variables	10	11	12	13	14	15	16	17
Implicit								
AG								
CON								
NFC								
Explicit								
EBI_I								
EBI_C								
EBI_S								
NEO_O								
NEO_A								
NEO_C								
NFC	-							
WG1	.11	-						
WG2	.10	-.20*	-					
WG3	.15	.06	.16	-				
ISSA_SS	.28**	.15	-.10	.11	-			
ISSA_A	.24**	.01	-.09	-.13	.38**	-		
ISSA_O	-.14	-.10	.12	.00	.08	.03	-	
ISSA_S	.04	-.13	.16	-.01	-.08	.03	-.05	-

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 4. Summary of Goodness-of-Fit Statistics for CFA Models

Model	x^2	df	CFI	RMSEA	90%C.I.
1. Freely correlated traits; freely correlated methods	151.14	110	.75	.055	.031, .076
2. No traits; freely correlated methods	232.24	130	.37	.080	.063,.097
3. Perfectly correlated traits; freely correlated methods	183.62	113	.56	.072	.052,.090
4. Freely correlated traits; uncorrelated methods	148.89	111	.77	.053	.027, .074

Table 5. Differential Goodness-of-Fit Statistics for Nested Model Comparisons

Model Comparisons	Δχ2	df	ΔCFI
Test of Convergent Validity			
Model 1 vs. Model 2	81.24*	20	.38
Tests of Discriminant Validity			
Model 1 vs. Model 3	32.48*	3	.19
Model 1 vs. Model 4	2.25	1	-.02

*$p < .001$

Table 6. Trait and Method Loadings for CFA Model 1

	Implicit	Explicit	Alpha	Openness	*g*
Implicit Measures					
NFC	.37*			.27	
Agreeableness	.66*		-.13		
Conscientiousness	.60*		.18		
Explicit Measures					
EBI-I		-.22			.32
EBI-C		-.16			.11
EBI-S		-.31			.06
NEO-O		.67*		-.12	
NEO-A		.12	.53*		
NEO-C		-.15	.68*		
NFC		.64*		.61*	
WG-1		.24			-.13
WG-2		-.13			.32
WG-3		.14			.24
ISSA-SS		.39*			-.03
ISSA-A		.39*			-.12
ISSA-O		-.23			-.06
ISSA-S		-.16			.39

*$p<.001$

DISCUSSION

The purpose of the current study was to validate an internet search assessment through the use of a multi-trait multi-method design. Model 1 fits the data fairly well according to the fit statistics, while there was a noticeable degradation of fit statistics in the more restrictive models. This degradation provided support for convergent and discriminant validity of the ISSA measure. Convergent validity evidence for the implicit measures was stronger than for the explicit measures. In particular, the critical thinking loadings were all non-significant and weak. When examining zero-order correlation table, weaker than expected relationships between the ISSA factors and critical thinking were found. In addition, the EBI did not correlate well with any of the measures, and the Simple Knowledge factor was negatively correlated with factor 1 of the Watson-Glaser. The low loadings and poor correlations could be caused by the low reliabilities of the Watson-Glaser scales and of the ISSA. However, the correlation matrix supported that the ISSA was related to Openness. This is seen in the significant and moderately strong correlations between scientific sources and argument with the need for cognition scale and the Openness facet of the NEO-PI-R. Based on these relationships, a model 5 was made and tested to see if the fit statistics could be improved upon. The most notable changes were the exclusion of the EBI factors and two of the ISSA factors (de-identified search and opinion confirmation). Figure 5 shows the full model.

As apparent in model 5, the two ISSA factors loaded onto Openness. The fit statistics for this model were greatly improved, relative to model 1 ($\chi^2_{(42)}$=56.79, CFI=.89, RMSEA=.054, 90%CI=.000, .087). The model provided better evidence of discriminant and convergent validity when compared to Model 1. However, the low reliabilities of the three Watson-Glaser scales

may have been an underlying reason for the lower fit statistics. Table 7 has the full factor loadings of the model.

The loadings are an improvement from Model 1, but they are still subpar. The weak loadings could indicate that the ISSA measure is inadequate in measuring what it is targeting. However, if the ISSA is better than what the evidence of what this study suggests than certain limitations could have contributed to the weak loadings.

Certain limitations of the study might have negatively affected the results. The first is the time factor of the study. To save time, the full Watson-Glaser was not used, which may have led to low reliabilities for the factors and poor loadings onto the *g* factor. Despite this time-saving strategy, the overall time requirements of the study was 45 minutes, which could have caused fatigue in the participants and produced less cognitive engagement among participants toward the end of the study. This is most noticeable in the poor alpha coefficients of the EBI and the ISSA, which participants took at the end of the study. Finally, the personality IATs were developed in Germany, and this could have led to cultural differences affecting how they performed in an English-speaking subject pool. This is supported by the poor loadings of the IATs on the Alpha factor of the models.

Two main areas for future research would be of interest. The first is having more time for the study so researchers can use the entirety of the Watson-Glaser. An alternative to the Watson-Glaser could be a short critical-thinking measure such as the Wonderlic. This could help with the poor critical-thinking factor in the model. In addition, potentially splitting up the administration of the measures to avoid participant fatigue could help with the psychometric properties of some of the scales. The second is to see if the ISSA is related to other measures of internet search tasks. The current internet search tasks are not short and would require a study built around

them. Finally, criterion measures such as behavioral assessments for internet search, i.e., have participants search for information on a subject they know little about. This way, one can link the ISSA with behaviors it is theoretically supposed to predict.

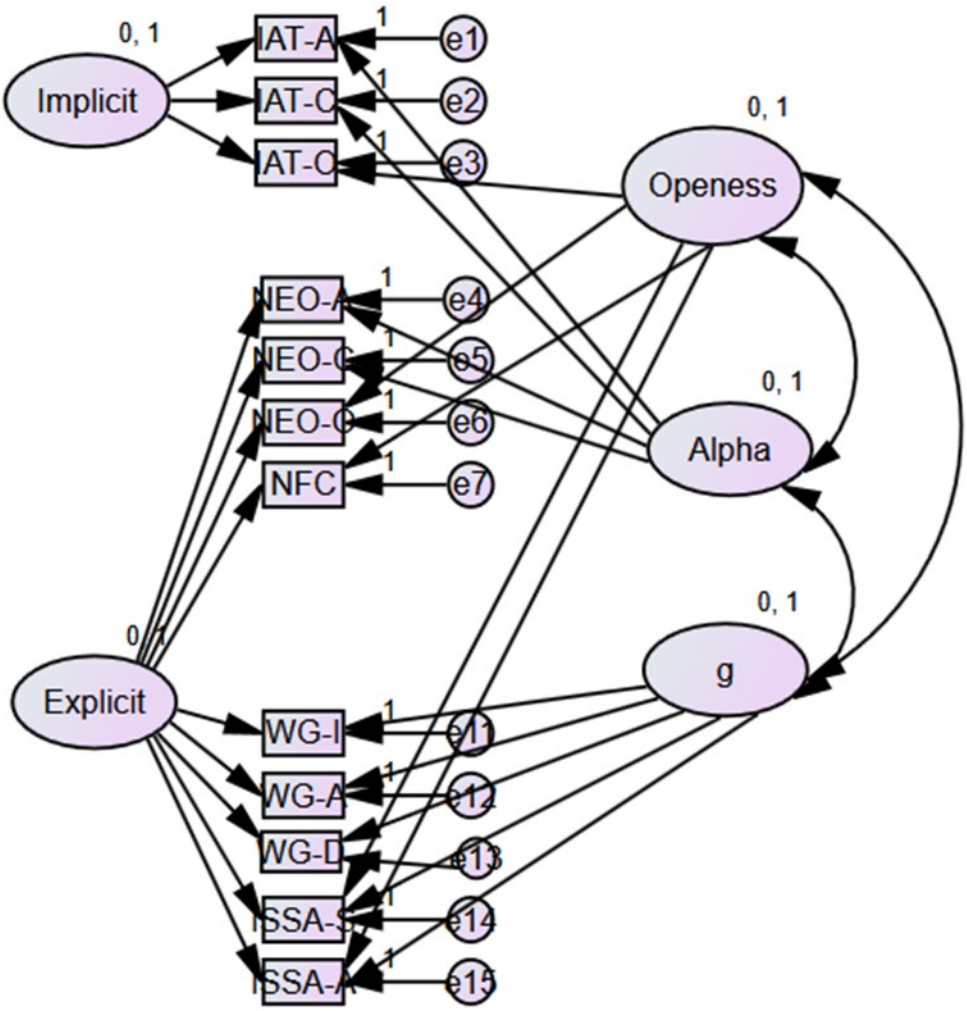

Figure 5. CFA Model 5. Freely Correlated Method Factors and Three Freely Correlated Trait Factors

Table 7. Trait and Method Loadings for CFA Model 5

	Implicit	Explicit	Alpha	Openness	*g*
Implicit Measures					
NFC	.49*			.18	
Agreeableness	.46*		-.09		
Conscientiousness	.69*		.17		
Explicit Measures					
NEO-O		-.59*		.33	
NEO-A		-.15	.62*		
NEO-C		.39	.59*		
NFC		-.15*		.88*	
WG-1		-.25			-.05
WG-2		.20			-.31
WG-3		-.15			-.40
ISSA-SS		-.44*		.37	.27
ISSA-A		-.36		.47	.55*

*p<.001

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APPENDICES

Appendix A: Human Subjects IRB Approval

To:
Donald Fischer
Psychology
Joseph Wansing

Date: Mar 9, 2021 3:13:03 PM CST

RE: Notice of IRB Exemption
Study #: IRB-FY2021-504
Study Title: Further investigation of the Internet Search Strategies scale

This submission has been reviewed by the Missouri State University Institutional Review Board (IRB) and was determined to be exempt from further review. However, any changes to any aspect of this study must be submitted, as a modification to the study, for IRB review as the changes may change this Exempt determination. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Researchers Associated with this Project:
PI: Donald Fischer
Co-PI: Joseph Wansing
Primary Contact: Donald Fischer
Other Investigators: Xin Wei Ong, Max Lischwe, Timothy Amadore

Appendix B: Internet Search Strategies Assessment

1. I would look more at websites that seemed to be from researchers.
1. I would look more at websites that appeared to be from educational institutions.
2. I would look more at websites that appeared to be from government agencies.
3. I would try to find websites that gave both pro and con arguments.
4. I would try to find websites from different kinds of researchers.
5. I would try to find and read the website that made the best quality arguments on either side of the issue.
6. I would give more weight to news websites that I personally agree with.
7. I would look at web sites that seem to look at things the way I do for facts that support my opinion.
8. I would look at the text underneath each website and go with my gut as to which sites look like they are providing reliable information.
9. I would give more weight to news websites that I trusted to give more objective factual information.
10. I would look at a few of the most popular websites from the search and read those.
11. I would turn off any personalized search options in my browser.
12. I would open up an incognito window and conduct my search from there.
13. I would enter a statement that says one opinion, count those websites and then enter the opposite statement and count those.
14. I would count up how many websites seemed to take a stand one way or another.
15. I would try to find a Wikipedia page dealing with the issue.

Appendix C: Watson-Glaser

Factor 1:
In 1946 the United States Armed Forces conducted an experiment called “Operation Snowdrop” to find out what kinds of military personnel seemed to function best under severe arctic climatic conditions. Some of the factors examined were weight, age, blood pressure, and national origin. All of the participants in “Operation Snowdrop” were given a training course in how to survive and function in extreme cold.

At the conclusion of the experiment, it was found that that only two factors among those studied distinguished between personnel whose performance was rated as effective and those rated as not effective on the artic exercises. These factors were: (1) desire to participate in the experiment, and (2) degree of knowledge and skill regarding how to live and protect oneself under arctic conditions.
Factor 2:
Zenith is the city to move to, it has the lowest taxes.
Factor 3:
No person who thinks scientifically places any faith in the predictions of the astrologers. Neverlethess, there are many people who rely on horoscopes provided by astrologers. Therefore-

Appendix D: NEO

Conscientiousness
1. I keep my belongings clean and neat.
2. I'm pretty good about pacing myself so as to get things done on time.
3. I am not a very methodical person.(R)
4. I try to perform all the tasks assigned to me conscientiously.
5. I have a clear set of goals and work toward them in an orderly fashion.
6. I waste a lot of time before settling down to work.(R)
7. I work hard to accomplish my goals.
8. When I make a commitment, I can always be counted on to follow through.
9. Sometimes I'm not as dependable or reliable as I should be.(R)
10. I am a productive person who always gets the job done.
11. I never seem to be able to get organized.(R)
12. I strive for excellence in everything I do.
Openness
1. I don't like to waste my time daydreaming.(R)
2. Once I find the right way to do something, I stick to it.(R)
3. I am intrigued by patterns I find in art.
4. I believe letting students hear controversial speakers can only confuse and mislead them.(R)
5. Poetry has little to no effect on me.(R)
6. I often try new and foreign foods.
7. I seldom notice the moods or feelings that different environments produce.(R)
8. I believe we should look to our religious authorities for decisions on moral issues.(R)
9. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
10. I have little interest in speculating on the nature of the universe or the human condition.(R)
11. I have a lot of intellectual curiosity.
12. I often enjoy playing with theories or abstract ideas.
Agreeableness
1. I try to be courteous to everyone I meet.
2. I often get into arguments with my family and co-workers.(R)
3. Some people think I'm selfish and egotistical.(R)
4. I would rather cooperate with others than compete with them.
5. I tend to be cynical and skeptical of others' intentions.(R)
6. I believe that most people will take advantage of you if you let them.(R)
7. Most people I know like me.
8. Some people think of me as cold and calculating.(R)
9. I'm hard-headed and tough-minded in my attitudes.(R)
10. I generally try to be thoughtful and considerate.
11. If I don't like people, I let them know it.(R)
12. If necessary, I am willing to manipulate people to get what I want.(R)

Appendix E: EBI

1. Smart people are born that way.
2. People can't do too much about how smart they are.
3. Some people will never be smart no matter how hard they work.
4. How well you do in school depends on how smart you are.
5. Absolute moral truth does not exist.(R)
6. Truth means different things to different people.(R)
7. Sometimes there are no right answers to life's problems.(R)
8. What is true today will be true tomorrow.
9. Too many theories just complicate things.
10. The best ideas are often the most simple.
11. If a person tries too hard to understand a problem they will likely end up confused.
12. Things are simpler than most professors would have you believe.

Appendix F: NFC

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun.(R)
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.(R)
5. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.(R)
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to.(R)
8. I prefer to think about small, daily projects to long-term ones.(R)
9. I like tasks that require little thought once I've learned them.(R)
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much.(R)
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.(R)
17. It's enough for me that something gets the job done; I don't care how or why it works.(R)
18. I usually end up deliberating about issues even when they do not affect me personally.

Appendix G: NEO-IAT

1. Self: I, mine, me, mine
2. Other: you, your, yours
3. Conscientious- pedantic, strong-willed, disciplined, organized, dependable
4. Not Conscientious- aimless, laid-back, chaotic, untidy, late
5. Agreeableness- understanding, compliant, cooperative, benevolent, polite
6. Not Agreeableness- critical, antagonistic, stubborn, persistent, irritable

Appendix H: NFC-IAT

Self
Others
Cognitively active- active, curious, interested, ambitious, inquisitive
Cognitively lazy- passive, indifferent, dependent, easygoing, inattentive

Appendix I: Informed Consent

Informed Consent Statement
The purpose of this study is to investigate an internet search strategies scale. You will answer questions about how you search for information on the internet. While answering the questions please be thinking about your past experiences researching different topics. In addition, you will answer questions about how you view knowledge and personality. It should take you less than an hour to complete the entire study.
There are no anticipated risks associated with the procedures and stimuli to which you will be exposed during the study. However, in-person research participation during the Covid-19 pandemic does carry an associated risk of infection. To minimize this risk, we are situating participants no less than six feet apart and requiring that all participants and experimenters be masked at all times during data collection. This policy is consistent with Missouri State University's current policy to mitigate the spread of Covid-19.
Participation in this study is voluntary and you can withdraw at any time, without penalty. You will receive ONE unit of credit for participating. Your identity as a subject in this study is confidential – no names or other personally identifying information will be retained or reported. The faculty member responsible for this study is Donald Fischer in the Psychology Dept (417-836-4164; Hill Hall 332) and he will answer any questions you may have regarding this study. You can also ask me (a research assistant) any questions you have about this study. Do you have any questions you wish to ask at this time?
Please silence your cell phones like you would if you were watching a movie, and put them out of sight.
You may now click on the link in the email message.