

AN INQUIRY INTO COGNITIVE AND MOTIVATIONAL  
MECHANISMS BETWEEN PERCEIVED SIMILARITY  
AND INFORMATION PROCESSING

by

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## ABSTRACT

Social-cognitive perspectives suggest that ingroup perceived similarity between a message recipient and communicator stimulates systematic (e.g., more effortful) information processing of the message, which is posited to occur through implicitly-conferred ingroup benefits (e.g., expecting/perceiving greater ease of processing messages with ingroup members). Yet, effects of perceived similarity on information processing have not been empirically tested in the context of learning, nor have their presumed underlying processes. I proposed a conceptual model postulating that a salient shared social identity will activate greater perceived similarity between *the processor* of information and *authors* of the respective information which, in turn, will enhance information processing via cognitive and motivational mechanisms. Specifically, I tested whether a shared social identity enhances learning serially via a) perceived similarity, b) cognitive synergy between the processor and authors (perceptions encompassing ease of processing and cognitive connection with one's partner), and c) effort.

College participants completed sample reading comprehension sections of the Graduate Record Examinations (GRE). Passages for each reading comprehension task were purported to be written by "experts" who have mastery of an esoteric topic. Experts were perceived to be either similar or dissimilar to the participant based on information processing (learning) styles. After making shared social identity salient, participants rated their perceptions (presumed cognitive and motivational mechanisms) vis-à-vis the expert and task both *before* and *after* the reading comprehension tasks.

Results failed to support a direct relationship between shared social identity and learning. But, supporting the hypothesized mediational sequence, a shared social identity predicted greater perceived similarity which, in turn, predicted greater learning serially via perceived (i.e., post-assessment) cognitive synergy and effort. Interestingly, inconsistent mediation manifested with pre-assessment mediators in the model, namely that the effect of shared social identity on learning was accentuated via perceived similarity but also inhibited via expected cognitive synergy. Findings have both theoretical and practical implications for understanding the complexities of a salient shared social identity on how people process information.

## DEDICATION

This thesis is dedicated to my beloved wife, Lauren Tortoriello, my parents, Kenneth and Peggy Tortoriello, my sister, Emme Tortoriello, and to my late grandparents, Frank and Leah Tortoriello, and Joseph and Virginia Zielinski, whose presence lives on in spirit ad infinitum. I love you all deeply.

## LIST OF ABBREVIATIONS AND SYMBOLS

$\alpha$	Cronbach's index of internal consistency
ANOVA	Analysis of Variance
CFI	Comparative fit index
$d$	Cohen's $d$ : Effect size estimate
$df$	Degrees of freedom: number of values free to vary after certain restrictions have been placed on the data
$F$	Fisher's $F$ ratio: A ratio of two variances
$IE$	Indirect effect
$M$	Mean: the sum of a set of measurements divided by the number of measurements in the set
$p$	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
$r$	Pearson product-moment correlation
RMSEA	Root mean square error of approximation
$SE$	Standard error estimate
$SD$	Standard deviation: measure of the variation of a set of data values from its mean
SRMR	Standardized root mean square residual
$t$	Computed value of $t$ test
$\chi^2$	Chi-square statistic
<	Less than
=	Equal to

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## CHAPTER I

### INTRODUCTION

Research in psychological science and other cognate disciplines suggests that perceived similarity between a message recipient and communication source can have important consequences on how the recipient processes information from the source. For instance, in the context of race and education, longitudinal studies suggest that students have higher math and reading achievement when their teacher shares their racial identity (Dee, 2004; 2005). Some interventions have yielded promising outcomes at mitigating such racial achievement gaps. For example, in Gehlbach et al. (2016), students who were instructed to identify similarities with their teachers received higher course grades than students who were not instructed to identify such similarities. These real-world outcomes in the realm of education suggest possible facilitative mechanisms between perceived similarity and information processing.

#### **Shared Social Identity and Communication Effectiveness**

Indeed, a recent study by Greenaway and colleagues (2015) tested a hypothesis that might account for the aforementioned findings. Principally, Greenaway et al. (2015) theorized that a shared social identity renders communication more effective. This shared social identity account in Greenaway et al. (2015) adopts key tenets from two extant theories in social psychology: social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). *Social identity theory* (Tajfel & Turner, 1979) fundamentally posits that one's social identity informs his/her self-concept. Presumably to preserve a positive self-concept, ingroups are perceived as favorable, especially in juxtaposition

with corresponding outgroups (Tajfel & Turner, 1979; Perdue, Dovidio, Gurtman, and Tyler; 1990). *Self-categorization theory* describes the phenomenon, *depersonalization*, in which people abandon individual distinctiveness to accommodate the superordinate, categorical prototype of an ingroup (Turner et al., 1987). Consequently, advantages are uniquely bestowed upon the ingroup: ingroup positivity, collective behavior, cohesion, cooperation, shared norms, etc. (Hogg & Terry, 2000). Collectively, these two theories underpin the shared social identity account of communication proposed by Greenaway et al. (2015): a salient shared social identity is associated with a constellation of social-cognitive benefits, thereby helping to render communication more effective between ingroup members.

Experiments in Greenaway et al. (2015) provided support for a shared social identity account of communication. In two studies, participants were provided instructions on how to build a model car from an ostensible ingroup (i.e., shared social identity) or outgroup (i.e., non-shared social identity) member. Shared social identity was manipulated by relaying fictitious feedback to participants regarding their information processing styles; ingroup members shared the same processing style as their partner (e.g., both deductive processors), and outgroup members had opposing processing styles to their partner (e.g., the participant was a deductive processor, but his/her partner was an inductive processor). Communication effectiveness was operationally defined as the participant's ability to accurately follow his/her partner's instructions. Participants more accurately followed instructions (i.e., objectively built higher quality models) when they shared (vs. did not share) information processing styles with their partners, and this effect was attenuated when a superordinate social identity (i.e., a social identity which subsumes both types of processors; in Greenaway et al. (2015), a university student) was made salient. Moreover, the effect of shared social identity on perceived communication quality

was mediated via perceived similarity with the communicator. Hence, at least two theoretical insights might be gleaned from Greenaway et al. (2015): 1) a shared social identity can render *actual* communication more effective and 2) a shared social identity can enhance *perceived* communication quality by means of perceiving heightened similarity with the communicator.

Despite these theoretical advancements, underlying mechanisms by which a salient shared social identity promotes more effective processing of messages remain uncharted. Greenaway and colleagues (2015) did measure concomitant variables of communication effectiveness such as perceived similarity, ingroup (partner) attitudes, task motivation, perceived partner effort, and perceived communication quality. Theoretically, these perceptions might mediate between shared social identity and information processing. However, it appears that Greenaway et al. (2015) conceptualized these variables as byproducts, rather than causes, of communication effectiveness. That is, Greenaway et al. (2015) modeled these aforementioned variables as outcomes of communication effectiveness. Given that these variables were assessed after task performance, this modeling is logical. Nevertheless, a theoretically-driven approach might contend that similar variables should be treated as intervening mechanisms between a shared social identity cue and communication effectiveness. To my knowledge, this conceptual process has yet to be tested, and Greenaway et al. (2015) presented this test as a potential direct for future research.

### **A Model of Shared Social Identity and Information Processing**

Building upon the shared social identity framework in Greenaway et al. (2015), I proposed a conceptual model illustrating the process by which general information processing might be augmented between ingroup members. As depicted in Figure 1, the model postulates serial mediation. First, perceived similarity is activated via a shared social identity. Next,

perceiving such similarity activates both cognitive and motivational mechanisms which can facilitate processing of novel information. Greenaway et al. (2015) speculated on possibilities, namely perceived ease of processing (e.g., Haslam, 2001), enhanced attention to stimuli (e.g., Kane, 2010; Mackie, Worth, and Asuncion, 1990), and greater task effort (e.g., Adarves-Yorno, Haslam, & Postmes, 2008). The proposed model submits two plausible mechanisms which encompass the aforementioned possibilities. *Cognitive synergy* was conceptualized as constituting ease of information processing and cognitive connection with one's partner (i.e., feeling mentally "in sync"). *Effort* was conceptualized as constituting motivation and attention toward processing the stimuli. Indeed, the *experience* of greater fluency and smoothness of communicating with an ingroup member should inspire more critical processing of stimuli. Finally, greater intent to process information should subsequently enhance the actual processing of information.

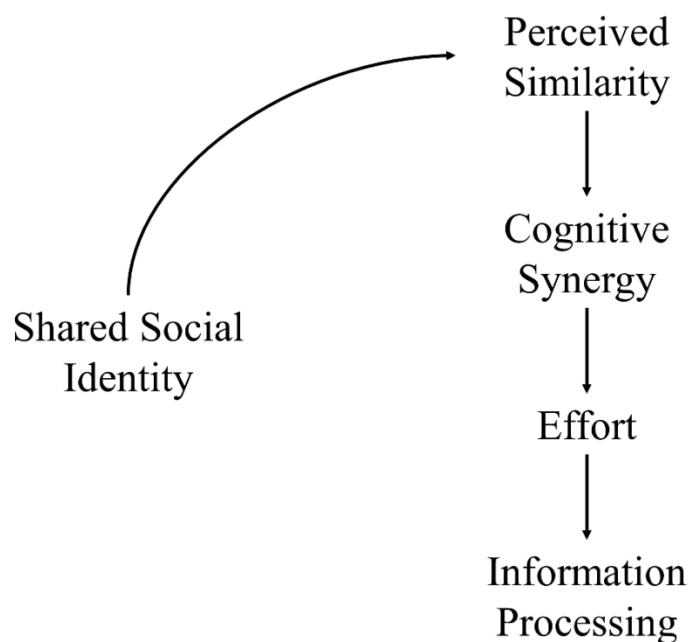


Figure 1. A conceptual model of shared social identity and information processing.

## Theoretical Allusions to Cognitive and Motivational Mechanisms

Literature on intergroup dynamics and persuasion has yielded indirect support for the cognitive and motivational mechanisms proposed to occur in my model. One supposition is that people might expect ingroup messages will be easier to process and that ingroup members are more attune to how fellow ingroup members think. Ingroups automatically elicit positive connotations that bear on information encoding (Perdue et al., 1990) and ingroup favoritism (Brewer, 1979). These positive connotations of ingroup members might evoke expectations or beliefs that information conveyed by ingroup members is superior. As a result, espousing beliefs of more fluent ingroup information processing (e.g., *cognitive synergy* between ingroup members), which is predicated upon a perceived “shared reality,” may render ingroup communication more intelligible. A potentially important distinction, however, is the *expectation* of fluent processing versus the *perception of experiencing* more fluent processing. Whereas the latter would certainly seem to facilitate ingroup communication, one should consider the possibility that the former may not (especially if effort is low). For instance, the expectation of greater fluency might reduce preparedness to expend the extra effort required to process complex messages, thereby hindering communication effectiveness.

A second supposition is that people should engage in more effortful (or systematic) processing toward ingroup messages. For example, in Mackie et al. (1990), participants were instructed to read persuasive messages purportedly written by either an ingroup or outgroup member. The strength of the message was manipulated to be either high or low. In theory, critical processing of information should enable people to better discern the strength of a given message. Indeed, for ingroup messages *only*, strong (vs. weak) messages predicted greater attitude change (Mackie et al., 1990). Further, ingroup messages generally predicted greater



recall of message content compared to outgroup messages. Other work suggests that greater attention is devoted to ingroup content, especially under conditions in which the merits of ingroup content are not easily recognizable (Kane, 2010). Collectively, the evidence reviewed supports the supposition that people put forth greater effort and attention to processing ingroup messages.

### **The Present Study**

The objective of the present research was twofold. First, I tested the central hypothesis of my conceptual model in the context of learning: shared social identity facilitates processing of novel information. Results in Greenaway et al. (2015) precisely revealed that a shared social identity enhanced one's ability to adhere to instructions and execute them effectively. However, to test whether processing novel information conveyed by ingroups can be processed and conceptually applied, I examined this hypothesis through the lens of learning. Support for this hypothesis would then suggest that facilitative effects of shared social identity on information processing are not merely superficial (e.g., following instructions) but rather are more sophisticated and complex (e.g., learning difficult concepts). Second, I tested the process proposed by my conceptual model: the effect of shared social identity on learning is serially mediated via perceived similarity, cognitive synergy, and effort.

In this study, I employed the similar shared social identity paradigm used in Greenaway et al. (2015), in which participants completed a "learning processing styles" questionnaire and were subsequently provided fictitious feedback. Next, participants were told that they would complete a learning assessment which included reading comprehension passages written by ostensible "experts." To manipulate shared social identity and, hence, perceived similarity,

experts were revealed to possess either the same processing style (“deductive”) or a different processing style (“inductive”) as the participants.

Prior to completing the reading comprehension task, my index of learning, participants provided pre-assessment ratings (i.e., *expectations*) designed to index possible cognitive and motivational mechanisms between perceived similarity and learning. Items assessed were intended to capture expected a) cognitive synergy between the participant and experts and b) effort put forth into completing the learning assessment. For exploratory purposes, I also assessed positive attributes that participants expected their experts to possess (e.g., knowledgeable). Although this construct did not factor into my conceptual model, it may, nonetheless, bear on learning information conveyed from ingroup members (e.g., Perdue et al., 1990). Participants similarly provided post-assessment ratings (i.e., *perceived experience*) of the same cognitive and motivational mechanisms which indexed perceptions during the reading comprehension tasks. As earlier speculated, the mere expectation of ingroup benefits to information processing might not actually facilitate learning. Thus, I will test two serial mediation models, one which contains pre-assessment perceptions as mediators and one which contains post-assessment perceptions as mediators.

## CHAPTER II

### METHODOLOGY

**Design.** The present study utilized a two-group experimental design with shared social identity (similar vs. dissimilar) as a between-subjects factor. Learning performance was the primary dependent measure. Perceived similarity and perceptions (pre- and post- assessment) were secondary dependent variables and conceptualized as mediators for mediational analyses.

**Participants.** 346 undergraduates from the University of Alabama participated in an online Qualtrics study for partial course credit in their introductory psychology course. The sample size collected was informed by an a priori power analysis for structural equation modeling (SEM). Using Mplus software (version 7.4, Muthén & Muthén, 2012), I ran a Monte Carlo simulation with 1000 iterations on the proposed serial mediation model. Results suggested that a sample size of at least 339 would suffice for detecting the most complex effect—the specific indirect effect of shared social identity on learning via three serial mediators—at .80 power, conservatively assuming small-to-moderate effect sizes ( $r_s = .20$ ) between a) shared social identity and perceived similarity and b) effort and learning, and moderate-to-large effect sizes ( $r_s = .40$ ) between the intervening variables (i.e., mediators). Five participants failed to complete the study, resulting in 341 participants ( $M_{\text{age}} = 18.51$ ,  $SD = 0.86$ ) for data analysis. The sample was predominantly female (81.8%) and Caucasian (83.6%).

**Procedure.** Participants consented to participate in an online study purporting to examine how people with different learning processing styles perform on learning assessments (under IRB #17-OR-084; see Appendix A for the approval form granted by the University of Alabama

Institutional Review Board). First, participants completed the Reduced Learning-Style Inventory (RLSI; Manolis, Burns, Assudani, & Chinta, 2012; see Appendix B), an abbreviated version of the 48-item Kolb Learning Style Inventory – Version 3 (Kolb, 1999). The RLSI had participants rate the extent to which 17 statements described their learning preferences using a 7-point Likert scale (1 = *does not at all describe me*, 7 = *very much describes me*). The RLSI was administered only as a pretext to present participants with feedback on their processing style (i.e., the study manipulation) and was not analyzed.

I manipulated shared social identity by employing the paradigm used in Greenaway et al. (2015). After completing the RLSI, all participants were given fictitious feedback that they were “deductive thinkers.” Following the feedback, participants were shown instructions on the learning assessment. The instructions purported that the researchers had solicited people to become experts on a topic and then construct passages to help teach participants their topics. Participants were randomly assigned to one of two conditions. In the similarity condition, all experts were presented as “deductive thinkers;” in the dissimilarity condition, all experts were presented as “inductive thinkers.” A manipulation check was administered to assess the degree to which the participant perceived himself/herself to be similar to his/her experts (1 = *not at all similar*, 7 = *extremely similar*; see Appendix G). This question was strategically placed at the conclusion of the survey to capture whether any perceived similarity sustained itself throughout the learning assessment. Presumably, the esoteric and technical nature of the passages written by the experts might diminish perceived similarity, so assessing perceived similarity directly following the manipulation could be misleading. To ensure that participants attended to and accurately processed the manipulation, attention checks were also administered (Appendix G).

Next, prior to beginning the learning assessment, participants rated pre-assessment perceptions pertaining to their experts and the impending learning assessment (see Appendix C). This questionnaire intended to index the extent to which participants expected their experts would possess positive attributes, cognitive synergy between themselves and their experts, and that they would put forth effort toward learning the material (1 = *not at all true*, 7 = *extremely true*).

Participants proceeded to the learning assessment, which comprised four passages and eight questions in total (Appendix D).<sup>1, 2</sup> Passages and reading comprehension questions were selected from a sample verbal reasoning section of a standardized examination intended for prospective graduate students (Graduate Record Examinations; GRE; Educational Testing Service, 2017). Thus, the learning assessment was considered highly challenging and presumed to require higher-order cognitive processing. Each question was scored in a binary fashion (incorrect response = 0, correct response = 1). Scores were subsequently aggregated into a composite index of *learning*. Time spent on each section (i.e., reading each passage and answering all respective questions) was also assessed to ensure that participants were not completing the assessment in a desultory fashion.

Immediately following, participants rated similar items that were administered prior to the assessment, which were modified to reflect the past tense. These post-assessment perceptions intended to index participants' actual experience during the learning assessment (Appendix E).

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<sup>1</sup> Pilot testing supported the validity of this learning assessment. Learning scores revealed moderate-to-strong associations with indices of scholastic achievement (high school GPA:  $r = .41$ ; college GPA:  $r = .26$ ; the ACT college readiness assessment:  $r = .53$ ; the SAT college readiness assessment:  $r = .59$ ). Learning scores also revealed positive trends with pre- and post-assessment perceptions pertaining to the assessment.

<sup>2</sup>10 questions were originally selected for this study, but pilot test data revealed that two questions had atypically high incorrect-response frequencies (89% and 92%). Thus, these questions were discarded and not assessed in the present study.

Finally, participants completed demographics (Appendix F), an exit questionnaire probing their overall experience of the study (Appendix G), and were debriefed on the study's true objectives.

## CHAPTER III

### RESULTS

#### **Data Exclusion and Reduction**

Prior to data reduction and analysis, I excluded cases in which participants were seemingly inattentive to the shared social identity manipulation. Critically, to perceive greater similarity between oneself and ostensible experts in one's ingroup (vs. outgroup), participants must have recognized *both* that 1) they were a deductive thinker and 2) their experts were deductive (vs. inductive) thinkers. Surprisingly, 39.3% of the sample either failed to correctly identify their processing style and/or identify their experts' processing styles. Thus, to retain a greater proportion of the sample (i.e., bolster statistical power), I applied more liberal exclusionary criteria. Insofar as each participant a) identified that his/her processing style started with the letter "D" and b) his/her experts' processing styles were identified as being identical (similarity condition) or the opposite (and starting with the letter "I;" dissimilarity condition), s/he was included in data analyses. Based upon these exclusionary criteria, 31.3% of the sample was eliminated, retaining a total of 237 participants for analyses (similarity condition:  $n = 115$ ; dissimilarity condition:  $n = 122$ ). Refer to Table 1 for comparisons between the retained sample and the excluded sample on study measures.<sup>3</sup> The retained sample is the sample on which I report for all subsequent analyses unless otherwise specified.

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<sup>3</sup>Comparisons in Table 1 revealed some trends that differed between the retained (included) and excluded samples. Notably, and not surprisingly, the included (vs. excluded) sample scored higher on perceived similarity, post-assessment positive attributes, post-assessment effort, and learning, suggesting greater attention to the survey in general and hence, supporting the validity of the study's attention check. Less expected, the included (vs. excluded) sample also included a higher female-to-male ratio. However, upon applying a Bonferroni correction for running 13 analyses, the included sample only significantly varied from the excluded sample on learning ( $\alpha_{\text{adjusted}} = .004$ ).

Table 1

*Comparisons Between Participants Included Versus Excluded from Data Analysis*

Variable	Included (n = 237)		Excluded (n = 104)		Difference		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
SIMILAR	3.37	1.39	3.04	1.34	-2.03	339	0.04
PRE_ATT	5.85	1.13	5.95	0.98	0.77	339	0.44
PRE_COG	5.18	1.02	5.28	1.12	0.80	339	0.42
PRE_EFF	5.75	0.95	5.80	0.90	0.41	339	0.69
POST_ATT	5.41	1.14	5.12	1.20	-2.09	339	0.04
POST_COG	3.92	1.31	3.69	1.29	-1.51	339	0.13
POST_EFF	4.97	1.28	4.57	1.43	-2.54	339	0.01
LEARN <sup>a</sup>	3.29	1.84	2.67	1.52	-3.24	235.48	0.001
AGE (years)	18.48	0.79	18.58	1.01	0.95	339	0.35
TIME_ASSESS (minutes)	13.16	15.10	10.41	9.54	-1.71	339	0.09
TIME_STUDY (minutes)	22.35	20.03	21.60	20.82	-0.32	339	0.75
	<i>n</i>	%	<i>n</i>	%	$\chi^2$	<i>df</i>	<i>p</i>
GENDER					5.80	1	0.02
Male	35	14.77%	27	25.96%			
Female	202	85.23%	77	74.04%			
RACE <sup>b</sup>					0.65	1	0.42
Caucasian	201	89.73%	84	86.60%			
African American	23	10.27%	13	12.50%			

*Note.* SIMILAR = Perceived Similarity; PRE\_ATT = Pre-Assessment Positive Attributes; PRE\_COG = Pre-Assessment Cognitive Synergy; PRE\_EFF = Pre-Assessment Effort; POST\_ATT = Post-Assessment Positive Attributes; POST\_COG = Post-Assessment Cognitive Synergy; POST\_EFF = Post-Assessment Effort; LEARN = Learning Score; TIME\_ASSESS = total time elapsed during the learning assessment; TIME\_STUDY; total time elapsed during the study.

<sup>a</sup>The assumption of homogeneity of variance was violated, so a correction was applied to the *df* for this *t*-test.

<sup>b</sup>Categories with cell sample sizes less than five were excluded from testing.

Next, I considered data reduction. Pre and post-assessment measures were intended to assess positive attributes, cognitive synergy, and effort. To test whether items indeed loaded onto these three factors, I ran two principal component analyses (PCAs) with oblique rotation (Direct Oblimin method) for pre- and post-assessment perceptions, respectively. Factors were extracted based on eigenvalues greater than one. Results consistently recommended a three-factor structure



for both pre and post-assessment items (explaining 71.01% and 75.35% of the total variance, respectively): *positive attributes*, *cognitive synergy* (amalgamating *ease of processing* items and *mental connection with partner* items), and *effort* (amalgamating *effort* items and the *attention* item). For means, standard deviations, and internal consistencies (i.e., Cronbach’s alphas), see Table 2.

Table 2

*Descriptives, Internal Consistencies, and Bivariate Correlations*

	<i>M</i>	<i>SD</i>	$\alpha$	1	2	3	4	5	6	7	8
1. SSI	—	—	—								
2. SIMILAR	3.37	1.39	—	.16*							
3. PRE_ATT	5.85	1.13	.90	.11	.07						
4. PRE_COG	5.18	1.02	.72	.16*	.16*	.55**					
5. PRE_EFF	5.75	0.95	.85	.07	.14*	.58**	.60**				
6. POST_ATT	5.41	1.14	.87	.06	.25**	.52**	.37**	.44**			
7. POST_COG	3.92	1.31	.86	.12	.62**	.24**	.31**	.34**	.53**		
8. POST_EFF	4.97	1.28	.87	.08	.34**	.30**	.29**	.56**	.50**	.55**	
9. LEARN	3.29	1.84	.54	.04	.18**	-.05	-.12	-.01	.01	.20**	.20**

*Note.* SSI = Shared Social Identity (0 = dissimilar; 1 = similar); SIMILAR = Perceived Similarity; PRE\_ATT = Pre-Assessment Positive Attributes; PRE\_COG = Pre-Assessment Cognitive Synergy; PRE\_EFF = Pre-Assessment Effort; POST\_ATT = Post-Assessment Positive Attributes; POST\_COG = Post-Assessment Cognitive Synergy; POST\_EFF = Post-Assessment Effort; LEARN = Learning Score.

No Cronbach’s alpha is report for perceived similarity, which is a single-item variable.

\*  $p < .05$ .

\*\*  $p < .01$ .

**Preliminary Analyses**

**Manipulation check.** To check the effectiveness of the shared social identity manipulation, I ran an independent-samples *t*-test in which shared social identity was the grouping variable (dissimilar vs. similar conditions) and perceived similarity was the dependent variable. Participants in the similar condition reported significantly higher ratings of perceived similarity with their experts ( $M = 3.59$ ,  $SD = 1.46$ ) relative to those in the dissimilar condition ( $M = 3.16$ ,  $SD = 1.29$ ),  $t(235) = 2.44$ ,  $p = .02$ ,  $d = .32$ . Thus, the shared social identity manipulation

was effective, such that participants perceived greater similarity to ostensible ingroup (deductive) experts compared to outgroup (inductive) experts.

To further justify my exclusionary criteria (i.e., removal of 31.3% of the sample), I also submitted perceived similarity to a 2(social identity: similar vs. dissimilar)  $\times$  2(inclusion status: excluded vs. included) factorial ANOVA. The main effect of shared social identity on perceived similarity was non-significant  $F(1, 336) = 0.44, p = .63$ . An interaction emerged,  $F(1, 336) = 4.92, p = .03$ , such that the effect of shared social identity on perceived similarity was non-significant for excluded participants (similar condition:  $M = 2.93, SD = 1.26$ ; dissimilar condition:  $M = 3.20, SD = 1.41$ ),  $F(1, 336) = 1.07, p = .30$ , but significant for included participants,  $F(1, 336) = 6.05, p = .01$ .<sup>4</sup> Thus, the removal of participants who failed the manipulation check seems highly justified on these grounds (i.e., they appeared unaffected by the manipulation).

## Main Analyses

**Testing independent paths of theorized model.** Prior to testing mediational pathways of the conceptual model (Figure 1), I tested all direct relations independently in accordance with some prescriptions for testing mediation (Baron & Kenny, 1986; see also, Judd & Kenny, 1981; Kenny, Kashy, & Bolger, 1998). Please refer to Table 1 for all correlational tests. First, I tested the relationship between shared social identity and learning. My theory postulated that a shared (similar) social identity facilitates learning relative to a non-shared (dissimilar) social identity. Inconsistent with this hypothesis, an independent-samples t-test revealed no difference on

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<sup>4</sup> The same interactive pattern emerged when submitting the manipulation check independent variable based on the more stringent exclusionary criteria (excluding 39.3% of the sample), wherein participants were required to precisely reproduce both their own processing style and their experts' during the manipulation check. Because this stringent manipulation check variable also (marginally) moderated the effect of shared social identity on perceived similarity,  $F(1, 336) = 3.81, p = .052$ , this justified favoring the more liberal exclusionary criteria (excluding only 31.3% of the sample) to retain a larger proportion of the sample.

learning scores between similar ( $M = 3.37$ ,  $SD = 1.83$ ) and dissimilar ( $M = 3.22$ ,  $SD = 1.85$ ) conditions,  $t(235) = 0.60$ ,  $p = .55$ . Nevertheless, a significant predictor-outcome relationship (i.e., a total effect) need not be present to explore mediation (Kenny et al., 1998).

Second, I tested each sequential path in the conceptual model: a) an independent-samples  $t$ -test of the predictor (*shared social identity*) on the first mediator submitted as the dependent variable (*perceived similarity*); b) a correlation between the first mediator and second mediator (*cognitive synergy*); c) a correlation between the second mediator and third mediator (*effort*); d) a correlation between the third mediator and outcome. Because my theory permits the possibility that perceptual mediators (i.e., cognitive synergy and effort) could plausibly facilitate *prior to* and/or *during* information processing, each relation with a mediator was tested using that mediator's pre- and post-assessment scores. Results generally supported hypotheses. Shared social identity positively related to perceived similarity (refer to manipulation check for inferential statistics); perceived similarity positively related to both pre- and post-assessment cognitive synergy ( $r_s = .16$  and  $.62$ , respectively); pre-assessment (post-assessment) cognitive synergy positively related to pre-assessment (post-assessment) effort,  $r = .60$  ( $r = .55$ ). However, only post-assessment effort ( $r = .20$ ), but not pre-assessment effort ( $r = -.01$ ,  $p = .83$ ), positively related to learning.

**Testing the theorized path model with pre-assessment mediators.** To test the presence of indirect effects, I ran my conceptual model as a serial-mediation path model (Figure 2), first with *pre-assessment* mediators, using the PROCESS macro for SPSS (Model 6; Hayes, 2013). Although pre-assessment effort did not relate to learning, mediation can still occur via alternative indirect paths. This serial mediation model was estimated from 10,000 bootstrapped samples using 95% confidence intervals (95% CIs); an indirect effect was deemed significant if its

corresponding 95% CI failed to include zero. All variables submitted to this model were standardized. Please refer to the top of Table 3 for all indirect effects and Figure 2 for total and direct effects. Despite an absence of total, direct, and total indirect effects of shared social identity on learning, three specific indirect effects were present. Specifically, only indirect effects which failed to include effort as a mediator were significant. That is, the *positive* specific indirect effect of shared social identity on learning via perceived similarity was significant ( $IE = .031$ ,  $SE = .017$ , 95% CIs [.007, .075]); in contrast, and contrary to hypotheses, the *negative* specific indirect effects of shared social identity on learning via a) perceived similarity and, in turn, cognitive synergy ( $IE = -.004$ ,  $SE = .003$ , 95% CIs [-.016, -.0004]) and via b) cognitive synergy ( $IE = -.030$ ,  $SE = .018$ , 95% CIs [-.077, -.003]) were significant. The latter effect seems logical, such that people expecting enhanced cognitive synergy might be more likely to abandon highly challenging tasks upon experiencing relatively less cognitive synergy. Indeed, this speculation was supported by the data; the difference between pre- and post-assessment cognitive synergy negatively related to post-assessment effort ( $r = -.31$ ,  $p < .001$ ). In summary, participants perceiving a shared social identity perceived greater similarity to their experts which, in turn, enhanced learning, whereas the same participants expected greater fluency on the reading comprehension task which ultimately inhibited learning. Thus, shared social identity had effects on processes that both facilitated and inhibited learning, which helps to explain why shared social identity failed to have a total effect on learning.

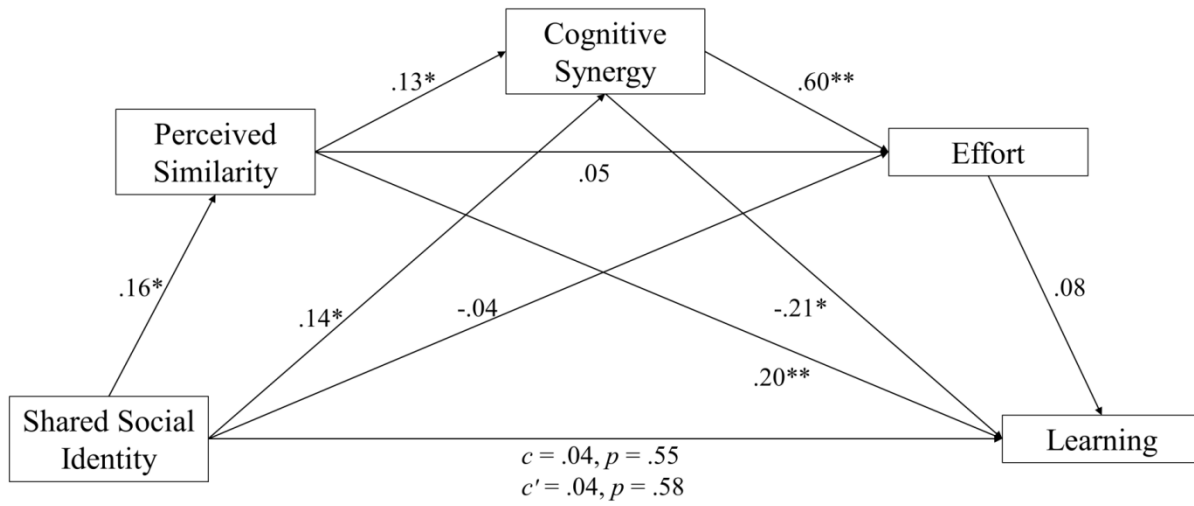


Figure 2. A pre-assessment theorized model of shared social identity and learning.

Residuals are not depicted.

$c$  = total effect;  $c'$  = direct effect.

\*  $p < .05$ . \*\*  $p < .01$ .

Table 3

*Standardized Indirect Effects in the Serial-Mediation Path Models for Pre- and Post-Assessment*

Model	Indirect Path	Estimate	SE	95% CI
PRE	Total Indirect Effect:	.003	.022	[-.040, .048]
<b>PRE</b>	<b>SSI→SIMILAR→LEARN</b>	<b>.031</b>	<b>.017</b>	<b>[.007, .075]</b>
<b>PRE</b>	<b>SSI→SIMILAR→COG→LEARN</b>	<b>-.004</b>	<b>.003</b>	<b>[-.016, -.0004]</b>
PRE	SSI→SIMILAR→EFF→LEARN	.001	.001	[-.0004, .006]
PRE	SSI→SIMILAR→COG→EFF→LEARN	.001	.001	[-.0004, .006]
<b>PRE</b>	<b>SSI→COG→LEARN</b>	<b>-.030</b>	<b>.018</b>	<b>[-.077, -.003]</b>
PRE	SSI→COG→EFF→LEARN	.007	.008	[-.005, .029]
PRE	SSI→EFF→LEARN	-.003	.007	[-.027, .005]
<b>POST</b>	<b>Total Indirect Effect:</b>	<b>.033</b>	<b>.019</b>	<b>[.002, .078]</b>
POST	SSI→SIMILAR→LEARN	.016	.014	[-.004, .056]
POST	SSI→SIMILAR→COG→LEARN	.006	.010	[-.008, .033]
POST	SSI→SIMILAR→EFF→LEARN	.000	.002	[-.003, .004]
<b>POST</b>	<b>SSI→SIMILAR→COG→EFF→LEARN</b>	<b>.007</b>	<b>.005</b>	<b>[.0001, .021]</b>
POST	SSI→COG→LEARN	.002	.006	[-.005, .026]
POST	SSI→COG→EFF→LEARN	.002	.004	[-.004, .014]
POST	SSI→EFF→LEARN	.001	.008	[-.013, .022]

Note. PRE = Path model with pre-assessment mediators; POST = Path model with post-assessment mediators; SSI = Shared Social Identity (0 = dissimilar; 1 = similar); SIMILAR = Perceived Similarity; COG = Cognitive Synergy; EFF = Effort; LEARN = Learning Score.

Bolded rows denote statistically significant indirect effects, such that their 95% confidence intervals fail to include zero.

**Testing the theorized path model with post-assessment mediators.** Similarly, I ran a theorized path model (Figure 3) with *post-assessment* mediators using the identical procedures, estimation methods, and statistical parameters mentioned above. Please refer to the bottom of Table 3 for all indirect effects and Figure 3 for total and direct effects. The total and direct effects of shared social identity on learning were non-significant. Diverging from the pre-assessment model, the total indirect effect of shared social identity on learning was significant (positive;  $IE = .033$ ,  $SE = .019$ , 95% CIs [.002, .078]). Supporting the process postulated by my conceptual model, this significant indirect effect was solely driven by the specific indirect effect of shared social identity on learning via perceived similarity which, in turn, predicted cognitive synergy which, in turn, predicted effort ( $IE = .007$ ,  $SE = .005$ , 95% CIs [.0001, .021]). That is,

participants perceiving a shared social identity perceived greater similarity with their experts, thereby eliciting the experience of greater ease of processing of the passages and connection with their experts, thereby eliciting the experience of putting forth greater effort and attention to the tasks, which, in turn, enhanced learning.

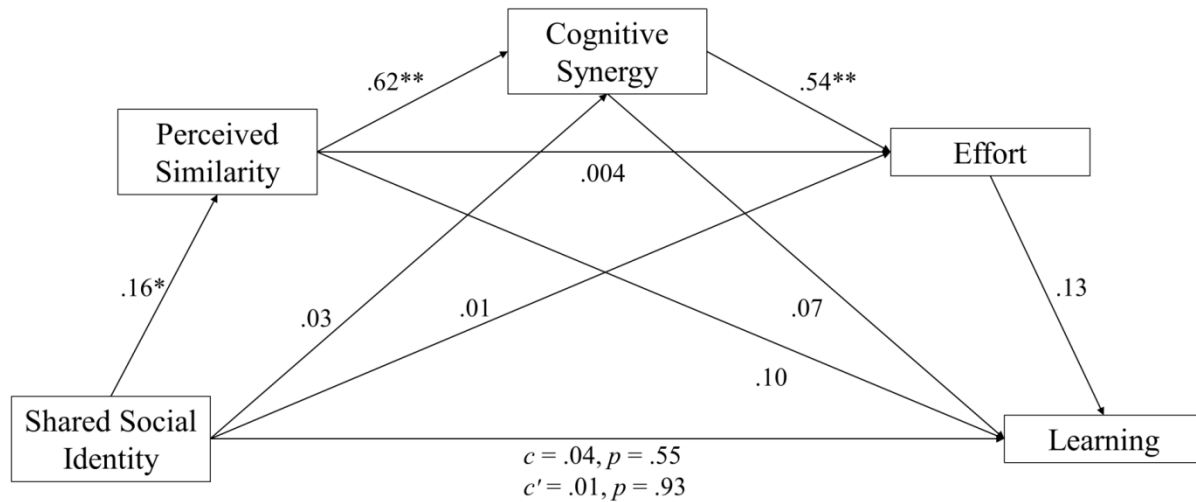


Figure 3. A post-assessment theorized model of shared social identity and learning.

Residuals are not depicted.

$c$  = total effect;  $c'$  = direct effect.

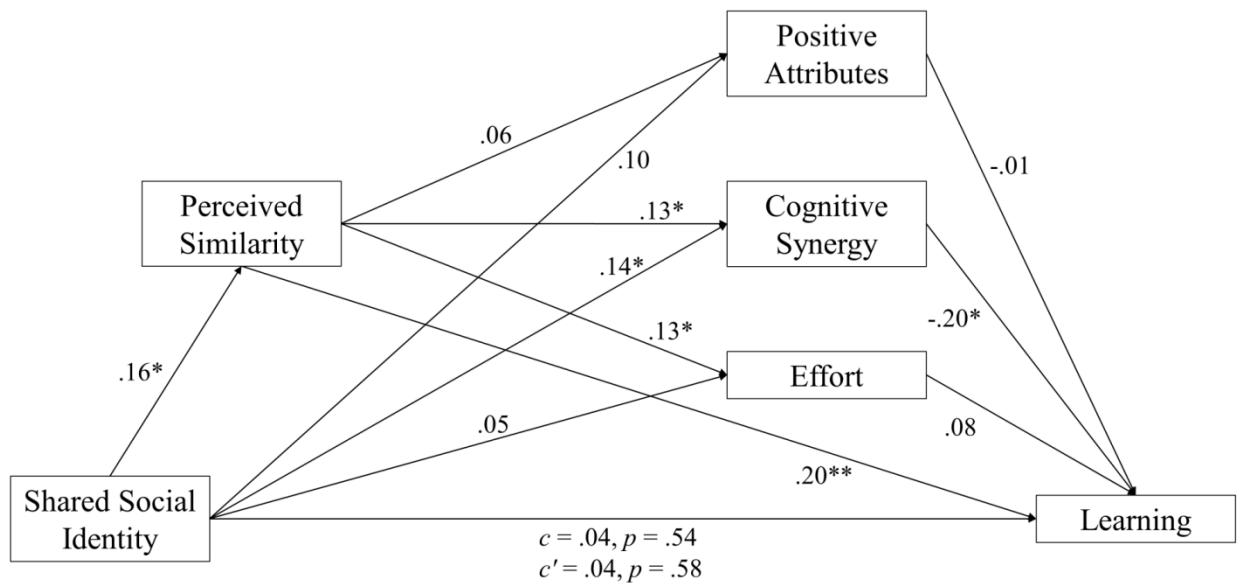
\*  $p < .05$ . \*\*  $p < .01$ .

### Auxiliary Analyses

#### Testing an alternative path model with serial and parallel mediation. My

conceptualization of the cognitive-motivational process underlying shared social identity and learning has hitherto been presumed to be sequential. Theoretically, this is a reasonable presumption. However, some of these cognitive and motivational mechanisms could occur in tandem. Hence, I also tested whether the effect of shared social identity on learning is mediated via a combination of serial and multiple (parallel) mediational processes (see Figures 4 and 5).

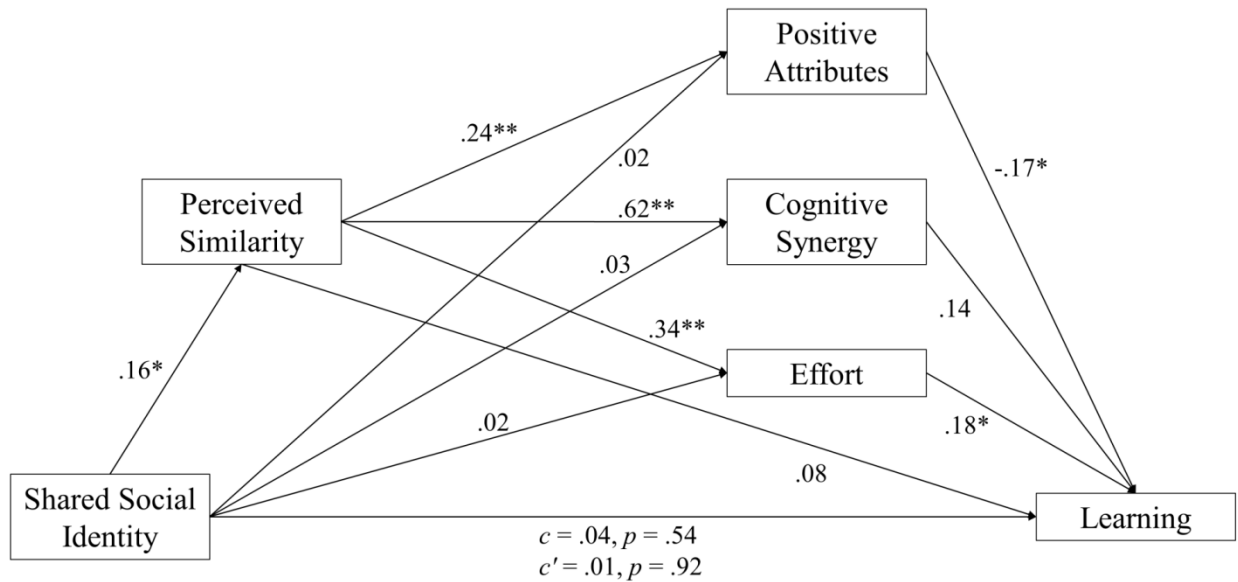
According to this conceptualization, a shared social identity elicits greater perceived similarity, which subsequently stimulates a co-varying array of cognitive and motivational mechanisms which, in turn, influence learning. Notably, path modeling based upon this conceptualization bestows at least three advantages. First, co-varying assessment perceptions enables analysis of unique contributions to explained variance (e.g., the indirect effect of shared social identity on learning via effort, controlling for cognitive synergy). Second, it utilizes all pre- or post-assessment perceptions assessed in the study (i.e., includes *positive attributes* which, given the ambiguity of its occurrence in the mediational process, was not captured in the conceptual model). Third, because it eliminates some *apparently* causal links amongst measured mediating variables, it makes fewer assumptions that correlated variables are causally related.



*Figure 4.* A pre-assessment alternative model of shared social identity and learning. Residuals and covariances between parallel mediators are not depicted.  $c$  = total effect;  $c'$  = direct effect. \*  $p < 05$ . \*\*  $p < 01$ .



To test indirect effects, I constructed the alternative models (Figures 4 and 5 for pre- and post-assessment mediators, respectively) using structural equation modeling (SEM) via Mplus (version 7.4, Muthén & Muthén, 2012) and ran 10,000 bootstrapped samples using 95% CIs. Because these models are just-identified (i.e., saturated), model fit indices were not estimated. Please refer to Table 4 for all indirect effects and Figures 4 and 5 for total and direct effects. In both pre-assessment and post-assessment models, all total, direct, and indirect effects were non-significant.



*Figure 5.* A post-assessment alternative model of shared social identity and learning. Residuals and covariances between parallel mediators are not depicted.  $c$  = total effect;  $c'$  = direct effect. \*  $p < .05$ . \*\*  $p < .01$ .

Table 4

*Standardized Indirect Effects in the Alternative Path Models for Pre- and Post-Assessment*

Model	Indirect Path	Estimate	SE	95% CI
PRE	Total Indirect Effect:	.003	.023	[-.043, .048]
PRE	SSI→SIMILAR→LEARN	.031	.017	[-.001, .064]
PRE	SSI→SIMILAR→ATT→LEARN	.000	.001	[-.002, .002]
PRE	SSI→SIMILAR→COG→LEARN	-.004	.003	[-.011, .002]
PRE	SSI→SIMILAR→EFF→LEARN	.002	.003	[-.003, .007]
PRE	SSI→ATT→LEARN	-.001	.009	[-.018, .016]
PRE	SSI→COG→LEARN	-.029	.018	[-.065, .006]
PRE	SSI→EFF→LEARN	.004	.009	[-.014, .023]
POST	Total Indirect Effect:	.033	.021	[-.009, .075]
POST	SSI→SIMILAR→LEARN	.012	.014	[-.015, .039]
POST	SSI→SIMILAR→ATT→LEARN	-.007	.004	[-.015, .002]
POST	SSI→SIMILAR→COG→LEARN	.014	.011	[-.009, .036]
POST	SSI→SIMILAR→EFF→LEARN	.009	.006	[-.002, .021]
POST	SSI→ATT→LEARN	-.004	.012	[-.028, .020]
POST	SSI→COG→LEARN	.004	.009	[-.014, .022]
POST	SSI→EFF→LEARN	.004	.012	[-.019, .028]

*Note.* PRE = Path model with pre-assessment mediators; POST = Path model with post-assessment mediators; SSI = Shared Social Identity (0 = dissimilar; 1 = similar); SIMILAR = Perceived Similarity; ATT = Positive Attributes; COG = Cognitive Synergy; EFF = Effort; LEARN = Learning Score.

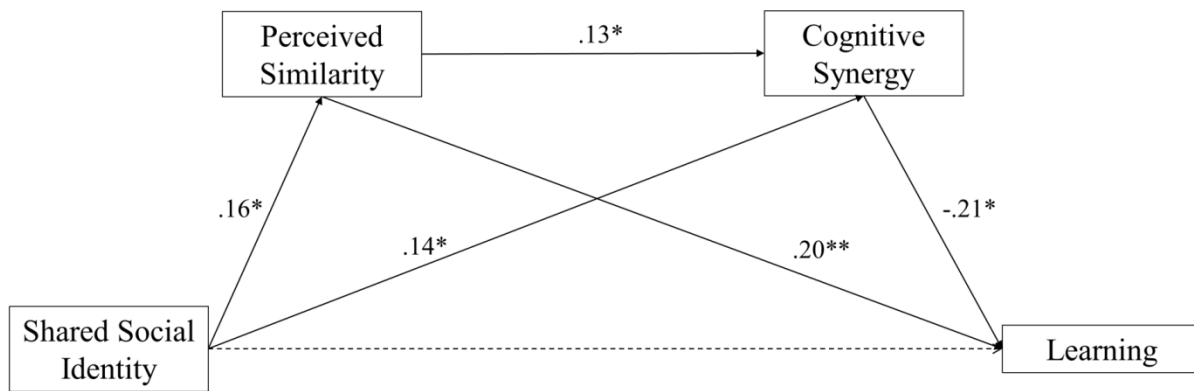
All indirect effects are non-significant due to their 95% confidence intervals including zero.

## Exploratory Analyses

**Identifying the best fitting model.** Thus far, I have only analyzed my theorized models as saturated models, meaning all possible paths in a given model—significant or non-significant—are estimated. Such models lack parsimony. To identify the best fitting model with the least complexity (i.e., fewest parameters estimated), I reran Figures 2 and 3 using Mplus and serially constrained non-significant paths.

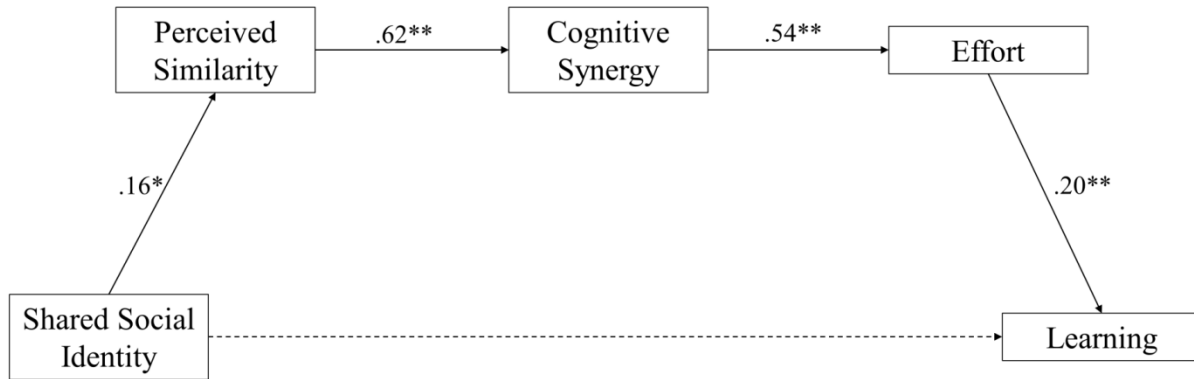
For the pre-assessment model, I originally constrained the following paths: (1) learning regressed on shared social identity, (2) effort regressed on shared social identity, (3) effort regressed on perceived similarity, and (4) learning regressed on effort. Because effort did not predict learning (i.e., the main outcome), I subsequently removed the effort variable from the

model, hence also eliminating its path from cognitive synergy. Thus, the only constrained path remaining was the direct effect of shared social identity on learning. The resulting pre-assessment model (Figure 6) revealed excellent fit,  $\chi^2 (1) = 0.27, p = .60$  (CFI = 1.00; SRMR = 0.009; RMSEA = 0.00).



*Figure 6.* A parsimonious, pre-assessment theorized model of shared social identity and learning. The dotted arrow denotes the constrained direct effect of shared social identity on learning. Residuals are not depicted.  
 \*  $p < 05$ . \*\*  $p < 01$ .

For the post-assessment model, I constrained the following paths: (1) learning regressed on shared social identity, (2) effort regressed on perceived similarity, (3) effort regressed on shared social identity, (4) cognitive synergy regressed on shared social identity, (5) learning regressed on cognitive synergy, and (6) learning regressed on perceived similarity. The resulting post-assessment model (Figure 7) revealed excellent fit,  $\chi^2 (6) = 4.67, p = .59$  (CFI = 1.00; SRMR = 0.035; RMSEA = 0.00).



*Figure 7.* A parsimonious, post-assessment theorized model of shared social identity and learning.

The dotted arrow denotes the constrained direct effect of shared social identity on learning. Residuals are not depicted.

\*  $p < 05$ . \*\*  $p < 01$ .

## CHAPTER IV

### DISCUSSION

#### **Summary of Main Findings**

Evidence in Greenaway et al. (2015) supported the theory that perceiving a shared social identity augments the effectiveness of communication. Inspired by initial support for this theory, the present study proposed a conceptual model, whereby a shared social identity can facilitate the processing of novel information. This conceptual model further postulates cognitive and motivational mechanisms through which information processing is serially facilitated, namely via cognitive synergy and task effort. Based on this conception of shared social identity and information processing, I empirically tested two principal hypotheses: 1) a shared social identity will positively predict learning and 2) the effect of shared social identity on learning will be serially mediated via perceived similarity, cognitive synergy, and effort.

Overall, empirical support for the conceptual model was mixed. Contrary to the former hypothesis, I observed no direct evidence that making a shared social identity salient facilitates learning, such that shared social identity failed to directly predict learning. Specifically, after participants were told they were deductive thinkers, scores on a reading comprehension assessment were not higher when passages were purported to be written by fellow deductive thinkers (vs. inductive thinkers). Mediation evidence alluded to one possible explanation for this null effect. In the pre-assessment model in which cognitive synergy and effort were assessed as *expectations* prior to performance, indirect effects evinced inconsistent mediation. Learners believing to share a social identity with their experts expected more fluent processing of the

passages which, in turn, inhibited learning. Presumably, with the expectation of easier processing and mentally connecting with their experts, learners may have felt unnerved by the task difficulty and surrendered more easily. But, as anticipated, learners believing to share a social identity with their experts also perceived greater similarity with their experts which, independent of the other mechanisms, was associated with enhanced learning. This latter effect is consistent with the over-arching theoretical perspective of my conceptual model and could be understood by considering post-assessment mechanistic measures. In sum, I failed to find evidence for the causal chain hypothesized for expectations; instead, analyses revealed an unanticipated case of inconsistent mediation.

But, evidence consistent with the anticipated causal chain was obtained with indices of *actual* cognitive synergy and effort. Indeed, the post-assessment model evinced a significant indirect effect of shared social identity on learning serially via perceived similarity, actual cognitive synergy, and actual effort. That is, learners believing to share a social identity with their experts perceived greater similarity with their experts, which predicted experiencing more fluent processing of the passages, which predicted putting forth more effort to processing, thereby predicting enhanced learning. This corroborates the theoretical sequence proposed by my conceptual model: a shared social identity activates greater perceived similarity; perceived similarity activates enhanced cognitive synergy between information processors and disseminators; cognitive synergy stimulates enhanced effort put forth toward processing novel information; ultimately, effort enhances information processing (e.g., learning). Further corroborating this theoretical sequence, mediational evidence failed to emerge for each of the alternative path models, which did not assume a serial process of pre- or post-assessment perceptions.

## Theoretical and Practical Implications

The aforementioned findings are generally consistent with foundational social-psychological theories. Though conceptually distinct, both *social identity theory* (Tajfel & Turner, 1979) and *self-categorization theory* (Turner et al., 1987) postulate a common assumption: the concept of self is inherently interconnected with one's ingroup identity. At this theoretical intersection is the basis of a shared social identity account for effective communication (Greenaway et al., 2015). Presumably, because ingroups are perceived favorably, they bestow psychological benefits (e.g., positive expectations, Perdue et al., 1990) which can have facilitative downstream effects on motivation (e.g., effort and attention; Kane, 2010) and information processing (Mackie et al., 1990). Path model analyses partially supported the theoretical notion of “bestowed psychological benefits” and “facilitative downstream effects.” Furthermore, as speculated by Greenaway et al. (2015), both cognitive and motivational factors seem to contribute to positive effects of shared social identity on behavior (see also, Brewer, 1979).

But, the present study also uniquely highlights a paradox not often discussed in this literature. That is, psychological benefits bestowed from ingroups need not necessarily be advantageous in certain contexts. Evidenced by the negative indirect of shared social identity on learning via *pre-assessment* (anticipated) cognitive synergy upon controlling for effort—that is, learners believing to share a social identity expected greater cognitive synergy which, in turn, inhibited learning—anticipating advantages vis-à-vis ingroup communication may yield deleterious effects. One interpretation of this finding is that without expecting to exert effort and attention to information processing, ingroup members forgo engaging in the necessary mental preparation for grappling with a difficult task. Another explanation is that learners expecting

easier processing and a synergistic connection with their experts might be more disappointed and demoralized upon encountering a highly difficult task. Indeed, the reading comprehension tasks were GRE practice exams which are designed for prospective graduate students, whereas the average participant in the present study was likely in his/her early years of college ( $M_{\text{age}} = 18.48$ ). Accordingly, the reading comprehension tasks should be considered highly difficult in the context of this study ( $M = 3.29$  on a 0-8 scale). Perhaps task difficulty moderates effects of shared social identity on learning, such that difficult learning tasks exacerbate inhibitory effects on learning via anticipated cognitive synergy (accounting for anticipated effort).

The present findings may also have practical implications. For example, some research suggests scholastic learning disparities when students share superficial features with their teachers (e.g., Dee, 2004; Dee 2005). Indeed, the present research attests to the potential for improving scholastic outcomes by augmenting students' perceived similarity with their teachers. This implication accords with findings derived from the intervention in Gehlbach et al. (2016). My study advances this knowledge by suggesting that the experience of student-teacher cognitive synergy and student effort might be driving scholastic improvements. Moreover, the present research suggests that the expectation of learning novel information as being easy and smooth is detrimental. Instead, learning interventions should focus on cultivating traits that prepare students to endure intellectual challenges (e.g., perseverance of effort, a subcomponent of grit; Duckworth, Peterson, Matthews, & Kelly, 2007).

### **Limitations and Future Directions**

Theoretical and practical importance notwithstanding, inferences drawn from the data must be interpreted cautiously given the study's limitations. First and foremost, nearly one third of the sample was excluded from data analysis due to failing the manipulation check (i.e.,



misidentifying the information processing style of the experts and/or the self). This presents at least two issues: 1) the smaller sample size reduces statistical power for detecting the most complex effect—an indirect effect via three serial mediators—thereby rendering null effects more difficult to interpret, and 2) the sample is constricted in unknown ways, which renders the results potentially less generalizable. But, notably, the exclusions were necessary to test the theory, so fit my basic interest in theory testing. Nonetheless, future research might consider methods to increase the salience and detection of this shared social identity manipulation for most participants (e.g., using social categories which are more chronically salient, such as race).

Second, the manipulation of shared social identity yielded a rather small effect size on perceived similarity. This small effect is not too surprising because the reading comprehension passages were esoteric, which might diminish similarity judgments and thereby diminish effects of a shared identity on similarity. Indeed, not only were the means of shared social identity on perceived similarity weakly differentiated, but the mean in the similar condition failed to exceed the midpoint, indicating that perceived similarity in this condition was low (albeit relatively less low than the dissimilar condition). Perhaps of the manipulation would have been stronger if the content of the passages failed to counter perceptions of similarity implied by the shared identity cue. Future studies should explore other types of social identities to augment the effects of this manipulation. For example, social identities which are highly central and important to one's self-identity should elicit stronger effects on perceived similarity and, in turn, learning.

Third, the findings are circumscribed to the type of shared social identity manipulated. The manipulation selected for this study was relevant to information processing and learning (e.g., deductive vs. inductive thinker), so I am reluctant to conclude that *any* shared social identity manipulation would yield similar effects. But, insofar as a shared social identity is

(strongly) associated with perceived similarity, any manipulation of shared social identity should, at least in theory, have downstream effects on the processes influencing learning and learning itself, irrespective of its relevance to learning. On the other hand, as in this study, perhaps only ingroup cues relevant to communication effectiveness would facilitate such processes. Future research should attempt to conceptually replicate the present study's effects by manipulating a similarity feature that is irrelevant to learning or information processing (i.e., favorite genre of music).

One final limitation of the present study is the inability to ascertain causality. Path modeling was theoretically-driven and, therefore, attempted to capture the *presumed* causal sequence of underlying cognitive and motivational processes. Nonetheless, causal inferences cannot be proven with path modeling. Experimental procedures are required to directly manipulate process variables. In light of this issue, I expound on several points. First, the ordering of paths can be arranged in a multitude of sequences and, hence, a multitude of alternative path models are possible. Second, the presumed cognitive and motivational mechanisms assessed were not exhaustive, and it is reasonable to assume third-variable accounts for relations amongst positive attributes, cognitive synergy, and effort on information processing. Third, the variables encompassed by the path model were not assessed in the same sequential order as they appeared in the model. For instance, learning was assessed prior to the post-assessment mediators, and all variables in the model were assessed prior to perceived similarity. Although this ordering scheme was formed on methodological rationale, future research might consider methodologies which permit assessing variables in the sequence in which they were modeled herein.

## **Conclusion**

The present study was the first to experimentally test whether a shared social identity facilitates learning. Some preliminary evidence suggests the presence of this phenomenon through the experience of cognitive synergy and effort during information processing on the learning task. However, the evidence also suggests that certain processes elicited by a shared social identity and perceived similarity can inhibit learning. Thus, effects of shared social identity on information processing are complicated. Future research is needed to conceptually replicate and bolster facilitative effects on learning herein, which were generally weak. Only thereafter might research expand to applied domains such as education or management to harness the potential benefits of a salient social identity on learning.

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## APPENDICES

### Appendix A

THE UNIVERSITY OF  
**ALABAMA**®

Office of the Vice President for  
Research & Economic Development  
Office for Research Compliance

February 27, 2017

Gregory Tortoriello  
Dept of Psychology  
College of Arts & Sciences  
Box 870348

Re: IRB # 17-OR-084, "Learning Styles and Assessment"

Dear Mr. Tortoriello:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver of one element of informed consent and waiver of written documentation of informed consent. Approval has been given under expedited review category 7 as outlined below:

*(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.*

Your application will expire on February 23, 2018. If your research will continue beyond this date, please complete the relevant portions of the IRB Renewal Application. If you wish to modify the application, please complete the Modification of an Approved Protocol form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, please complete the Request for Study Closure form.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

Carpanta T. Myles, MSM, CIM, CIP  
Director & Research Compliance Officer  
Office for Research Compliance

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## Appendix B

### Reduced Learning-Style Inventory (RLSI; Manolis et al., 2012)

Instructions: *Below is a list of statements pertaining to your learning preferences. Please rate the extent to which each describes you using the following scale.*

1 = does not at all describe me, 7 = very much describes me

1. When I learn I like to watch and listen.
2. When I learn I like to think about ideas.
3. I learn best when I trust my hunches and feelings.
4. I learn best when I listen and watch carefully.
5. I learn best when I rely on logical thinking.
6. When I am learning I have strong feelings and reactions.
7. When I am learning I tend to reason things out.
8. I learn by feeling.
9. I learn by watching.
10. I learn by doing.
11. When I am learning I am an observing person.
12. When I am learning I am a logical person.
13. I learn best from observation.
14. I learn best from a chance to try out and practice.
15. I learn best when I can try things out for myself.
16. When I learn I like to observe.
17. When I learn I like to be active.

## Appendix C

### Pre-Assessment Perceptions

Instructions: *Prior to beginning the reading comprehension task, please rate the extent to which you believe each of the following statements to be true. It is important that you respond honestly.*

1 = not at all true, 7 = extremely true

1. I expect that my experts will be knowledgeable. (PA)
2. I expect that my experts will be trustworthy. (PA)
3. I expect that my experts will be credible. (PA)
4. I expect that my experts' passages will be easy to process. (CS)
5. I expect to understand my experts' topics. (CS)
6. I expect that my experts will put forth great effort into helping me learn their topics. (CS)
7. I expect that my experts will understand how I think or learn. (CS)
8. I will be motivated to learn my experts' topics. (E)
9. I will put forth great effort to learn my experts' topics. (E)
10. I will continue to try hard to learn, even if I encounter obstacles. (E)
11. I will pay careful attention when reading my experts' passages. (E)

PA = Positive Attributes; CS = Cognitive Synergy; E = Effort.



## Appendix D

### Learning Assessment (Educational Testing Service, 2017)

#### Passage I

Historian F. W. Maitland observed that legal documents are the best—indeed, often the only—available evidence about the economic and social history of a given period. Why, then, has it  
*Line* taken so long for historians to focus systematically on  
5 the civil (noncriminal) law of early modern (sixteenth- to eighteenth-century) England? Maitland offered one reason: the subject requires researchers to “master an extremely formal system of pleading and  
10 procedure.” Yet the complexities that confront those who would study such materials are not wholly different from those recently surmounted by historians of criminal law in England during the same period. Another possible explanation for historians’  
15 neglect of the subject is their widespread assumption that most people in early modern England had little contact with civil law. If that were so, the history of legal matters would be of little relevance to general historical scholarship. But recent research suggests  
20 that civil litigation during the period involved artisans, merchants, professionals, shopkeepers, and farmers, and not merely a narrow, propertied, male elite. Moreover, the later sixteenth and early seventeenth centuries saw an extraordinary explosion  
25 in civil litigation by both women and men, making this the most litigious era in English history on a per capita basis.

**Question #1(I).** *Correct answer is B*

The passage suggests that the history of criminal law in early modern England differs from the history of civil law during that same period in that the history of criminal law

- (A) is of more intellectual interest to historians and their readers
- (B) has been studied more thoroughly by historians
- (C) is more relevant to general social history
- (D) involves the study of a larger proportion of the population
- (E) does not require the mastery of an extremely formal system of procedures

**Question #2(I).** *Correct answer is D*

The author of the passage mentions the occupations of those involved in civil litigation in early modern England most likely in order to

- (A) suggest that most historians' assumptions about the participants in the civil legal system during that period are probably correct
- (B) support the theory that more people participated in the civil legal system than the criminal legal system in England during that period
- (C) counter the claim that legal issues reveal more about a country's ordinary citizens than about its elite
- (D) illustrate the wide range of people who used the civil legal system in England during that period
- (E) suggest that recent data on people who participated in early modern England's legal system may not be correct

**Question #3(I).** *Correct answer is B*

The author of the passage suggests which of the following about the “widespread assumption” (line 15)?

- Ⓐ Because it is true, the history of civil law is of as much interest to historians focusing on general social history as to those specializing in legal history.
- Ⓑ Because it is inaccurate, the history of civil law in early modern England should enrich the general historical scholarship of that period.
- Ⓒ It is based on inaccurate data about the propertied male elite of early modern England.
- Ⓓ It does not provide a plausible explanation for historians’ failure to study the civil law of early modern England.
- Ⓔ It is based on an analogy with criminal law in early modern England.

## Passage II

Geese can often be seen grazing in coastal salt marshes. Unfortunately, their intense grazing removes the grassy covering, exposing marsh sediment; this increases evaporation, which in turn increases salt concentration in marsh sediments. Because of this increased concentration, regrowth of plants is minimal, leading to increased erosion, which leads to a decrease in the fertile topsoil, leading to even less regrowth. In time, the salt marsh becomes a mudflat. This process challenges one of the most widely held beliefs about the dynamics of salt-marsh ecosystems: supposedly, consumers such as geese do not play a large role in controlling the productivity of marsh systems. Rather, the standard view claims, marshes are controlled by bottom-up factors, such as nutrients and physical factors.

**Question #1(II).** *Correct answer is C*

The author discusses “the standard view” (line 14) most likely in order to identify a view that

- (A) explains the occurrence of the chain of events described in the passage
- (B) provides a summary of the chain of events described in the passage
- (C) is called into question by the chain of events described in the passage
- (D) advocates reassessment of the widely held belief described in the passage
- (E) is undermined by the widely held belief described in the passage

**Question #2(II).** *Correct answer is C*

According to the passage, which of the following is a widely held belief about geese?

- Ⓐ They are not often seen grazing in coastal salt marshes.
- Ⓑ They are not the primary consumers in salt-marsh ecosystems.
- Ⓒ They play only a minor role in the productivity of salt-marsh ecosystems.
- Ⓓ They are the primary determinants of which resources will thrive in coastal salt marshes.
- Ⓔ They control the productivity of salt-marsh ecosystems through a bottom-up process.

### Passage III

Last year, Mayor Stephens established a special law-enforcement task force with the avowed mission of eradicating corruption in city government. The mayor's handpicked task force has now begun  
*Line* 5 prosecuting a dozen city officials. Since all of these officials were appointed by Mayor Bixby, Mayor Stephens' predecessor and longtime political foe, it is clear that those being prosecuted have been targeted because of their political affiliations.

**Question #1(III).** *Correct answer is C*

Which of the following, if true, most weakens the editorial's argument?

- (A) Complaints of official corruption in city government have decreased since the anticorruption task force began operating.
- (B) Former mayor Bixby did not publicly oppose Mayor Stephens' establishment of the anticorruption task force.
- (C) Almost all of the officials who have served in city government for any length of time are appointees of Mayor Bixby.
- (D) All of the members of the anticorruption task force had other jobs in city government before the task force was formed.
- (E) During the last mayoral election campaign, then-Mayor Bixby hotly disputed the current mayor's claim that there was widespread corruption in city government.

## Passage IV

The decrease in responsiveness that follows continuous stimulation (adaptation) is common to all sensory systems, including olfaction. With continued exposure to chronically present ambient odors, individuals' perception of odor intensity is greatly reduced. Moreover, these perceptual changes can be profound and durable. It is commonly reported that following extended absences from the odorous environment, reexposure may still fail to elicit perception at the original intensity.

Most research on olfactory adaptation examines relatively transient changes in stimulus detection or perceived intensity—rarely exceeding several hours and often less—but because olfactory adaptation can be produced with relatively short exposures, these durations are sufficient for investigating many parameters of the phenomenon. However, exposures to odors in natural environments often occur over far longer periods, and the resulting adaptations may differ qualitatively from short-term olfactory adaptation. For example, studies show that even brief periods of odorant stimulation produce transient reductions in receptors in the olfactory epithelium, a process termed “receptor fatigue.” Prolonged odor stimulation, however, could produce more long-lasting reductions in response, possibly involving structures higher in the central nervous system pathway.

**Question #1(IV).** *Correct answer is B*

According to the passage, the phenomenon of olfactory adaptation may cause individuals who are reexposed to an odorous environment after an extended absence to

- Ⓐ experience a heightened perception of the odor
- Ⓑ perceive the odor as being less intense than it was upon first exposure
- Ⓒ return to their original level of perception of the odor
- Ⓓ exhibit a decreased tolerance for the odorous environment
- Ⓔ experience the phenomenon of adaptation in other sensory systems



**Question #2(IV).** *Correct answer is A*

The passage asserts which of the following about the exposures involved in the “research on olfactory adaptation” (line 11)?

- Ⓐ The exposures are of long enough duration for researchers to investigate many aspects of olfactory adaptation.
- Ⓑ The exposures have rarely consisted of reexposures following extended absences from the odorous environment.
- Ⓒ The exposures are intended to reproduce the relatively transient olfactory changes typical of exposures to odors in natural environments.
- Ⓓ Those exposures of relatively short duration are often insufficient to produce the phenomenon of receptor fatigue in study subjects.
- Ⓔ Those exposures lasting several hours produce reductions in receptors in the olfactory epithelium that are similar to the reductions caused by prolonged odor stimulation.

## Appendix E

### Post-Assessment Perceptions

Instructions: *Now, similar to the questions you completed prior to the assessment, we would like to ask you questions about your perceptions of the assessment. Please rate the extent to which you believe each of the following statements to be true. Once again, it is critical that you be honest.*

1 = not at all true, 7 = extremely true

1. My experts were knowledgeable. (PA)
2. My experts were trustworthy. (PA)
3. My experts were credible. (PA)
4. My experts' passages were easy to process. (CS)
5. I understood my experts' topics. (CS)
6. My experts put forth great effort into helping me learn their topics. (CS)
7. My experts understood how I think or learn. (CS)
8. I was motivated to learn my experts' topics. (E)
9. I put forth great effort to learn my experts' topics. (E)
10. I continued to try hard to learn, even if I encounter obstacles. (E)
11. I paid careful attention when reading my experts' passages. (E)

PA = Positive Attributes; CS = Cognitive Synergy; E = Effort.

## Appendix F

### Demographics Questionnaire

Instructions: *The following questions pertain to basic demographic information. Please answer each question.*

What is your sex?

- Male
- Female

\*What is your age?

What is your race?

- White/Caucasian
- African American
- Hispanic
- Asian
- Native American
- Pacific Islander
- Other

Are you a native English speaker?

- Yes
- No

*\*Denotes open-response item*

## Appendix G

### Exit Questionnaire

Instructions: *This final task is an exit survey that asks about your overall experience and general impressions of this session. Please be honest in answering the following questions. Note that your responses to these questions will not affect you receiving credit in any way.*

Rate the degree to which you perceived yourself to be similar to your experts. (1 = *not at all similar*, 7 = *extremely similar*) (MC)

\*In general, what do you think this experiment was testing?

\*Do you think any of the tasks that you completed were related?

\*Do you think any earlier task affected your behavior on a later task?

\*Did you notice anything about the experiment that seemed strange and/or unusual?

\*What learning processing type were YOU? Name the type of thinker. (AC)

\*What learning processing type were your EXPERTS? Name the type of thinker. (AC)

\*Additional comments that you would like to share with us:

*\*Denotes open-response item; MC = manipulation check; AC = attention check.*