

Relation between Subjective Measures of Metacognitive Awareness and Implicit Bias Among U.S. Undergraduate Students¹

Relación entre Medidas Subjetivas de Conciencia Metacognitiva y Sesgo Implícito entre Estudiantes Universitarios Estadounidenses

Relação entre Medidas Subjetivas de Consciência Metacognitiva e viés implícito entre estudantes universitários dos Estados Unidos

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Abstract:

Objective. The purpose of the present study was to explore the relation between subjective measures of metacognitive awareness and implicit bias, and to investigate whether metacognition is a viable pathway to meet the two objectives. **Method.** A sample of U.S. undergraduate students (N = 117) completed self-report measures of implicit bias (Situational Attitude Scale) and metacognitive awareness (Metacognitive Awareness Inventory). Correlational analyses, Pearson's r coefficients, and a hierarchical linear regression analysis were conducted to address the research objectives. **Results.** Findings revealed that implicit bias and metacognitive awareness were related, and that conditional knowledge, comprehension monitoring, information management, debugging, and evaluation led to decrements in negatively charged implicit bias. **Conclusion.** Evidently, metacognition is a viable pathway for raising awareness of one's implicit biases and subsequently mitigating them through the development of tailored educational interventions.

Keywords: Metacognition, Self-regulated learning, Implicit judgments, Adult education, Social justice.

Resumen:

Objetivo. El propósito del presente estudio fue explorar la relación entre las medidas subjetivas de conciencia metacognitiva y sesgo implícito e investigar si la metacognición es una vía viable para cumplir los dos objetivos. **Método.** Una muestra de estudiantes de pregrado de EE. UU. (N = 117) completaron medidas de autoinforme de sesgo implícito (Escala de Actitud Situacional) y conciencia metacognitiva (Inventario de Conciencia Metacognitiva). Se realizaron análisis correlacionales, coeficientes r de Pearson y un análisis de regresión lineal jerárquica para abordar los objetivos de la investigación. **Resultados.** Los hallazgos revelaron que el sesgo implícito y la conciencia metacognitiva estaban relacionados y que el conocimiento condicional, el monitoreo de la comprensión, la gestión de la información, la depuración y la evaluación condujeron a disminuciones en el sesgo implícito con carga negativa. **Conclusión.** Evidentemente, la metacognición es una vía viable para crear conciencia sobre los sesgos implícitos de uno y, posteriormente, mitigarlos mediante el desarrollo de intervenciones educativas personalizadas.

Palabras clave: Metacognición, Aprendizaje autorregulado, juicios implícitos, Educación de adultos, Justicia social.

Resumo:

Escopo. O objetivo do presente estudo foi explorar a relação entre as medidas subjetivas de consciência metacognitiva e viés implícito, e pesquisar se a metacognição é um caminho viável para atingir os dois objetivos. **Método.** Uma amostra de estudantes de graduação dos EUA (N = 117) completou medidas de auto relatório de viés implícito (Escada de Atitude Situacional) e consciência metacognitiva (Inventário de Consciência Metacognitiva). Foram realizadas análises correlacionais, coeficientes r de Pearson e análise de regressão linear hierárquica para atender aos objetivos da pesquisa. **Resultados.** Os resultados revelaram que o viés implícito e a consciência metacognitiva estavam relacionados e que o conhecimento condicional, o monitoramento da compreensão, o gerenciamento da informação, a depuração e a avaliação levaram a diminuições no viés implícito de carga negativa. **Conclusão.** Evidentemente, a metacognição é um caminho viável para criar conscientização sobre os vieses implícitos e, posteriormente, mitigá-los por meio do desenvolvimento de intervenções educacionais personalizadas.

Palavras-chave: Metacognição, Aprendizagem autorregulada, julgamentos implícitos, Educação de adultos, Justiça social.

Introduction

Metacognition has traditionally been conceptualized as one of three main components of self-regulated learning (SRL; Panadero, 2017). Generally, metacognition is defined as the act of taking one's own cognition as the object of cognitive thought, and it is considered an effortful, time-consuming, higher-order process of reflection (Brown, 1987; Flavell, 1979). Metacognition, as a psychological phenomenon, was conceptualized initially as having four main elements: (1) metacognitive knowledge (repertoire of information about phenomena); (2) metacognitive experiences (relevant information regarding problem solving and reasoning); (3) goals/tasks; and (4) actions/strategies (Flavell, 1979). Subsequently, researchers like Palincsar and Brown (1984) refined the notion of metacognition and defined it as learners' ability to monitor and control their own learning. Later, Schraw and Dennison (1994) developed a more comprehensive conceptualization of metacognition that continues to be used by contemporary metacognitive researchers.

Implicit bias, also known as implicit social cognition, is understood as individuals' preconceived notions, attitudes, or opinions that influence their decision-making and interpretation of others in an involuntary, subconscious fashion. Further, these stereotypes are not always necessarily negative attributions but may also include positive beliefs about others. The essential element with implicit biases is that they are recognized as beyond individuals' conscious, autonomous monitoring and control (Applebaum, 2019; Hutson, 2019). A male colleague, for instance, may favor the advice of his male counterparts at work and may inadvertently discount the advice of his female counterparts. Implicit biases influence the feelings, attitudes, and perceptions individuals have about others (e.g., preconceptions regarding race, ethnicity, gender, sexual orientation, etc.) (Applebaum, 2019). While research on the relation between implicit bias and other concepts such as race and ethnicity are plentiful (Rynders, 2019), no study to date has investigated the interplay between metacognition and implicit bias, which is a gap in the literature on these topics that needs to be filled. Thus, the purpose of the present investigation is to explore the relation between self-report measures of metacognitive awareness and implicit bias among a sample of U.S. undergraduate students. This is the first study of this type to our knowledge, and hence, it represents a major contribution to the literature on these topics.

Self-Regulated Learning Theory and Metacognition

Self-regulated learning (SRL) theory posits that SRL encompasses cognition, metacognition, and motivation. Several theoretical accounts of SRL have been proposed in the literature (see Panadero, 2017, for a review). Winne and Hadwin (2008), for instance, developed a Metacognitive Perspective Model (MPM) of SRL in which metacognitive processes play a central role. According to the tenets of this model, learners are perceived as being active, involved self-regulated individuals who control their own learning through the implementation of metacognitive monitoring and strategy use, which are central to the goals of the present study.

Regarding metacognition, several theories address the role of metacognitive monitoring in learning (Panadero, 2017). Nelson and Narens (1990), for instance, proposed a historically important two-process model of metacognition that distinguishes between cognitive processes at the *object* level versus metacognitive activities at the *meta* level. This model postulates that monitoring and control are reciprocal, albeit independent processes, both of which assist individuals to make informed decisions (*meta* level) about their immediate environment (*object* level). As individuals interact with their environment, information they collect is processed at the *meta* level to monitor and control their behavior more precisely. However, more

recent theoretical frameworks, as discussed below, propose that the relation between monitoring and control is more complex than initially conceived by the Nelson and Narens (1990) model.

Gutierrez et al. (2016), for instance, maintain that monitoring occurs through two different, albeit inversely related, processes of metacomprehension accuracy and error, and that individuals develop metacognitive learning judgments in different ways. According to this framework, the processes related to accurately monitoring judgments are different from those related to erroneous judgments and, as an equally important aspect, errors in performance judgments are not unidimensional, but rather divided into discordant judgments, in relation to actual performance, that lead to overconfidence and those that lead to underconfidence. Students, for instance, may feel insecure about their understanding of a concept assessed on a test, yet know it well; conversely, students may feel overly self-assured that they know a concept when, in fact, they do not.

These SRL and metacognitive models suggest that increased metacognitive awareness enables learners to construct a better understanding of their comprehension, which facilitates control processes such as allocation of attention and effort, and, presumably, should enable individuals to mitigate their implicit biases. This supposition became our guiding line of inquiry for this research.

Metacognitive Awareness

According to Schraw and Dennison (1994), metacognition is comprised of two main components, *knowledge of cognition and regulation of cognition*. These two dimensions subsume eight micro-processes. *Knowledge of cognition* is composed of declarative knowledge (repertoire of cognitive strategies at the learner's disposal), procedural knowledge (a set of heuristics for implementing cognitive strategies), and conditional knowledge (the where, when, and why to apply strategies given task demands). *Regulation of cognition*, on the other hand, encompasses planning (preparing the ground before the task, such as the resources necessary to complete it and any anticipated challenges that the student may face during the task), information management (the set of strategies to effectively manage the incoming information needed to complete the task), debugging (the set of strategies available to solve learning difficulties), comprehension monitoring (the skills necessary to effectively monitor progress toward task completion), and evaluation (generally recognized as a holistic and general judgment of how well the task was accomplished, and used to gauge future performance) (Schraw & Dennison, 1994).

In general, different studies conclude that knowledge, regulation, and capacity for self-awareness regarding the learning process of individuals as well as knowledge of individuals' own metacognitive skills benefit learning outcomes (Gutierrez & Schraw, 2015; Gutierrez de Blume, 2020; Gutierrez de Blume, 2021). In addition to improved learning in the classroom, metacognitive awareness also impacts activities beyond the school setting, such as professional practice, through an enhanced self-regulation mechanism that allows individuals to inhibit maladaptive behaviors (Gutierrez de Blume, 2020; Gutierrez de Blume, 2021).

Implicit Bias

Research shows that implicit biases are pervasive insofar as everyone is susceptible to them, including individuals who outwardly claim to be impartial (Hutson, 2019; Roche et al., 2020). Research also shows that while implicit and explicit biases are interrelated, they are also independent processes. Nevertheless, they may sometimes work together and inform one another (Rynders, 2019). Interestingly, implicit biases may not always be linked or completely overlap with individuals' explicit attitudes or opinions, and at times may in fact be independent from what they expressly share with others (Saul, 2018), and hence, the differentiation between *implicit* and *explicit* bias. What makes implicit biases so insidious is that individuals generally tend

to hold implicit biases that favor their own ingroup (the “us vs. them” mentality), albeit research has shown that individuals can still harbor implicit biases against their ingroup, especially in alignment with dominant group norms and expectations. Nevertheless, and of special significance to the present study, implicit biases are malleable, suggesting that they can be gradually unlearned through a variety of “debiasing” educational interventions (Applebaum, 2019; Dogra et al., 2016). Therefore, better understanding of how to combat implicit biases in education and other settings is of special interest to researchers and practitioners, and metacognition may be a fruitful avenue in this regard.

Metacognition and Implicit Bias

Although research on the relation between metacognition and implicit bias is lacking to date, theoretical accounts of SRL and metacognition support the notion that metacognition and bias should be related to some extent (Pandero, 2017; Winne & Hadwin, 2008). Research on specific aspects of metacognition such as comprehension monitoring demonstrates that as individuals become more aware of what they know and do not know about a topic through mechanisms such as feedback reflection, they should be better able to adjust future learning episodes (Bol et al., 2005; Gutierrez & Schraw, 2015; Gutierrez de Blume, 2017; Hacker et al., 2008; Montoya-Londoño et al., 2021). Because greater self-regulated learning skills enhance metacognitive monitoring and control processes in learners (Gutierrez et al., 2016; Rincón & Hederich-Martínez, 2021), conceivably, students who are more proficient in metacognitive monitoring and control should be more readily aware of their own implicit biases, and hence, be more capable of reframing their way of thinking to minimize, if not eliminate, them. Alternatively, greater awareness of one’s own biases may not necessarily lead to a reduction in or elimination of said biases. Indeed, Sadker and colleagues (Sadker, 2000; Sadker & Sadker, 1986) showed that bringing awareness of implicit biases toward gender did not lead teachers to abandon those biases in their classroom practice.

The Present Study

Research Questions and Expectations. The present investigation was guided by the following research questions.

1. What is the relation between subjective metacognitive awareness and implicit bias among a sample of U.S. undergraduate students?
2. Are students who are more aware of their metacognition also more aware of (and able to mitigate) their implicit biases?

Hypothesis 1: We expected the components of subjective metacognitive awareness, namely declarative, procedural, and conditional knowledge (knowledge of cognition) as well as planning, information management, debugging, comprehension monitoring, and evaluation (regulation of cognition), would be significantly related to subjective implicit bias.

Hypothesis 2: We expected that subjective metacognitive awareness, namely declarative, procedural, and conditional knowledge (knowledge of cognition) as well as planning, information management, debugging, comprehension monitoring, and evaluation (regulation of cognition), would assist students to be more aware of and mitigate their subjective implicit bias (2a). Further, we expected each main component of metacognitive awareness (knowledge of cognition and regulation of cognition) to serve as unique mechanisms in service of raising awareness of and mitigating implicit bias (2b).

Method

Research Design and Sampling

The present study employed a convenience, non-random sampling approach with a non-experimental, correlational research design (Tabachnick & Fidell, 2013).

Participants

Participants were 124 undergraduate students enrolled in academic programs within the College of Education (CoE) from a mid-sized university in the southeast United States. Of the 124 students, however, only 117 provided complete data. The age of the 117 remaining participants ranged from 19-52 years ($M = 22.72$; $SD = 9.08$), with 92 identifying as female (25 male). Fifteen participants were freshmen, 26 were sophomores, 41 juniors, and 35 seniors, with a mean grade point average of 2.92 ($SD = 0.78$). Regarding racial makeup, 36 identified as People of Color (5 Asian; 19 Black; 9 Hispanic/Latin(x); 3 Hawaiian or Other Pacific Islander) and 81 identified as White. To be included in the study students needed to be 18 years of age or older, to have been admitted as undergraduate students, and to not have been diagnosed with a learning disability.

Materials and Instruments

Subjective Metacognitive Awareness

Self-report metacognitive awareness was measured using the Metacognitive Awareness Inventory (MAI) initially piloted and validated by Schraw and Dennison (1994). The MAI contains 52 declarative statements that are intended to capture the eight sub-elements and two main elements of metacognition. Following are some examples of items: "I constantly wonder if I am meeting my goals" (monitoring); "I try to use strategies that have worked in the past" (procedural knowledge); "I reevaluate what I have learned when I get confused" (debugging strategies); and "I know how well I did in an assessment once the test is over" (evaluation). Students responded to the items on a 0-100 sliding scale ranging from "not at all true of me (0)" to "very true of me (100)".

Scores were calculated by taking the average of the items that make up each scale, respectively. Next, the composite of declarative, procedural, and conditional knowledge was used to compute the knowledge of cognition, and the regulation of cognition was comprised of the composite of planning, information management, monitoring comprehension, debugging, and evaluation. Internal consistency reliability coefficients for the present sample were: knowledge of cognition, $\alpha = 0.86$, regulation of cognition, $\alpha = 0.90$; declarative knowledge, $\alpha = 0.72$; procedural knowledge, $\alpha = 0.75$; conditional knowledge, $\alpha = 0.81$; planning, $\alpha = 0.78$; comprehension monitoring, $\alpha = 0.82$; information management, $\alpha = 0.79$; debugging, $\alpha = 0.79$; and evaluation, $\alpha = 0.80$.

Subjective Implicit Bias

Implicit bias was measured using an adapted version of the 10-item Situational Attitude Scale (SAS) initially developed and validated by Sedlacek (1996). The SAS was initially created to measure perceptions of

situation-specific sources of implicit bias towards individuals who self-identify as non-White (i.e., not from European descent), as Whites are still considered the dominant race in the U.S. (Ancis et al., 1996). It was subsequently modified to include implicit bias against other minoritized populations such as Arabs (Sergent et al., 1992), and Blacks/African Americans (Balenger et al., 1992), among others. However, for the present investigation, the items of the SAS were modified to specifically refer to situation-specific bias related to people of color by including person(s) of color as the reference group in each of the situations assessed by the measure. Sedlacek devised the SAS to be flexible to such changes to make it adaptable to any racial or ethnic group. Sample situations included, "A new family of color moves in next door to you."; "Your best friend has just become engaged to a person of color."; and "You are walking down the street alone and must pass a corner where a group of five young men of color are loitering."

Each of the 10 situations on the measure are followed by 10 emotions/feelings elicited by the given situation. For the purposes of the present study, all the emotions/feelings were scaled such that emotions/feelings with negative valence were placed at the low end of each scale whereas emotions/feelings with positive valence were placed at the high end of each scale to maintain consistency in interpretation. For instance, emotions/feelings such as "sad", "intolerable", "angry", and "bad" were placed as anchors at the low end of the scale while their counterparts such as "happy", "tolerable", "not angry", and "good" were placed as anchors at the high end of the scale. As with the metacognitive awareness measures, students responded to the items on a 0-100 sliding scale ranging from "[emotions/feelings with negative valence] (0)" to "[emotions/feelings with positive valence] (100)." Thus, lower scores represented a higher propensity toward negatively charged implicit bias whereas higher scores represented a lower propensity toward negatively charged implicit bias across all situations. The SAS score was calculated by taking the average of all situations. The internal consistency reliability coefficient for the present sample for the SAS was $\alpha = 0.88$.

Procedure

All ethical guidelines regarding research involving human participants were followed during the conduct of the study, including securing university IRB approval (#H21115) and participants' voluntary informed consent to participate. All measures were input to the Qualtrics software for electronic administration during the Fall 2020 and Spring 2021 academic semesters. Instructors from the CoE teaching undergraduate students were first contacted for their willingness to assist in participant recruitment. Instructors who taught online or hybrid courses were asked to place a course announcement in the University's learning management system (LMS) that included a brief description of the study and the Qualtrics link to the survey whereas those teaching traditional/in-person courses were asked to print a recruitment flyer with the same brief description, but instead of a link, the flyer included a QR Scan Code to the Qualtrics survey. Thus, regardless of recruitment method, all participants completed the same survey online. The first page of the survey was the electronic informed consent form, which participants were required to review carefully and click, "Yes, I wish to voluntarily participate", before proceeding to the survey. Participants who did not want to participate were instructed to exit the survey. The average time for survey completion across the 117 students with complete data was 22.90 minutes ($SD = 3.96$).

Data Analysis

Data were submitted to all requisite data screening and assumption testing procedures prior to data analysis, including univariate normality (Tabachnick & Fidell, 2013). All variables in the present study approximated univariate normality. No cases were classified as outliers using box-and-whisker plots and a standardized residual analysis using a regression sub-command, leaving all 117 remaining cases available for data analysis.

Because of the seven cases with missing data, Little's MCAR χ^2 statistics were conducted, which is intended to ascertain that the pattern of missing data was missing at random (MAR) rather than missing not at random (MNAR), which could bias results due to systematic differences in non-responses. Findings from this test were non-significant for the present study, Little's MCAR χ^2 (95, $N = 124$) = 32.12, $p = 0.91$, indicating that the missingness pattern in the data was MAR. The data also met other requisite statistical assumptions, including homoscedasticity, linearity, and lack of multicollinearity. Therefore, data analyses proceeded without making any adjustments to the data.

The first research question was answered by conducting correlational analyses, Pearson's r . The second research question was answered by conducting a hierarchical (ordinary least squares) linear regression analysis in which the sub-components of knowledge of cognition—declarative, procedural, and conditional—were entered in Block 1 and sub-components of regulation of cognition—planning, information management, debugging, comprehension monitoring, and evaluation—were entered in the Block 2. Subjective implicit bias served as the criterion in the analysis. The squared multiple correlation coefficient, $R^2_{adjusted}$, was employed as the measure of effect size. This version of R^2 is more conservative than its typical counterpart, and it is especially useful for studies with smaller sample sizes because it corrects for potential overestimation of the observed effect in smaller samples. Cohen (1988) provided the following interpretive guidelines for $R^2_{adjusted}$: 0.010 - 0.499 as small; 0.500 - 0.799 as medium; and > 0.800 as large. Larger effect sizes hint at which aspects of metacognitive awareness may provide a more fruitful avenue for developing potential educational interventions specifically targeting implicit bias.

Results

Descriptive statistics for the sample regarding the variables of interest to the present investigation are presented in Table 1. Table 2 presents the bivariate, zero-order correlation matrix for the MAI subscales with the SAS, and Table 3 does the same, except that it employs the two main dimensions of the MAI, knowledge of cognition and regulation of cognition, rather than the individual subscales.

TABLE 1
*Descriptive Statistics and Internal Consistency Reliability Coefficients for the
 Metacognitive Awareness Inventory Scales and the Situational Attitude Scale*

Variables	<i>M</i>	<i>SD</i>
Knowledge of Cognition	81.34	12.57
Declarative	82.31	9.53
Procedural	80.98	11.61
Conditional	84.42	9.88
Regulation of Cognition	73.06	11.97
Planning	74.37	10.92
Comprehension Monitoring	76.67	11.95
Information Management	72.61	10.56
Debugging	78.99	10.01
Evaluation	76.91	9.28
Situational Attitudes Scale	60.07	13.05

N = 117
 Source: Authors

TABLE 2
*Zero-Order Correlation Matrix for Metacognitive Awareness
 Inventory Individual Subscales and the Situational Attitudes Scale*

Variable	1	2	3	4	5	6	7	8	9
1. Declarative Knowledge	-	0.73**	0.76**	0.49**	0.57**	0.65**	0.64**	0.71**	0.19
2. Procedural Knowledge		-	0.79**	0.58**	0.56**	0.57**	0.61**	0.55**	0.24
3. Conditional Knowledge			-	0.70**	0.68**	0.75**	0.63**	0.66**	0.45**
4. Planning				-	0.76**	0.73**	0.55**	0.70**	0.54**
5. Comprehension Monitoring					-	0.60**	0.68**	0.69**	0.55**
6. Information Management						-	0.63**	0.53**	0.59**
7. Debugging							-	0.74**	0.48**
8. Evaluation								-	0.58**
9. Situational Attitudes Scale									-

N = 117

**p < 0.01 (one-tailed test of significance)

Source: Authors

TABLE 3
*Zero-Order Correlation Matrix for the Metacognitive Awareness
 Inventory Main Dimensions and the Situational Attitudes Scale*

Variable	1	2	3
1. Knowledge of Cognition	-	0.76**	0.43**
2. Regulation of Cognition		-	0.69**
3. Situational Attitudes Scale			-

$N = 117$

** $p < .01$ (one-tailed test of significance)

Source: Authors

Descriptive statistics in Table 1 reveal that students tended to rate themselves higher in the knowledge of cognition components of metacognitive awareness compared to the regulation of cognition components. Interestingly, participants also tended to rate themselves as exhibiting less implicit bias, given the mean of 60.07, which is just over 10 points above the median of 50 (representing neither more nor less implicit bias).

RQ1: Relation between Metacognitive Awareness and Implicit Bias

In answer to the first research question, Table 2 demonstrates that all the individual components of metacognitive awareness significantly and positively correlated with SAS scores, except for declarative and procedural knowledge, both of which are components of the knowledge of cognition dimension, which were non-significantly related to SAS scores. Table 3, which presents only the two main dimensions of metacognitive awareness rather than the individual components, shows that both the knowledge of cognition and regulation of cognition dimensions significantly and positively correlated with SAS scores, albeit the association between regulation of cognition and SAS scores was much higher than that of knowledge of cognition. Thus, overall, as individuals' subjective metacognitive awareness *increases*, their subjective implicit bias *decreases*. This is the case because higher values on the SAS signify less implicit bias, per the method employed to scale and score the SAS.

RQ2: Greater Metacognitive Awareness as a Pathway to Reduce Implicit Bias

Hierarchical linear regression results revealed that the omnibus model with the combined metacognitive awareness components reached statistical significance, $F(8,108) = 11.74, p < 0.001, R^2_{adjusted} = 0.592$ ($R^2 = 0.659$). The knowledge of cognition components provided significant incremental variance to the possible mitigation of implicit bias, $\Delta F(3,113) = 6.28, \Delta p = 0.020, \Delta R^2 = 0.181$. Further, the regulation of cognition components provided even more substantial incremental variance to the possible mitigation of implicit bias, $\Delta F(5,111) = 11.39, \Delta p < 0.001, \Delta R^2 = 0.479$. Individual unstandardized and standardized regression coefficients for each of the blocks are displayed in Table 4. With respect to knowledge of cognition, only subjective conditional knowledge, which relates to the awareness of when and why to apply strategies given the demands of the task or environment, significantly contributed to the reduction of subjective implicit bias. Regarding the regulation of cognition components, all but planning significantly contributed to decreases in subjective negatively charged implicit bias. Comparison of the standardized regression coefficients indicate

that comprehension monitoring ($\beta = .82$) was the most important metacognitive component that reduced negatively charged implicit bias.

TABLE 4
Hierarchical Linear Regression Results for the Predictive Effects of Metacognitive Awareness Individual Components on Implicit Bias

Predictor	<i>t</i>	<i>p</i>	<i>b</i> ^a	β ^b	CI _{95%} ^c
Knowledge of Cognition					
Declarative	0.61	0.55	0.32	0.12	-0.26, .90
Procedural	0.79	0.45	0.37	0.17	-1.44, .70
Conditional	3.02	.02	.43	.44	.25, .61
Regulation of Cognition					
Planning	0.13	0.91	0.09	0.13	-0.98, .98
Comprehension Monitoring	7.33	< 0.001	0.63	0.82	0.39, .87
Information Management	2.29	0.04	0.31	.035	0.03, .59
Debugging	3.96	0.01	0.43	0.57	0.22, .64
Evaluation	4.27	0.002	0.54	0.40	0.35, .73

Note. Predictors in bold are statistically significant at the $p < .05$ level of significance.

^a unstandardized regression coefficient; ^b Standardized regression coefficient;

^c 95% confidence interval for the unstandardized regression coefficient.

$N = 117$

Source: Authors

Thus, even though both knowledge of cognition components and regulation of cognition components significantly mitigated implicit bias, the unique variance explained by the regulation components of metacognitive awareness was over twice that attributable to knowledge of cognition components alone. This is especially important because the regulation of cognition dimension encapsulates the monitoring and control processes necessary to self-regulate behavior, which is, presumably, the reason why greater regulatory awareness of metacognition contributes to such a decrement in negatively charged implicit bias.

Discussion

The purpose of the present study was to explore the relation between subjective measures of metacognitive awareness and implicit bias among U.S. undergraduate students. Results revealed that there were significant positive relations only between the conditional knowledge component of knowledge of cognition and all components of regulation of cognition, partially supporting the first expectation. The fact that conditional knowledge was the only component of knowledge of cognition that significantly related to implicit bias is not surprising, as conditional knowledge relates to the why and when to apply cognitive strategies given

contextual and task demands, which are reflective processes (Schraw & Dennison, 1994). This finding is also congruent with Gutierrez and Schraw's (2015) assertion that conditional knowledge is, conceivably, the most relevant and sophisticated aspect of knowledge of cognition for learners.

Interestingly, the correlations were larger for the components of regulation than for knowledge. Regulation of cognition involves more sophisticated and advanced skills that allow individuals to monitor more effectively, control, and self-regulate their behavior (Efklides, 2011; Gutierrez et al., 2016; Schraw & Dennison, 1994; Winne & Hadwin, 2008). Thus, the significant positive relation between all the regulation of cognition components and implicit bias is encouraging because it indicates that as individuals' regulatory skills of their own cognition increases, implicit bias decreases with it. Results of the second research question are even more promising in this regard.

The regression model indicated that conditional knowledge and each component of regulation, except for planning, significantly positively predicted implicit bias, also partially supporting the second expectation. As with the bivariate correlation results, the regression model suggested that enhanced metacognitive awareness, especially regulatory components (except planning), predicts decrements in implicit bias. Thus, it appears that increasing individuals' skill with metacognitive regulation of their cognition will assist them in more adaptively regulating implicit biases, as the results tentatively show. The two strongest predictors of implicit bias were comprehension monitoring followed by debugging, both regulation components of metacognitive awareness.

Comprehension monitoring refers to a set of skills enabling individuals to effectively monitor (thought) and control (action) their learning whereas debugging involves related regulatory skills regarding error-detection and reparation (Schraw & Dennison, 1994). These findings are in line with research on metacognitive monitoring that reports increased monitoring skill leads to concomitant reductions in errors in judgment (Bol et al., 2005; Gutierrez & Schraw, 2015; Gutierrez et al., 2016; Gutierrez de Blume, 2017; Hacker et al., 2008). Like this body of research, it is plausible that as subjective metacognitive awareness increases, people become more readily aware of subconscious or unconscious perceptions through deeper monitoring, control, self-regulation, and evaluations that relate to errors in judgments, which subsequently leads to a greater awareness of implicit biases and affords these individuals an opportunity to adjust behavior accordingly. Indeed, research has shown that individuals have been able to adaptively adjust behavior through such self-regulatory skills as self-generated feedback (Bol et al., 2005; Gutierrez & Schraw, 2015; Hacker et al., 2008; Huff & Nietfeld, 2009; Serra & Metcalfe, 2009; Thiede et al., 2012), a sophisticated metacognitive skill.

Implications for Theory and Research and Recommendations for Learning

Implicit in the findings discussed above is first and foremost a confirmation that early Civil Rights and feminist efforts aimed at uplifting Black Power (Watkins, 2001) and consciousness raising (Rosenthal, 1984) may have indeed been basically "on the right track" in addressing at least the horizontal hostility (White, Schmidt & Langer, 2006) and self-effacing aspects of racial, gender and sexist oppressions. Our research seems to support the connections between lessening of implicit biases and raising to conscious awareness how we *think about thinking* about race/racism, sex/sexism, gender roles and binaries/fluidities. While more research is needed, this preliminary study upholds the commonly accepted practice of addressing oppressions at the level of consciousness. It appears that these -isms become embedded into the fabric of our being through "taken for granted" (Greene, 1988) assumptions of common culture.

Some have compared the dominant culture influences to the water fish swim in, or the air we breathe. Concepts so deeply embedded and pervasive – so taken for granted – that the only way to *recognize* them is to engage in practices that "make the familiar strange" (Greene, 1988). Perhaps the connections between making the familiar strange and engaging in processes to foreground our metacognition through unpacking

distinctions between knowledge of cognition and regulation of cognition, may provide fertile ground for developing new pathways into reducing social injustice.

For example, one additional factor that social justice educators may want to consider is that *thinking about thinking* in this way is less morally charged than thinking about racism (and other -isms). One struggle social justice educators teaching courses on diversity face constantly is the moral stigma students feel, which becomes a barrier to confronting their own racism. These educators see the dilemma play out on the students' faces as they quickly shift from *seeing* social injustice back to denial. They think: "Racism is bad. Racists are evil. Therefore, if I admit to racist beliefs and attitudes (even implicit bias), I *must* be evil and morally depraved. But, I'm *not* morally depraved, therefore I am *not racist*. I don't understand what the professor is talking about, we're *all good people* (good people cannot be racist)... therefore racism does not exist." If only we can disconnect the presumption of moral degeneracy from racism and other forms of social injustice, perhaps a wedge can be inserted permitting the more nuanced and realistic awareness that regulation of cognition might render learners more educable on these topics.

Avenues for Future Research

Of course, more research is needed. This study is only preliminary, but nonetheless promising. More large-scale studies are needed to validate the indications of this preliminary study. Studies with larger sample sizes and those employing qualitative and mixed methods research designs would be helpful. Qualitative studies can assist researchers in understanding the processes behind how, why, and when metacognitive awareness raises awareness of, and may potentially mitigate, implicit bias. Additional research on these topics from the perspective of educators and students would also benefit our understanding of metacognitive awareness and implicit bias from those who teach and learn.

Methodological Reflections and Limitations

The present investigation has several limitations worth noting. First, the present study represents an exploratory study insofar as it is the first, to our knowledge, that attempted to relate subjective metacognitive awareness and implicit bias, and thus, the exploratory nature of the study limits its generalizability. Second, the study is cross-sectional and non-experimental in nature such that, when combined with the administration of only subjective measures for both metacognitive awareness and implicit bias, further limits the generalizability of the findings. Nevertheless, we wish to highlight some strengths of the research as well.

The study employed a relatively large sample size, which lends credibility to the statistical evidence because results are not likely to be spurious in nature. This is especially important, given the exploratory nature of the research. Furthermore, the study occurred in ecologically-valid settings insofar as it took place in the context in which these students learn, and not the contrived setting of a laboratory. Thus, despite the limitations of the research, it represents a worthwhile contribution to the literature on metacognition and implicit bias.

Conclusion

The present study tentatively showed that a potential pathway to raising students' awareness of their implicit biases is by enhancing their metacognitive awareness skills, but especially regulatory skills. More specifically, skills like conditional knowledge (the where, when, and why to apply strategies given task demands), information management (the set of strategies to effectively manage the incoming information needed to complete the task), debugging (the set of strategies available to solve learning difficulties), comprehension

monitoring (the skills necessary to effectively monitor progress toward task completion), and evaluation (generally recognized as a holistic and general judgment of how well the task was accomplished, and used to gauge future performance) are possible skills to target for training to help individuals become more aware of their biases and, hopefully, take reasonable, active steps to mitigate them. Research has already demonstrated that metacognitive skills are malleable and that educational interventions are beneficial for a variety of learning outcomes (Gutierrez & Schraw, 2015; Gutierrez de Blume, 2020; Gutierrez de Blume, 2021; Schraw & Dennison, 1994). Thus, researchers and practitioners should work together to develop educational interventions that enhance metacognitive awareness and reduce bias.

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Notes

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