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Metacognition in Real Life Situations and Study Skills and Habits: Two Types of Processes

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Abstract
The relationship between metacognition in real life situations and study skills and habits was examined using a sample of college students. Results showed no significant relationship between these two variables nor was there a significant relationship between study skills and reaction time as measured on the metacognitive test. However, there was a positive significant correlation between study skills, and high school and college GPA's; a significant negative relationship between high school GPA and reaction time; and a positive significant correlation between high school GPA and metacognitive test scores calculated based on reaction time. High school GPA was significantly related to study skills and to the relationship between study skills and academic performance as opposed to college GPA. The importance of college GPA as a significant predictor of study skills depends on whether or not students grades were assigned objectively without manipulation or inflation.

Key words: Metacognition, Reaction Time, Study Skills and Habits, College Students, GPA

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Introduction

Examining the relationship between metacognition in real life situations, on one hand, and study skills and habits, on the other hand, at the college level is unique in a way that study skills and habits are mainly a sequential process while metacognition is a simultaneous process that relies on visual spatial perception (see Al-Hilawani, 2008; Al-Hilawani & Sartawi, 1997). Exploring this relationship is also unique because study skills and habits are considered academic metacognitive processes.

Literature review revealed no research targeting the relationship between study skills and habits and metacognition using the same group of students. Studies reviewed in this paper showed that these areas have been examined separately and that metacognition as viewed in this research has been examined basically in young children and not in college students. This is the first time where metacognitive processing and study skills and habits are being examined in college age students.

The novelty of this present study also stems from exploring the effect of *reaction time* in relation to other variables such as metacognition. Traditionally, examining reaction time was associated with measuring students' intelligent quotient (IQ) in a laboratory setting (e.g., Bates & Stough, 1998). This current study, however, used cartoon drawings that depicted real life knowledge and situations to represent the naïve psychology, the naïve physics, and the naïve biology domains to examine the relationship between reaction time and metacognition using university students. These three domains focus on knowing about people, plants and animals, and physical objects as they exist in the natural environment (Wellman & Gelman, 1992).

The following sections are overviews of metacognition, reaction time, and study skills and habits as related to this current research:

Metacognition

The concept of metacognition (Flavell, 1978) has been around among educators and psychologists for some times to explain and understand students' behaviors in academic and non-academic settings. Al-Hilawani, Marchant, and Poteet (1994) mentioned that the importance of this concept comes from its value to explain differences in learning noticed in school-age students by focusing on examining (1) their self-management skills, self-regulatory behaviors, and/or self-awareness necessary to monitor one's self during the learning process and (2) their choice and implementation of learning strategies required to complete, understand, retain, and transfer given tasks. Learning strategies are considered in this context a form of metacognitive processes. Metacognition in this context is considered a way to control actions related to academic demands that are complicated to be managed automatically (Trainin & Swanson, 2005).

Recently, Al-Hilawani (2008) expanded the traditional meaning of metacognition (i.e., academic metacognition) to refer to strategic employment of one's cognitive processes and resources to construct knowledge in a meaningful manner and to devise thinking and problem solving skills to reach understandings and insights of the natural and surrounding environment (i.e., real life situation-metacognition). This meaning refers to employing one's higher order thinking processes of recognition, discrimination, judgment, and cognitive restructuring of events; and is achieved through the mental process of thematic and common features analysis and discrimination. Thematic analysis referred to stimuli that reflected the same theme but showed different objects, events, situations, and human behaviors. Common feature analysis meant that stimuli showed elements related to each other. The required task demand for this complex mental process is performing the mental activity of grouping, categorizing, sorting, and classifying objects by use, color, shape, size, length, and/or weight; and performing problem-solving activities in terms of object use, size, shape, and color.

Measuring metacognition as related to visual analyses and discriminations of real life situations, compared to academic situation, focused on the visual-spatial perception modality of information processing, an approach suitable for students who are strong in processing information visually and considered appropriate for students who have low verbal repertoire or hearing loss (Al-Hilawani, 2008). This approach was operationalized by using pictures to assess abilities related to accurate syntheses, analyses, perceptions, judgments, predictions, and explanations of what students usually experience in real-life situations.

Reaction Time

Reaction time could affect students' social interactions because students who are slow in responding to demands, to requests, and/ or to social cues may face negative consequences. Initially, reaction time was studied with reference to students' intelligence quotient (IQ). Research shows that there is a correlation between reaction time and IQ; individuals with high ability processed information faster than those with low ability (e.g., Bates & Stough, 1998).

Reaction time was also examined with reference to college students' emotional states. Studying undergraduate college students revealed that subjecting these students to social exclusion led to emotional distress and to slow reaction time to the presented stimuli. Twenge, Catanese, and Baumeister (2003) reported that undergraduate students who were rejected by their peers exhibited a slower reaction time when compared to socially accepted students, who were more accurate in their estimation of elapsed time, in a reaction time game. Social rejection affected executive functioning by slowing down responses to unfamiliar tasks but not automatic responses to familiar ones.

Studying the relationship between metacognition and reaction time has not been examined previously using college students. Reaction time refers in this study to the time needed to process and then to respond correctly to the presented stimuli.

Study Skills and Habits

Appropriate study skills and habits are associated positively with learning performances (Hoover, 1989). Reviewing the literature (e.g., Jones, Slate, & Kyle, 1992) revealed that study skills and habits are essential tools and activities needed for learning independently (i.e., learning how to learn) and for acquiring purposeful and intended knowledge at various levels of education. This literature showed that study skills and habits are among the variables to consider when examining academic achievements at the school level (e.g., Stanley, Slate, & Jones, 1999) or at the college level among those with learning disabilities (LD) and attention deficit hyperactivity disorder (ADHD) or among normally developing students (e.g., Proctor, Prevatt, Adams, Reaser, & Petscher, 2006; Reaser, Prevatt, Petscher, & Proctor, 2007). The overall research results at the college level showed that those with inadequate study skills and habits (whether or not they have academic difficulties such as learning disabilities) are considered at-risk as they are unprepared or underprepared to start a successful college education.

Study skills and habits are considered a form of metacognitive processing because they help students during the learning process to acquire, retain, and produce the new information. They cover activities such as self-testing, self-regulating, and managing time. These activities are important for knowing, knowing what to know, and knowing how to know to acquire the verbal knowledge. They link comprehension with memorization. Therefore, metacognition in the form of one's awareness and understanding of learning strategies and the timing of their application is related to academic performance. This could explain why students with high GPA possess better metacognitive strategies in the form of better study skills and habits than students with low GPA (e.g., Al-Hilawani & Sartawi, 1997). It could also explain the positive relationship between study skills and habits, on the one hand, and metacognition, as related to acquiring knowledge from text, on the other hand.

Significance of the Study

This study was conducted to answer the question of whether or not there was a significant relationship between study skills and habits needed to succeed in the academic realm, on the one hand, and metacognition in terms of analyzing pictures, on the other hand. While measuring metacognition and study skills and habits are apparently distinct from each other, they both involve thinking in a problem solving manner to accomplish successfully a specific task. This study was also conducted to examine the relationship between reaction time on the test of metacognition, performance on the study skills questionnaire, and some demographic variables (i.e., monthly income, the number of family members, and the type of high school diploma: science or arts streams).

An assumption in this study is that thinking in a problem solving manner is efficient when it is based on a domain-specific knowledge. A second assumption is that a domain-general knowledge is still in use and is needed, as a frame of reference, in the absence of or sometimes concurrently with domain-specific knowledge. This assumption is considered when preparing remediation and intervention programs in both metacognition and study skills and habits.

A third assumption is that metacognition may be assessed on a continuum ranging from low scores for young school students or students with cognitive disabilities to higher scores for more abled and college students.

Participants

A total of 191 undergraduates (mean age = 20.52 years; SD = 1.76 years; age range = 17.44 to 25.92 years; n =190; one case did not indicted her date of birth and therefore excluded from the study) were recruited to participate in this research. Participants represented various colleges: Education (n = 118), law (n = 9), arts (n = 16), science (n = 20), engineering (n = 7), allied health science (n = 11), and social sciences (n = 6). There were four cases of new undergraduates who did not specify their colleges. There were 114 females (mean age = 20.38 years; SD = 1.70 years; age range = 17.44 to 25.84 years; n=113; one female did not mention her date of birth) and 77 males (mean age = 20.71 years; SD = 1.83 years; age range = 17.85 to 25.92 years): 52 freshman, 40 sophomores, 43 juniors, 52 seniors, and 4 students who did not report their class standing.

Instrumentation

First: Study Skills and Habits.

Data gathered using a modified version of the instrument constructed by Al-Hilawani and Sartawi (1997). The modification was rewording and clarifying some of the 55 items. The first part covered demographic information which included gender, date of birth, high school and college GPA's, type of high school diploma (arts or science), years in college (i.e., class standing), major, and estimate of monthly income. The second part contained 55 items (see Appendix A/ Part B). Al-Hilawani and Sartawi put these items in a four-point likert-type scale format. Responses to these series of statements after modifications and rewording were *not applicable* (assigned 1 point), *rarely* (assigned 2 points), *sometimes* (assigned 3 points), and *always* (assigned 4 points). Twenty four items were worded positively while 31 items were worded negatively. All negative items were reverse-scored. A total high score would indicate good study skills and habits while a low score would indicate otherwise.

Each of the 55 items was correlated with the total score to identify weak and/or negatively correlated items. Analysis revealed one item to have a significant but negative correlation with total score (Item # 13: I usually read a newspaper / a story slowly and carefully; r = -.21, p <.003). This item was removed from final analysis but it was kept in the appended copy. It is to mention that the same concept was covered by another item in the instrument and did not correlate significantly with the total score (Item # 35: I read slowly to grasp the general idea; r = .10, p = .154.). Analysis showed another item that did not correlate significantly with the total score (Item # 39: I always ask the instructor to repeat what s/he said; r = .10, p = .153). These two items were used along with the rest to analyze the data obtained because removing the two items did not improve dramatically the reliability level which was .89 when using 52 items whereas using the 54 items yielded a reliability coefficient (alpha) of .88. The significantly correlated items with the total score (i.e., 52 items) ranged from r =.16, p<.03 to .65, p<.001.

Second: Metacognition Test

The test of metacognition (e.g., Al-Hilawani, Dashti, & Abdullah, 2008) was constructed based on the view that cognitive development is domain specific (Wellman & Gelman, 1992) and that metacognition could be approached and measured in daily life situations using pictures. Wellman and Gelman suggested, based on their literature review, three possible commonsense framework theories which are the naïve physics, the naïve psychology, and the naïve biology domains. Examples on the three knowledge domains as reported in Al-Hilawani et al's (2008, p. 143) study are mentioned below: *"naïve psychology include[s]... internal-mental states, such as desire, sadness, pain, fear, anger, disgust, surprise, and happiness. Examples of naïve physics include cause-effect relationships and understanding the identification, classification, and transformation of physical objects. Examples of naïve biology include identifying and understanding the processes of organic growth, reproduction, inheritance, classification, eating and sleeping, and illness and death, among others".*

The metacognitive instrument consisted of 28 computerized cartoon drawings test questions (i.e., 12 test items representing the biology domain, 7 test items representing the physics domain, and 9 test items representing the psychology domain). Each test item was formed of a target picture and four options of pictures. One of the four options was the correct choice because it matched with or it related directly to the target picture. The metacognition tool was transformed into a computerized test to measure students' reaction time.

The sequence of the 28 test items and their options was counterbalanced and presented to each participant in a random order. Each test item was timed to appear on the computer screen for one minute. If the student did not select within the one-minute period one of the four options as an answer to the presented picture, the next test item would appear immediately on the computer screen. The maximum time allowed to complete this test was 30 minutes: 28 minutes for the actual test and 2 minutes for the two trial exercises. Each test question answered correctly was assigned one point. Thus, the maximum possible score that a student could receive was 28 out of 28.

The correlation of each metacognitive item with the total score was obtained to remove irregular test items from the final analysis. It was expected that because this instrument has been designed to cover a wide age range, a ceiling effect in performance would appear when administered to college participants. Results showed that students' responses varied on 22 items all of which correlated significantly with the total score (correlations ranged from r = .19 to r = .56). Results also showed that all students responded to the rest of items (i.e., six items) with 100% accuracy. Four of these six items were from the biology domain (i.e., passing hereditary traits, growth, knowledge of carnivores and herbivores, and transformations), one item was from the physics domain (i.e., matching object use and identification), and one item was from the psychology domain (i.e., sadness). These six items were not removed from the test. The yielded reliability coefficient (alpha) was .74.

When obtaining the correlations of correct items calculated based on mean reaction time, the ceiling effect disappeared and 27 items correlated significantly with the total score calculated based on mean reaction time (correlations ranged from r = .18 to r = .53). The item that did not correlate with the total score was from the biology domain (i.e., illness; r = .08; p = .25). The yielded reliability coefficient (alpha) was .75. This coefficient alpha level is acceptable for research purposes (Nunnally, 1967).

Procedures

All recruited students responded to a questionnaire and then to items in the form of pictures presented on a computer screen. They were not informed about the nature of the questionnaire or the pictures. The steps and procedures mentioned in Al-Hilawani et al's (2008) research concerning administering the computerized metacognitive tool were followed and implemented in this current study. Each student was guided through two trial test items on the metacognitive test. The first trial test item presented on the computer screen was a picture of an apple and four options— two kittens, three bananas, an open book, and a robot. Students were required to point to the option related to or matched with the target picture. The second trial test item showed a target picture of a red circle and the options of three red triangles and a red circle. Students were required to point to the shape related to or matched with the target picture. When students selected the best option out of the four available pictures, the author clicked on that option with the mouse. When students finished taking the two trial exercises, they proceeded to take the actual test. When a student finished taking the test, the computer program automatically stored the test results. Responding to the study skills questionnaire and to the metacognition test took approximately 25 to 35 minutes.

Results

The two instruments yielded four dependent variables: The total score on the study skills and habits questionnaire, students' correct responses on the metacognitive test, reaction time, and the correct responses calculated based on the mean reaction time to each of the 28 test items. 28 mean reaction times were used to determine if a student should receive a zero point or a one point for each of the 28 test items. If the response was correct and fell at or below the calculated mean of reaction time, the computer would assign one point for responding to that item. If the response was correct but exceeded the assigned mean reaction time, the computer would assign a zero point for that particular item.

Means and Standard Deviations

Table 1 shows means and standard deviations of raw scores on the study skills and habits questionnaire, the test of metacognition, students' reaction time, and scores based on the mean reaction time. It appears in this table that female college students obtained better raw scores on the four dependent variables compared to male students and that the means of correct scores on the metacognitive test for males and females decreased when calculating the metacognitive scores based on mean reaction time.

Table 1. *Study Skills and Habits Scores, Metacognitive Test Scores, Reaction Time, and Test Scores Based on Reaction Time.*

Student groups		Study skills and habits		Scores on metacognitive test		Reaction time in seconds		Metacognitive scores based on reaction time	
	n	M	SD	M	SD	M	SD	M	SD
College Sample	191	3.03	.29	19.73	2.81	145.29	30.99	12.31	4.56
Males	77	2.96	.31	19.55	2.80	146.87	29.24	11.91	4.82
Females	114	3.07	.27	19.85	2.82	144.22	32.20	12.59	4.37

Pearson Product-Moment Correlations

Table 2 shows no significant correlations between study skills, on the one hand, and metacognitive scores, reaction time, and test scores based on reaction time, on the other hand. The table shows that study skills, and high school and college GPA's correlated significantly but negatively with the *sex* variable, indicating that females had better study skills and higher high school and college GPA's than males.

The table shows that high school and college GPA's correlated significantly with each other and that both correlated significantly with study skills. Students with high GPA's in high school and in college had better study skills and habits than students with low GPA's. The table shows a negative significant correlation between high school GPA and reaction time and a positive significant correlation between high school GPA and metacognitive test scores calculated based on reaction time. It appears that time is significantly associated with students' performance in a way that students with high GPA in high school took less time and got more correct responses on the test than those with low GPA.

The table shows that reaction time had a negative significant correlation with metacognitive scores based on reaction time and with monthly income. This means that time influences the number of correct responses on the test and that those with lower monthly income took more time compared to students with higher monthly income.

Finally, table 2 reveals a positive significant correlation between high school GPA and the type of high school certificate; those who were enrolled in the arts stream obtained higher GPA than those enrolled in the science stream.

Table 2:
Pearson Product-Moment Correlations of the Study Skills and Habits Scores, Metacognitive Scores, Total Time, Metacognitive Scores based on Reaction Time with Student Variables

Variables	1	2	3	4	5	5	7	8	9	10	11	12
College Sample												
1. Study skills (N=191)	1.00											
2. Metacognitive Scores (N=191)	02	1.00										
3. Total time (N=191)	-.09	.04	1.00									
4. Metacognitive scores based on reaction time (N=191)	05	.49**	-.75**	1.00								
5. Gender (N=191)	-.20**	-.05	.04	-.07	1.00							
6. Age (N=190)	04	.08	.07	-.01	.09	1.00						
7. High school GPA (N=184)	18*	.04	-.21**	.16*	-.25**	-.18*	1.00					
8. College GPA(N=174)	20**	.04	.01	-.03	-.34**	-.09	.28**	1.00				
9. Year of study (N=187)	04	.04	-.02	.06	.03	.75**	.01	.02	1.00			
10. Monthly income (N=149)	-.10	-.04	-.18*	.15	.10	-.17*	.10	-.05	-.09	1.00		
11. Number of family members (N=191)	10	.04	-.02	.04	-.01	-.05	-.06	-.06	-.14	.05	1.00	
12. High school certificate type (N=190)	11	.02	.03	.01	-.09	.17*	.15*	.13	.19**	-.14	.09	1.00

Note: $* = p < .05$, $** = p < .01$

Analysis of Variance and Covariance

One-Way Analysis of Variance (ANOVA) was conducted to find if there was a significant age difference between males and females. ANOVA showed no significant age difference between males and females, F (1, 188) = 1.621, p =.204. Another ANOVA was performed to find a significant difference between males and females on the test of metacognition. ANOVA showed no significant difference between males and females on the metacognitive test, F (1, 189) = .541, p =.463.

Due to the correlations reported in table 2, two Univariate Analysis of Covariance (ANCOVA) were performed to examine differences between males and females in reaction time and in metacognitive test scores based on reaction time. In the first ANCOVA analysis, high school GPA and monthly income were used as covariances to control their effect on reaction time. The ANCOVA analysis revealed that the high school GPA covariate was significant, F (1, 139) = 4.357, p < .04 ($\eta 2$ = .030, weak effect size), the monthly income covariate almost reached the significant level, F (1, 139) = 3.771, p =.054 ($\eta 2$ = .026, weak effect size), but no significant difference between males and females in reaction time, F (1, 139) = .040, p =. 842 ($\eta 2$ = .001, weak effect size). In the second ANCOVA analysis, high school GPA was used as a covariance to control its effect on scores calculated based on reaction time. The ANCOVA analysis showed that the high school GPA covariate was significant, F (1, 181) = 4.011, p < .05 ($\eta 2$ = .022, weak effect size), but showed no significant difference between males and females in scores calculated based on reaction time, F (1, 181) = .057, p =. 812 ($\eta 2$ = .001, weak effect size).

ANCOVA was also conducted to examine differences in performance between males and females on study skills and habits. High school and college GPA's were used as covariates. The ANCOVA analysis showed that the high school GPA covariate was significant, F (1, 165) = 4.419, p < .04 ($\eta 2$ = .026, weak effect size), but the college GPA covariate was not significant, F (1, 165) = 2.124, p = .147 ($\eta 2$ = .013, weak effect size). ANCOVA identified no significant differences between males and females in scores on study skills and habits questionnaire when controlling the effect of high school and college GPA's, F (1, 165) = .701, p =. 404 ($\eta 2$ = .004, weak effect size). When not controlling the effect of high school and college GPA’s, results of ANOVA showed significant effect for the sex variable in which females performed better than males on study skills and habits questionnaire, F (1, 189) = 7.670, p <. 006 ($\eta 2$ = .04, weak effect size; see table 1 for means and standard deviations).

Series of Analysis of Covariance

The first series of ANCOVA analyses was performed to examine differences on the four dependent variables (i.e., study skills, metacognitive score, reaction time, and metacognitive score based on reaction time) based on the type of high school certificate. Table 2 showed two relevant covariates, students' age and high school GPA. While the year of study variable is correlated with the type of high school certificate, it is considered irrelevant in this particular section. ANCOVA results showed that the age covariate was significant, F (1, 179) = 4.054, p < .04 ($\eta 2$ = .022, weak effect size) and the high school GPA covariate was also significant, F (1, 179) = 8.179, p <.01 ($\eta 2$ = .044, weak effect size). But no significant difference in study skills and habits scores was found based on the type of high school certificate, F (1, 179) = .122, p = .728 ($\eta 2$ = .001, weak effect size). The type of high school certificate is not significantly related to students' study skills and habits.

The next ANCOVA results showed that the age covariate was not significant, F (1, 179) = 2.615, p = .108 ($\eta 2$ = .014, weak effect size), the high school GPA covariate was not significant, F (1, 179) = .796, p =.374 ($\eta 2$ = .004, weak effect size), and no significant difference in metacognitive test scores when examined based on the type of high school certificate, F (1, 179) = .009, p = .923 ($\eta 2$ = .001, weak effect size). The type of high school certificate is not significantly related to students' metacognitive test scores.

The subsequent ANCOVA results showed that the age covariate was not significant, F (1, 179) = .047, p = .828 (η2 = .001, weak effect size) but the high school GPA covariate was significant, F (1, 179) = 8.587, p <.01 (η2 = .046, weak effect size). There was no significant difference in reaction time when examined based on the type of students' high school certificate, F (1, 179) = .678, p = .411 (η2 = .004, weak effect size). The type of high school certificate is not significantly related to reaction time.

The final ANCOVA results showed that the age covariate was not significant, F (1, 179) = .424, p = .516 (η2 = .002, weak effect size) but the high school GPA covariate was significant, F (1, 179) = 5.442, p <.02 (η2 = .030, weak effect size). No significant difference was identified in metacognitive scores calculated based on mean reaction time when examined based on the type students' high school certificate, F (1, 179) = .112, p = .739 (η2 = .001, weak effect size). The type of high school certificate is not significantly related to metacognitive scores calculated based on mean reaction time.

It appears that students' study programs (i.e., science stream compared to arts stream) had no significant effect on their performances on the four dependent variables. It also appears that the high school GPA is a contributing covariate.

The second series of ANCOVA analyses was conducted to examine differences on the four dependent variables based on students' year of study (i.e., freshman, sophomores, juniors, and seniors) with age as a covariate. ANCOVA results showed that the age covariate was not significant, F (1, 181) = .018, p = .895 (η2 = .001, weak effect size) and revealed no significant differences between the groups of students in study skills, F (3, 18) = .263, p=.852 (η2 = .004, weak effect size). In the next analysis, the age covariate was not significant, F (1, 181) = .302, p = .583 (η2 = .002, weak effect size) and the differences on the metacognitive test were not significant, F (3, 181) = .563, p=.640 (η2 = .009, weak effect size). The age covariate in the next analysis was not significant, F (1, 181) = 2.623, p = .107 (η2 = .014, weak effect size) nor was the difference between groups in reaction time, F (3, 181) = 1.190, p=.315 (η2 = .019, weak effect size). The age covariate in the last analysis was not significant, F (1, 181) = 1.853, p = .175 (η2 = .010, weak effect size) nor was the difference between groups in metacognitive scores based on mean reaction time, F (3, 181) = 1.048, p = .373 (η2 = .017, weak effect size). It seems that students' year of study does not affect performance significantly on the four dependent variables. The age covariate was not significant, either.

The third series of ANCOVA analyses was performed to examine differences on the four dependent variables based on students' college GPA (i.e., low [up to 79 GPA; n=76], mid [80 to 89 GPA; n=70], and high [90 and more GPA; n=23]) using high school GPA as a covariate. Analysis showed that the high school GPA covariate was significant, F (1, 165) = 5.010, p < .03 (η2 = .029, weak effect size) but no significant differences among groups in study skills, F (2, 165) = 2.259, p = .108 (η2 = .027, weak effect size). The next ANCOVA analysis revealed that the high school GPA covariate was not significant, F (1, 165) = .004, p = .951 (η2 = .001, weak effect size) nor was the difference in metacognitive test, F (2, 165) = .451, p=.638 (η2 = .005, weak effect size). In the subsequent ANCOVA analysis, the high school GPA covariate was significant, F (1, 165) = 8.829, p < .02 (η2 = .051, weak effect size) but the difference between the three groups in reaction time was not significant, F (2, 165) = 2.110, p=.125 (η2 = .025, weak effect size). The final ANCOVA analysis showed that the high school GPA covariate was significant, F (1, 165) = 5.981, p < .02 (η2 = .035, weak effect size). However, the difference in metacognitive test based on reaction time was not significant, F (2, 165) = 2.255, p =.108 (η2 = .027, weak effect size). This analysis shows that the high school GPA is a significant covariate in study skills, in reaction time, and in scores calculated based on reaction time and that the three levels of college GPA are not significantly related to any of the four dependent variables.

The final series of ANCOVA analyses was performed to examine differences on the four dependent variables based on students' high school GPA (i.e., low [up to 79 GPA; n=70], mid [80 to 89 GPA; n=79], and high [90 and more GPA; n=35]) using age and college GPA as covariates. The first analysis showed that the age covariate was not significant, $F (1, 163) = 3.087$, $p=.08$ ($\eta 2 = .019$, weak effect size), but the college GPA was significant, $F (1, 163) = 4.955$, $p<.03$ ($\eta 2 = .030$, weak effect size). There were significant differences in study skills due to students' GPA level, $F (2, 163) = 3.444$, $p<.03$ ($\eta 2 = .041$, weak effect size). The Bonferroni follow-up analysis revealed one significant difference between students with *high* GPA and those with *low* GPA.

The next ANCOVA analysis showed that the age covariate was significant, $F (1, 163) = 6.273$, $p<.01$ ($\eta 2 = .037$, weak effect size), but the college GPA was not, $F (1, 163) = .041$, $p=.841$ ($\eta 2 = .001$, weak effect size). Differences in metacognitive test based on levels of high school GPA were not significant, $F (2, 163) = .743$, $p=.477$ ($\eta 2 = .009$, weak effect size).

Subsequent ANCOVA showed that the age covariate was not significant, $F (1, 163) = .138$, $p =.711$ ($\eta 2 = .001$, weak effect size), and the college GPA covariate was not significant, $F (1, 163) = 3.507$, $p = .063$ ($\eta 2 = .021$, weak effect size). However, there were significant group differences in reaction time between the three levels of high school GPA, $F (2, 163) = 4.721$, $p<.01$ ($\eta 2 = .055$, weak effect size). The Bonferroni follow-up analysis revealed that the high (mean reaction time = 136.029) and the mid (mean reaction time = 142.809) GPA groups took significantly less reaction time compared to the low GPA group (mean reaction time = 155.098). No significant difference was found between the mid and the high groups.

The final ANCOVA analysis showed that the age covariate was not significant, $F (1, 163) = 1.524$, $p =.219$ ($\eta 2 = .009$, weak effect size) but the college GPA covariate was significant, $F (1, 163) = 4.463$, $p <.04$ ($\eta 2 = .027$, weak effect size). Differences in metacognitive test based on reaction time between the three levels of students' high school GPA were significant, $F (2, 163) = 4.225$, $p<.02$ ($\eta 2 = .049$, weak effect size). The Bonferroni follow-up analysis revealed that the high and the mid GPA groups performed significantly better compared to the low GPA group. No significant difference was found between the mid and the high groups.

It is apparent that high school GPA is significantly related to study skills and habit and to the relationship between study skills and later academic performance when compared to college GPA. It is also apparent that there is a significant relationship between high school GPA and reaction time. Therefore, a multiple regression was performed to determine the variables that accounted for a significant amount of unique variance in students' study skills.

Multiple Regression Analysis

A multiple regression analysis was performed to find how well high school and college GPA's, students' year of study, students' age and gender, monthly income, number of family members, type of high school certificate, reaction time, scores on the metacognitive test, and scores based on reaction time (i.e., 11 predictors) predicted students' scores on the study skills and habits instrument (i.e., the criterion variable). Table 3 shows that the multiple regression equation was significant and that the high school GPA and the number of family members were the only variables that accounted for a significant amount of unique variance in the prediction of study skills and habits.

Table 3: *Multiple Regression Analysis Predicting the Dependent Variable.*

Predictor	Beta	t	R	R2	Adjusted R 2	Overall F
Study Skills as the Criterion Variable						
High School GPA	.328	3.615**				
College GPA	.056	.633				
Year of Study	.123	1.337				
Students' Age	.020	.245				
Monthly Income	-.130	-1.500				
Number of Family Members	.244	2.812**				
High School Certificate Type	.014	.152				
Metacognitive Test	.093	.713				
Reaction Time	-.145	-.818				
Metacognitive Scores based on Reaction Time	-.098	-.479				
Gender Variable	-.053	-.612				
Constant		3.369**				
Overall			.442	.195	.123	2.690**

Note: * = $p < .05$, ** = $p < .01$

Discussion

This study examined the relationship between metacognition and study skills and habits using a sample of college students. Results showed no significant association between performances on the two types of measures, an indication that they targeted distinct types of processes that capitalize on problem solving and thinking skills but in different contexts. Literature (e.g., Al-Hilawani & Abdullah, 2010) indicated that metacognition as measured in this study is related to the concept of intelligence; it is linked to practical intelligence as compared to academic or other forms of intelligences (Wagner, 2000). Wagner mentioned that a correlation between practical and academic intelligences varied from large to non-existence contingent upon the type of tests used.

This study showed no significant difference between males and females on the metacognitive test, in reaction time, and in scores calculated based on reaction time. This finding of no gender-based significant differences is consistent with results reported on younger age students (e.g., Al-Hilawani et al., 2008). While no significant difference was found between males and females in scores on the study skills questionnaire when controlling the effect of high school and college GPA's, females performed better than males on this questionnaire when the effects of GPA at the high school and college levels were not controlled. This result is expected when examining a such matter in a conservative and a tribal society where cultural and family expectations influence males and females daily routines and future expectations. It appears that students' academic performances and the overall social aspects and conditions, among others, are intertwined and interconnected in a way that attending to one factor to explain a phenomena to a degree of excluding others would lead to insufficient and inaccurate clarifications. Stating that females have better study skills and habits is inaccurate in the presence of interfering family, social, and cultural variables. This statement is applicable to high school and college GPA's.

This study also showed that students with lower monthly income took more time on the test of metacognition compared to students with a higher monthly income. This is the first time a such result is reported in this kind of research. Searching the literature has not revealed studies on this issue. Future research may examine this matter in depth and determine the personal profile of individuals in this regard.

This study showed that students in the arts stream obtained higher high school GPA than those enrolled in the science stream. This demonstrates that studying topics such as history and geography in the arts stream is easier, in terms of getting higher grades, than studying topics such as mathematics, physics, chemistry, and biology. Students are more likely to get higher GPA in high school if they are enrolled in the arts stream compared to the science stream.

This study showed that time played an important role in yielding significant differences between groups of students. While it is invisible, the effect of time becomes obvious when it is used as a criterion in measuring performance such as the number of correct responses on the test of metacognition.

Although research showed significant relationship between the college GPA and study skills (e.g., Proctor et al., 2006), this present study demonstrated that the high school GPA is significantly and more genuinely related to study skills and habits and to the relationship between study skills and academic performance compared to the college GPA. This result is supported by the outcome of the multiple regression analysis which showed that the high school GPA and the number of family members accounted for a significant amount of variance in the prediction of study skills and habits. The finding that high school GPA is significantly related to students' study skills, unlike college GPA, cast doubt on the criteria used to assign college grades in the institution where this study was conducted.

Referring further to the result of multiple regressions, it seems that having a large family helps in acquiring needed study skills and habits in a way that family members help each other with academic works and with the best study practices. While no research is found on the effect of family size on study skills and habits, it is found that interactions among siblings and family members facilitate performance and understanding on false-belief tasks and enhance general language ability (e.g., Jenkins & Astington, 1996).

Limitations

This study has some limitations. It used a small and a convenient sample of university students. Students from all university colleges could not be represented sufficiently to examine differences on the four dependent variables. Had a representative sample been selected, an adequate response could have been obtained to the issue of which college did not contribute to the college GPA not being a significant predictor of study skills. It could have provided information on whether or not grade inflation is a problematic trend in all colleges or it is confined to a specific one.

Implications

This study showed metacognition not to be significantly related to study skills and habits which indicates that both processes could be different from each other. Although tasks used to measure these two processes seem distinct from each other, they are significantly linked to high school GPA via the time variable which seems to be the connection between these two types of processes.

In general, metacognition and study skills and habits are associated with ability of learning how to learn but in different contexts: academic and non-academic. This could explain why some students who are not doing well in academia are being successful in the non-academic and practical world. For example, enhanced and improved one's awareness of naïve biology, naïve physics, and naïve psychology of daily life practices definitely improves one's social competency skills in real life situations but not one's study skills and habits. To improve study skills and habits, they should be performed within domain specific areas using materials designed to cover all important skills that students should master and that focus on explicit verbal exchange and interactions to help integrate new knowledge into the students' conceptual systems (see Sternberg, 1998).

It appears that the high school GPA, obtained by administering exams in a controlled environment and possibly away from personnel connections and subjective interference and favors, provides accurate information on students' study skills and habits. It also appears that the university GPA, unlike the high school GPA, does not reflect strongly the skills and habits that students have, casting doubts on the value of college GPA in this present study. This critical issue should be addressed and dealt with effectively by the university administration.

Finally, whether students should master all study skills or selective ones should be based on needs assessments. This could result in designing a program for particular students that could make a difference in their pursuit of future academic endeavor.

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Appendix A (Part B):
The Study Skills and Habits Questionnaire
***(Responses:* Not Applicable = 1; Rarely = 2; Frequently = 3; Always = 4)**

Item Number	Item	Item Number	Item
1	I can understand all the instructor says in class.	11	I prepare sufficiently for exams a head of time.
2	I can take notes during lesson /material presentations.	12	I study hard for exams.
3	I study alone.	13	I usually read a newspaper / a story slowly and carefully.
4	I need to take many breaks during studying.	14	I devote enough time to my assignments.
5	I have problems using punctuation marks.	15	I follow instructor's instruction in class.
6	I can not study without listening to the radio or music.	16	I do not study all required materials when preparing for exams.
7	I am a good listener to class discussion.	17	I forget what I have studied.
8	I allocate time to my various assignments.	18	I have difficulties organizing my thoughts when writing.
9	I asked my classmates in class to explain what the instructor says.	19	I finish all my assignments.
10	I ask the instructor about ambiguous questions.	20	I get distracted during studying when hearing any sound.
		21	I listen carefully to instruction in class before responding to questions.

Continued: Appendix A

Item Number	Item	Item Number	Item
22	I am indifferent about exams.	35	I read slowly to grasp the general idea.
23	I face problems reading some words in the unit/chapter/ lesson.	36	I have difficulties expressing my thoughts in writing.
24	I encounter spelling difficulties.	37	I manage effectively leisure time and study time.
25	I usually request assistance when doing my assignments.	38	I always get distracted when trying to study.
26	I depend in my study on instructor's discussed and presented materials.	39	I always ask the instructor to repeat what s/he said.
27	I read test instruction during exams.	40	I review my answers to test questions during exams.
28	I am unable to answer correctly some comprehension questions after finishing reading the unit/chapter/ lesson.	41	I look carefully for answers when solving unit/chapter/ lesson questions.
29	If I do not get assistance, I will not finish my assignments.	42	I write down everything that the instructor writes on the board.
30	I respond to all required test questions during the exam.	43	I do my assignments hasty.
31	I ask for assistance during reading.	44	I always get distracted when academic requirements become demanding.
32	I encounter problems in sentence structure during writing.	45	I take a long time to respond to test questions.
33	I go through periods of lethargy during studying.	46	I get tired easily when doing my assignments.
34	I think thoroughly about test questions before responding.	47	When I want to memorize important information in the unit/chapter/ lesson, I read fast.

Continued: Appendix A

Item Number	Item
48	I summarize in my notebook major points in the unit/ chapter/lesson.
49	I finish the easy assignments first then the difficult ones.
50	I take a lot of leisure time while working on my assignments.
51	I answer during exams the easy questions first then the difficult ones.
52	I study in a quiet area.
53	I easily get tired when writing.
54	I have difficulties allocating the appropriate amount of time to each test question.
55	I suffer from a slow writing process.