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The Effect of Mindfulness on Metacognition and Exams

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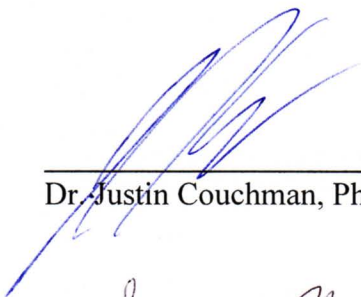
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The Effect of Mindfulness on Metacognition and Exams

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Abstract

This study consisted of two experiments examining the effect of mindfulness on metacognition and exams and if a daily brief mindfulness regimen could improve mindfulness. Participants for both experiments were randomly assigned to either an experimental group that completed a novel brief daily mindfulness regimen or a control group that completed a daily nutrition education regimen. After completion of a two-week regimen, participants completed a regularly scheduled exam using confidence judgments and revision tracking. The mindfulness regimen did not improve mindfulness; however, the experimental groups for both experiments already possessed above average mindfulness both before and after completing the regimen. Both control groups possessed average mindfulness pre- and post- regimen. Overall, in both experiments participants in comparison with actual performance were able to accurately use in-the-moment exam confidence judgments, but were inconsistent with post-exam judgments. Additionally, participants in Experiment 1 made significantly more revisions from an incorrect response to a correct response than from a correct to incorrect response which revealed good in-the-moment monitoring. For individuals with above average or average mindfulness, a link may exist between mindfulness and metacognition that is in-the-moment. Students may benefit from mindfulness through their ability to assess how they are performing while completing a task such as an exam. Future studies involving demographically representative samples and samples with below average mindfulness may help to provide a better understanding of the link between mindfulness and metacognition.

The Effect of Mindfulness on Metacognition and Exams

Mindfulness is a skill that allows one to experience the current moment without passing judgment or bringing to the surface negative thoughts or memories. It enables an individual to become more aware of any thoughts, emotions, and impulses felt in the present moment (Dijk, 2012). Mindfulness has existed for thousands of years and was often used as a form of religious meditation. However, modern mindfulness practices can vary and include nonreligious, non-meditating, and therapeutic exercises that still encompass the traditional ideas and core goal of mindfulness (McKay, Wood, & Brantley, 2007).

Mindfulness provides its user with numerous benefits both in practical and clinical settings. Hülshager, Alberts, Feinholdt, and Lang (2013) conducted two experiments to determine the effects of mindfulness on emotional exhaustion and job satisfaction. Both experiments showed decreased emotional exhaustion and increased job satisfaction in participants. Cassin and Rector (2011) also examined participants with generalized social phobia and observed that after induced stress, mindfulness strategy application helped to reduce post-event distress in comparison to a group that did not use mindfulness strategies. Likewise, Boettcher et al. (2014) found that online mindfulness training resulted in decreased anxiety symptoms and an improvement in overall quality of life among those suffering with anxiety.

In addition to existing mindfulness-based programs, a program can be created that varies in length and caters certain aspects of mindfulness towards a specific objective. The Mindfulness-Based Stress Reduction (MBSR) program focuses solely on mindfulness-related skills involved in stress reduction and can be directed towards one specific environment, such as the workplace. In contrast, a larger, often therapeutic program, such as Dialectical Behavior

Therapy (DBT), uses a broader scope of mindfulness-related skills with a less defined target audience.

A typical MBSR programs lasts 8 weeks (Chaskalson, 2011); however, research involving various mindfulness training programs have varied a typical 8 week program by both increasing and decreasing its length and have found significant results . Schonert-Reichl et al. (2015) found that after four months of implementing an easy to administer social and emotion learning program that included core mindfulness exercises, elementary students who participated in the program showed promising improvements in both behavioral and cognitive change. Black and Fernando (2014) administered a five-week mindfulness-based program that included mindfulness exercises performed for 15-minutes three times per week for five weeks. Elementary students who participated in the program showed improvements including increased attention, self-control, participation in class, and respect towards others. Even less than one week of mindfulness training and participation has yielded significant improvements in mindfulness. Zeidan, Johnson, Diamond, David, & Goolkasian (2010) observed that after practicing mindfulness skills for 20 minutes per day over four days, naïve participants showed significant improvements in mindfulness compared to a control group.

Although usually never explicitly acknowledged, one aspect affected by mindfulness appears to be metacognition. Metacognition has been defined as “one’s knowledge and control of the domain of thinking,” or awareness and regulation of cognition (Brown, Bransford, Ferrara, & Campione, 1983). Narens and Nelson (1994) purposed a simple model that mapped the workings of metacognition. The model involved two interrelated levels of metacognition known as the “object-level” and the “meta-level.” The object-level monitors, or informs, the meta-level. In

turn, the meta-level modifies the object-level to use cognitive information to inform decisions and control behaviors.

Metacognition develops throughout life, beginning just before children, constructing one important aspect of metacognition known as theory of mind, or “a coherent understanding of people as mental beings” (Berk, 2013). Self-awareness provided by metacognitive ability can be highly influential within an individual. For example, Yoshida et al. (2012) found that muscular dystrophy patients who used reappraisal and distraction metacognitions had greater pain control beliefs that were influential in the development and regulation of pain-related cognition.

Possessing high functioning metacognitive ability can be beneficial not only in everyday decision making but also in the classroom. Metcalfe and Finn (2008) found that one type of metacognition known as judgments of learning can directly affect how an individual chooses to study including that an individual may choose not to study information because he or she believes he or she already knows the information when he or she actually does not. Hines, Touron, and Hertzog (2009) also found that the amount of time spent studying was related with metacognitive ability. If an individual can accurately gauge his or her metacognitive ability, he or she can perform optimally. However, poor metacognitive ability can have negative consequences, such as overconfidence. Dunlosky and Rawson (2011) found that overconfidence and inaccurate self-evaluations of learning can weaken a student’s learning and retention. They also suggested that interventions aimed at increasing skills for accurate self-evaluation of learning could be beneficial.

With an understanding of both mindfulness and metacognition and their benefits, there is justifiable belief that mindfulness can affect or be linked to metacognitive ability, even if mindfulness programs never explicitly state this. Unfortunately, very little research exists

provides an exploration of the possible link between both mindfulness and metacognition. However, from our understanding of mindfulness and metacognition, we can see that specific mindfulness exercises do target areas of metacognition. For example, the mindful breathing exercise results in an individual maintaining focused attention, being aware of thoughts that distract from the exercise and calmly dismissing them, and refocusing attention if lost (McKay, Wood, & Brantley, 2007). Mindfulness exercises such as these could potentially affect one's metacognition.

In this study, we wanted to test the effects of mindfulness on metacognition through confidence judgments and revision tracking on a regularly scheduled undergraduate college exam. Additionally, since the effects of increased mindfulness has been shown using programs lasting less than 8 weeks, we wanted to create and test a novel brief daily mindfulness regimen in which the daily time spent performing mindfulness exercises was less than any significantly effective program found in current literature to find if our program could still increase mindfulness in comparison to a control group. We predicted that our experimental group would show increased mindfulness at the completion of the brief daily mindfulness regimen and also show significantly better metacognition as determined by confidence judgments and revision tracking.

Experiment 1 Method

Participants

The participants in this study were undergraduate students at Albright College in a Research Methods psychology course who received extra credit for participating. They were recruited at the beginning of a class via a sign-up sheet. Participation was completely voluntary and the recruitment methods and study was approved by the IRB. There were a total of 18

participants (17 women, $M = 19.22$ years, $SD = 0.42$ years, age range: 19-20). Further, 94.4% were Sophomores and 5.6% were Juniors. The ethnicity of the participants were: 72.2% White/Caucasian, 11.1% Black/African American, 11.1% Hispanic/Latino, and 5.6% Asian.

Materials

The materials used in this experiment included a daily brief mindfulness regimen for the experimental group and a daily nutrition education regimen for the control group. We defined our daily brief mindfulness regimen as a two-week regimen with mindfulness exercises to be completed daily after one initial mindfulness training session lasting about 15 minutes. The mindfulness regimen materials were divided into three sections: an introduction page, educational materials, and a mindfulness journal. The introduction page defined mindfulness and provided a concise overview of the regimen. The following three pages consisted of descriptions and instructions for three mindfulness skills. These skills were taken verbatim from *The Dialectical Behavior Therapy Skills Workbook* (McKay, Wood, & Brantley, 2007) and consisted of: mindful breathing, wise-mind meditation, and doing tasks mindfully. Each exercise involved an aspect of metacognition. The final two pages were the mindfulness journal that was to be completed on a daily basis. Mindful breathing and wise-mind meditation were to be completed for at least three minutes each per day and at least one daily task was to be completed mindfully (see Appendix A for sample mindfulness regimen materials). This regimen is well beneath the typical length of a mindfulness program and has the least amount of training sessions and daily mindfulness skill requirements found in mindfulness research.

The control group received nutrition education materials. Nutrition education was selected for the control group since it has been successfully used as a control in a prior study examining the effects of mindfulness (Zeidan et al., 2010) and also has very little relevance

concerning mindfulness skills. The nutrition education regimen materials were divided into three sections: an introduction page, educational materials, and a food journal. The introduction page defined nutrition education and provided a concise overview of the regimen concerning the daily food journal. The following three pages consisted of eating and staying active tips taken verbatim from the United States Department of Agriculture printable materials (Printable, 2011). The final two pages were the food journal that was to be completed on a daily basis. Participants were encouraged to track daily food and drink consumed for each of the three major meals (see Appendix B for sample nutrition education materials). Participants' food journals could be as in-depth as they chose to make them and may have taken less time to complete in comparison to the mindfulness journal in order to eliminate any possible metacognitive benefits they may have received from stopping to recall and possibly alter eating habits.

The measurements used in this experiment included the Freiburg Mindfulness Inventory (FMI) short form and metacognitive confidence judgments and revision tracking. The full version FMI consists of a 30-item scale while the FMI short form consists of a 14-item scale. Walach, Buchheld, Buittenmüller, Kleinknecht, & Schmidt (2006) reported two studies which concluded the FMI to be a valid and reliable measurement of mindfulness. The researchers also concluded that the FMI short form may be better suited for a generalized context where a Buddhist mindfulness background cannot be expected from participants. The FMI has also been used in other studies as a successful measure of mindfulness (Zeidan et al., 2010). The FMI short form was used to measure mindfulness both before and after completing either the experimental or control regimen.

Judgments in confidence, or confidence judgments, were used as one measure of metacognitive ability. Confidence judgments about general knowledge questions can be good

accuracy indicators (Perfect, 2002). On a multiple choice exam, an individual must make a decision and select an answer he or she feels is correct. When doing this, an individual can also judge through self-awareness how confident he or she feels about the selected answer.

Confidence judgments recorded after a decision have been used successfully in previous studies and allowed an individual to evaluate self-reflective and task-specific information (Dinsmore & Parkinson, 2013). In our experiment, confidence judgments were obtained during and after the exam. During the exam, participants judged in-the-moment how confident they felt about their answer on a scale of 1 through 5 with 1 meaning no confidence, or “I know I do not know if this answer is correct,” and 5 meaning extreme confidence, or “I know I do that this answer is correct,” by circling their response and writing a number. After the exam, participants judged how confident they felt about their performance out of a score of 1 through 5 and 1 through 100.

Revision tracking was another measure of metacognitive ability. When using confidence judgments during the exam and if the participant changed his or her original answer in order to select a new answer, the participant placed an x over the original response and confidence judgment and circled the new response while writing a new confidence judgment.

Procedure

Once participants were recruited, each participant was randomly assigned to either one of two groups: an experimental (mindfulness) group and a control (nutrition education) group. Separate times were scheduled during the same day for each group to meet for their initial and only session to receive and review regimen materials. If an individual could not meet with his or her respective group, that individual met for individual instruction another time during the same day.

For each group, participants chose any seat in Albright College's Psychology Department's computer lab. Once seated, each group was told that the purpose of the study was to examine how their respective regimen affected metacognition. Participants completed informed consent forms and then anonymously completed the FMI. Materials were provided to each respective group and reviewed thoroughly for 10-15 minutes to ensure that each participant fully understood the content of their materials and could properly complete his or her journal. It was highly and repeatedly emphasized throughout the session: that participants ask any questions throughout the course of the experiment concerning journal completion, that participants complete journals accurately and honestly, and that participants do not discuss with other classmates the nature of the experiment or their materials and regimen. Additionally, participants were sent occasional reminders via e-mail to complete all journal materials throughout the experiment. During this initial session and throughout the experiment, very few individuals had questions or concerns.

Nine participants in the experimental group and nine participants in the control group completed their regimen. In the experimental group, the average time spent on mindful breathing by participants was 4.18 minutes ($M = 4.18$, $SD = 0.98$). The average time spent on wise-mind meditation was 3.91 minutes ($M = 3.91$, $SD = 0.94$). Participants generally performed only the minimum requirements for an entry in order to complete the journal. In the control group, all participants completed every food journal entry.

Two weeks after the initial meeting, participants had a regularly scheduled undergraduate college exam in their Research Methods psychology class. On the day of the exam, participants returned materials to the experimenters before the exam began. Additionally, demographic information was collected including class year, gender, ethnicity, and age.

Participants completed the exam using confidence judgments and revision tracking. All participants already had experience using confidence judgments and revision tracking from a prior exam in the same course with the same instructor. At the completion of the exam, participants completed another FMI. A debriefing statement was viewed by participants upon completion of the experiment in order to further inform participants on any additional details about the study. Any participant who did not correctly complete all journal entries did not have his or her data included in analysis.

Results

In order to ensure that one group was not significantly more mindful than the other before starting the regimen, we performed an independent samples t-test on the average pre-regimen FMI score for the experimental group ($M = 40.67$, $SD = 5.87$) and the average pre-regimen FMI score for the control group ($M = 36.22$, $SD = 6.70$) and found no significant difference between the scores, $t(16) = 1.496$, $p = 0.154$.

In order to determine regimen effect on mindfulness after regimen completion on average post-regimen FMI score between and within both groups, a 2 (Group) x 2 (FMI Score) mixed measures ANOVA was performed. There was no main effect for group, $F(1, 16) = 2.343$, $p = 0.145$. There was no main effect for the average post-regimen FMI score for the experimental group ($M = 40.78$, $SD = 6.38$) and control group ($M = 39.00$, $SD = 5.89$), $F(1, 16) = 0.466$, $p = 0.504$. There was no interaction between group and FMI score, $F(1, 16) = 0.397$, $p = 0.537$.

Each group's average pre- and post-regimen FMI scores were compared to the average score on the FMI (35). An independent t-test was performed and found that the experimental group's pre-regimen score ($M = 40.67$, $SD = 5.87$) was significantly higher than the average FMI score ($M = 35$), $t(16) = 2.894$, $p = 0.011$. Similarly, an independent t-test found that the

experimental group's post-regimen score ($M = 40.78$, $SD = 6.379$) was significantly higher than the average FMI score ($M = 35$), $t(16) = 2.717$, $p = 0.015$. In contrast, an independent t-test found that the control group's pre-regimen score ($M = 36.22$, $SD = 6.70$) was not significantly different than the average FMI score ($M = 35$), $t(16) = 0.547$, $p = 0.592$. An independent t-test also found that the control group's post-regimen score ($M = 39.00$, $SD = 5.895$) was not significantly different than the average FMI score ($M = 35$), $t(16) = 2.036$, $p = 0.059$.

All participants completed their exams using real-time confidence judgments on a 1 through 5 rating scale. Goodman-Kruskal gamma correlations were performed and found a significant relationship between students' 1 through 5 rated confidence judgments during the exam for each exam question and whether the individual correctly answered the question (actual performance), 0.41 ($SE = 0.05$). A dependent samples t-test showed that the correlation was significant, $t(17) = 7.12$, $p < 0.001$, see Figure 1.

A 2 (Group) x 3 (Performance) mixed measures ANOVA was performed to see the effects of regimen group on exam performance including actual performance, post-exam final grade rating out of 5, and post-exam final grade rating out of 100. There was no main effect for group, $F(1, 15) = 0.364$, $p = .555$. There was a main effect for performance, $F(2, 30) = 3.667$, $p = .038$, $\eta^2 = .196$. Pairwise comparison revealed that actual performance was significantly different from the post-exam final grade rating out of 100 ($SE = 0.041$, $p = 0.016$) and was not significantly different from the post-exam final grade rating out of 5 ($SE = 0.051$, $p = 0.172$). Additionally, post-exam final grade ratings were not significantly different from each other ($p = 0.233$), see Figure 2. There was not an interaction between group and performance, $F(2, 30) = 0.467$, $p = 0.632$.

A 2 (Group) x 2 (Revision) mixed measures ANOVA was performed to examine revision data including incorrect to correct response and correct to incorrect response revisions for both groups. There was no main effect for group, $F(1, 16) = 0.400, p = 0.536$. There was a main effect for type of revision, $F(1, 16) = 6.377, p = 0.022, \eta^2 = 0.285$. Participants made significantly more revisions from incorrect response to correct responses ($N = 20, M = 1.11, SD = 0.39$) than from correct responses to incorrect responses ($N = 7, M = 0.96, SD = 0.61$). There was not an interaction between group and type of revision, $F(1, 16) = 0.038, p = 0.848$.

Experiment 2 Method

Participants

The participants in this study were undergraduate students at Albright College in a Cognitive Psychology course. They were recruited at the beginning of a class via a sign-up sheet. Participation was completely voluntary and the recruitment methods and study was approved by the IRB. There were a total of 17 participants (15 women, $M = 21.06$ years, $SD = 0.87$ years, age range: 19-23) who completed the study. Further, 5.9% were Sophomores, 11.8% were Juniors, and 82.4% were Seniors. The reported ethnicity of the participants was: 70.6% White/Caucasian, 11.8% Black/African American, 11.8% Asian, and 5.9% Hispanic/Latino.

Materials

The materials used in this experiment included the same materials used by the experimental and control groups in Experiment 1 except that the Five Facet Mindfulness Questionnaire (FFMQ) was used instead of the FMI to measure mindfulness in this experiment. The FFMQ consists of 39 items and five subscales which measure five facets of mindfulness including observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience; the FFMQ is the only measure to examine five facets of

mindfulness (Baer et al, 2006). Previous research suggests that the FFMQ has reasonable psychometric properties in measuring five facets of mindfulness including those related to mindful meditation (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Baer et al, 2008). All measures of mindfulness capture only some aspects of mindfulness while omitting other aspects (Walach et al., 2006). Additionally, since participants in Experiment 1 revealed trending significant improvement in mindfulness post-regimen, the FFMQ was used in this experiment instead of the FMI short form as it may be a better indicator of how the regimens affect mindfulness.

Confidence judgments used in Experiment 1 were also used in this experiment.

Procedure

Procedure for this experiment was the same as the procedure for Experiment 1 with the exception of the FFMQ being used to measure mindfulness in both pre- and post-regimen experimental and control groups instead of the FMI.

Eight participants in the experimental group and eight participants in the control group completed their regimen. In the experimental group, the average time spent on mindful breathing by participants was 3.44 minutes ($M = 3.44$, $SD = 0.44$). The average time spent on wise-mind meditation was 3.36 minutes ($M = 3.36$, $SD = 0.36$). Participants generally performed only the minimum requirements for an entry in order to complete the journal. In the control group, all participants completed every food journal entry.

Results

In order to ensure that one group was not significantly more mindful than the other before starting the regimen, we performed an independent samples t-test on the average pre-regimen FFMQ score for the experimental group ($M = 3.09$, $SD = 0.92$) and the average pre-regimen

FFMQ score for the control group ($M = 2.95$, $SD = 0.48$) and found no significant difference between the scores, $t(14) = 0.769$, $p = 0.454$.

In order to determine regimen effect on mindfulness after regimen completion on average post-regimen FFMQ score between and within both groups, a 2 (Group) x 2 (FFMQ Score) mixed measures ANOVA was performed. There was no main effect for group, $F(1, 14) = 1.810$, $p = 0.200$. There was no main effect for the average post-regimen FMI score for the experimental group ($M = 3.32$, $SD = 0.36$) and control group ($M = 2.96$, $SD = 0.49$), $F(1, 14) = 3.080$, $p = 0.101$. There was no interaction between FFMQ score and group, $F(1, 14) = 2.709$, $p = 0.122$.

Each group's average pre- and post-regimen FFMQ scores were compared to the average score on the FFMQ (3). An independent t-test was performed and found that the experimental group's pre-regimen score ($M = 3.09$, $SD = 0.09$) was significantly higher than the average FFMQ score ($M = 3$), $t(14) = 2.605$, $p = 0.021$. Similarly, an independent t-test found that the experimental group's post-regimen score ($M = 3.32$, $SD = 0.36$) was significantly higher than the average FFMQ score ($M = 3$), $t(14) = 2.470$, $p = 0.027$. In contrast, an independent t-test found that the control group's pre-regimen score ($M = 2.95$, $SD = 0.48$) was not significantly different than the average FFMQ score ($M = 3$), $t(14) = -0.285$, $p = 0.779$. An independent t-test also found that the control group's post-regimen score ($M = 2.96$, $SD = 0.49$) was not significantly different than the average FFMQ score ($M = 3$), $t(14) = -0.238$, $p = 0.815$.

All participants completed their exams using real-time confidence judgments on a 1 through 5 rating scale. Goodman-Kruskal gamma correlations were performed and found a significant relationship between students' 1 through 5 rated confidence judgments during the exam for each exam question and whether the individual correctly answered the question (actual

performance), 0.486 ($SE = 0.04$). A dependent samples t-test showed that the correlation was significant, $t(16) = 10.62$, $p < 0.001$, see Figure 3.

A 2 (Group) x 3 (Performance) mixed measures ANOVA was performed to see the effects of regimen group on exam performance including actual performance, post-exam final grade rating out of 5, and post-exam final grade rating out of 100. There was no main effect for group, $F(1, 15) = 1.033$, $p = 0.325$. There was a main effect for performance, $F(2, 30) = 17.312$, $p = .000$, $\eta^2 = .536$. Pairwise comparison revealed that actual performance was significantly different from the post-exam final grade rating out of five ($SE = 0.036$, $p = 0.000$) and was not significantly different from post-exam final grade rating out of 100 ($SE = 0.023$, $p = 0.553$). Further, both post-exam final grade ratings were significantly different from one another ($p = 0.000$), see Figure 4. There was not an interaction between group and performance, $F(2, 30) = 4.361$, $p = 0.022$.

A 2 (Group) x 2 (Revision) mixed measures ANOVA was performed to examine revision data including incorrect to correct response and correct to incorrect response revisions for both groups. There was no main effect for group, $F(1, 15) = 3.342$, $p = 0.088$. There was no main effect for type of revision, $F(1, 15) = 2.697$, $p = 0.121$. There was not an interaction between group and type of revision, $F(1, 15) = 1.314$, $p = 0.270$.

Discussion

The results of both experiments indicate that the daily brief mindfulness regimen did not improve mindfulness. Interestingly enough, each experimental group was already significantly above average mindfulness both pre- and post-regimen. This revealed an inherently biased sample that greatly helped explain why the regimen may not have resulted in mindfulness improvement. Examination of the metacognition data showed that the experimental and control

groups in both experiments were able to use accurately confidence judgments during the exam, but were inconsistent with accurately using post-exam judgments compared to actual performance. In Experiment 1, participants made significantly more revisions from incorrect responses to correct responses which provided further evidence that participants showed adept metacognition and good in-the-moment monitoring.

Based on the results, it is difficult to determine how effective the brief daily mindfulness regimen used in this study could be. With both experiments having experimental samples that were already above average mindfulness, there is some justification based on prior literature (Schonert-Reichl et al., 2015; Black & Fernando, 2014; Zeidan et al., 2010) to believe that this study's brief mindfulness regimen may be effective in a sample with below average or average mindfulness. The results did confirm a nutrition education regimen as an effective control in mindfulness studies as shown in a prior study (Zeidan et al., 2010). Metacognition data revealed that confidence judgments are effective in allowing an individual to be self-reflective towards task-specific information (Dinsmore & Parkinson, 2013) and that revision tracking data from Experiment 1 is in line with memory and decision-making research (e.g., 51% of revisions were correct in Kruger et al. 2005; 69.3% in meta-analysis by Benjamin et al. 1984).

Numerous limitations may have affected the results of this study. One notable limitation included the participant sample. Participants were mainly Caucasian females around 20 years of age currently pursuing an undergraduate degree at college. Indicated by the results, the experimental group already possessed above average mindfulness thus limiting the potential effectiveness of the brief daily mindfulness regimen used in this study. Another limitation involved implementation of the mindfulness regimen. The regimen relied mostly on the trust and judgment of participants. Participants were expected to have known how to use the three

exercises effectively and reported accurately and honestly about their daily use of them. Without any method of detecting deceit in journal entries, participants could have easily filled in journals with the minimum requirements.

With little research examining a potential link between the two topics, this study provides a starting point for future research concerning mindfulness and metacognition. One major improvement to this study involves obtaining a larger, more representative sample. Knowing how mindfulness and metacognition may differ across numerous demographics such as age, sex, race, and education are essential in establishing a potential link between the two. Adjustments to the brief daily mindfulness regimen may also be needed. Increasing daily requiring from 3 to 5 minutes may have an effect on improving mindfulness while keeping the regimen as brief as possible. Furthermore, this study's mindfulness regimen should be tested in a clinical population that displays below average mindfulness or a population that displays average mindfulness. Other mindfulness scales besides the measures used in this study could also be used when examining mindfulness since all measures omit some aspect of mindfulness (Walach et al., 2006).

This study conducted two experiments that observed the effects of mindfulness on metacognition and exams and sought to reveal if a daily brief mindfulness regimen that was shorter in length than any effective mindfulness regimen in current literature could improve mindfulness. The mindfulness regimen did not improve mindfulness; however, both experimental groups already possessed above average mindfulness pre- and post-regimen which could have reduced the effect of the regimen. Concerning confidence judgments for all participants including those with above average and average mindfulness were consistently correlated with actual performance while post-exam judgments varied in comparison to each

other and actual performance. Students with above average or average mindfulness ability may benefit by having a better understanding of how they are performing in-the-moment. The results of this study help lead to the conclusion that mindfulness may be linked to metacognition that is in-the-moment.

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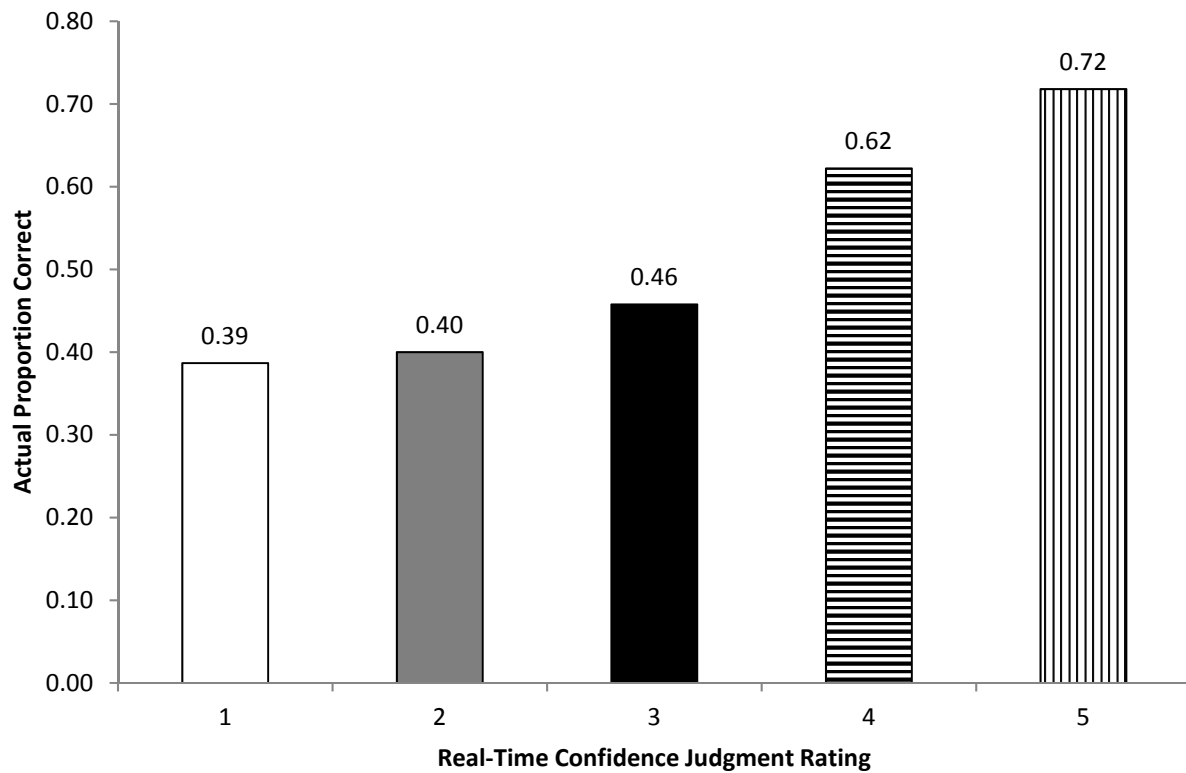


Figure 1. Actual proportion of correct responses for each real-time confidence judgment rating on the exam for all participants in Experiment 1. Real-time confidence ratings strongly correlated with actual performance.

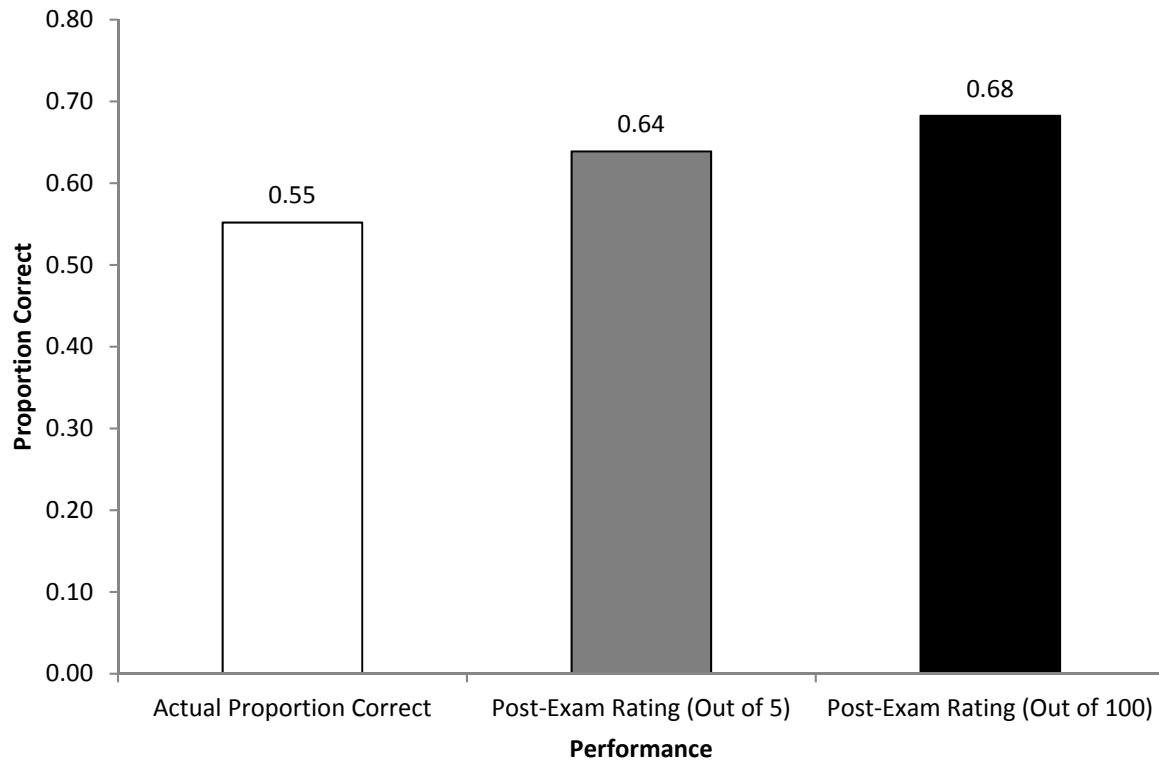


Figure 2. Proportion correct for responses that were actually correct and post-exam ratings for Experiment 1. Post-exam rating (out of 100) was significantly different than actual proportion correct, but not significantly different from post-exam rating (out of 5).

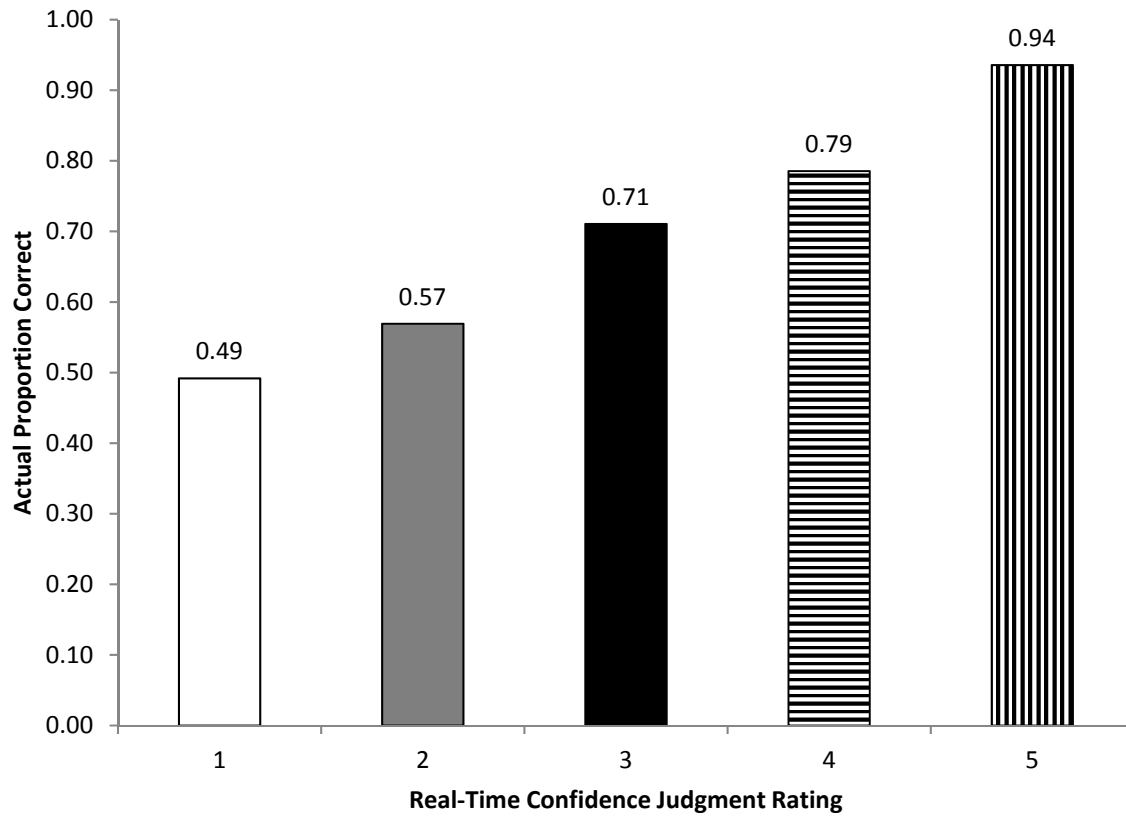


Figure 3. Actual proportion of correct responses for each real-time confidence judgment rating on the exam for all participants in Experiment 2. Real-time confidence ratings strongly correlated with actual performance.

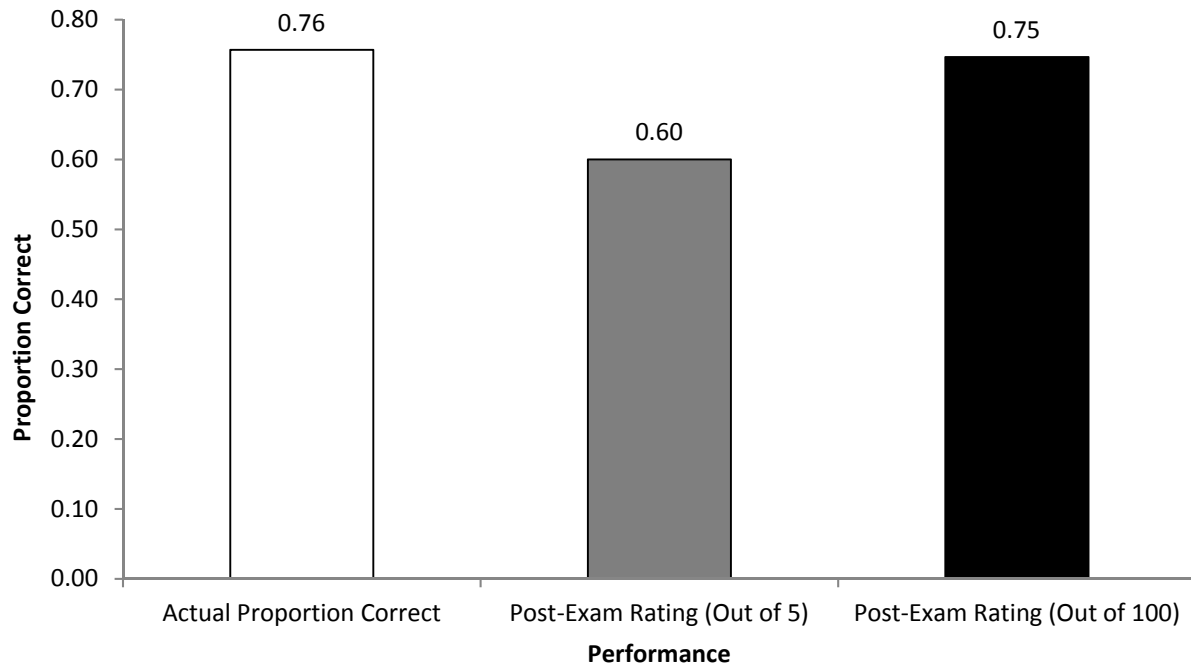


Figure 4. Proportion correct for responses that were actually correct and post-exam ratings for Experiment 2. Actual performance was significantly different from post-exam rating (out of 5). Additionally, post-exam rating (out of 5) and post-exam rating (out of 100) were significantly different.

Appendix A

Sample mindfulness regimen materials.

What is Mindfulness?

Mindfulness is the ability to be aware of your thoughts, emotions, physical sensations, and actions – in the present moment – without judging or criticizing yourself or your experience.

Studies have shown mindfulness skills to be effective at reducing the odds of having another major depressive episode, reducing symptoms of anxiety, reducing chronic pain, decreasing binge eating, increasing tolerance of distressing situations, increasing relaxation, and increasing skills to cope with difficult situations.

Daily Mindfulness Regimen

Your daily mindfulness regimen will consist of three skills:

1. Mindful breathing
2. Wise-mind meditation
3. Doing tasks mindfully

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Exercise: Mindful Breathing

This mindful breathing exercise will help you learn . . . to separate your thoughts from your emotions and physical sensations. Practice breathing mindfully for three to five minutes a day at a minimum. But if you want to practice it longer, do it for as long as you can.

Remember, to breathe mindfully, you need to focus on three parts of the experience: **First**, you must count your breaths. This will help focus your attention. **Second**, you need to focus on the physical experience of breathing. This is accomplished by observing the rising and falling of your chest and stomach as you inhale and exhale. And **third**, you need to be aware of any distracting thoughts that arise while you're breathing. Then you need to let the thoughts go. Letting go of the distracting thoughts will allow you to refocus your attention on your breathing and help you further calm yourself.

Instructions

To begin, find a comfortable place to sit in a room where you won't be disturbed for as long as you've set your timer. Turn off any distracting sounds. If you feel comfortable closing your eyes, do so to help you relax.

To begin, take a few slow, long breaths, and relax. Place one hand on your stomach. Now slowly breathe in through your nose and then slowly exhale through your mouth. Feel your stomach rise and fall as you breathe. Imagine your belly filling up with air like a balloon as you breathe in, and then feel it deflate as you breathe out. Feel the breath moving in across your nostrils, and then feel your breath blowing out across your lips. As you breathe, notice the sensations in your body. Feel your lungs fill up with air. Notice the weight of your body resting on whatever you're sitting on. With each breath, notice how your body feels more and more relaxed.

Now, as you continue to breathe, begin counting your breaths each time you exhale. You can count either silently to yourself or aloud. Count each exhalation until you reach "4" and then begin counting at "1" again. To begin, breathe in slowly through your nose, and then exhale slowly through your mouth. Count "1." Again, breathe in slowly through your nose and slowly out through your mouth. Count "2." Repeat, breathing in slowly through your nose, and then slowly exhale. Count "3." Last time – breathe in through your nose and out through your mouth. Count "4." Now begin counting at "1" again.

This time, though, as you continue to count, occasionally shift your focus to how you're breathing. Notice the rising and falling of your chest and stomach as you inhale and exhale. Again, feel the breath moving in through your nose and slowly out through your mouth. If you want to, place one hand on your stomach and feel your breath rise and fall. Continue counting as you take slow, long breaths. Feel your stomach expand like a balloon as you breathe in, and then feel it deflate as you breathe out. Continue to shift your focus back and forth between counting and the physical experience of breathing.

Now, lastly, being to notice any thoughts or other distractions that remove your focus from your breathing. These distractions might be memories, sounds, physical sensations, or emotions. When your mind begins to wander and you catch yourself thinking of something else, return your focus to counting your breath. Or return your focus to the physical sensation of breathing. Try not to criticize yourself for getting distracted. Just keep taking slow, long breaths into your belly, in and out. Imagine filling up your belly with air like a balloon. Feel it rising with each inhalation and falling with each exhalation. Keep counting each breath, and with each exhalation, feel your body relaxing, more and more deeply.

Keep breathing until your alarm goes off. Continue counting your breaths, noticing the physical sensation of your breathing and letting go of any distracting thoughts or other stimuli. Then, when your alarm goes off, slowly open your eyes and return your focus to the room.

Exercise: Wise-Mind Meditation

Wise mind is the ability to make healthy decisions about your life based on both your rational thoughts and emotions. Wise mind is a balance between feelings and rational thoughts.

Often, both intuition and wise mind are described as “feelings” that come from “the gut” or the stomach area. The exercise that follows will help you get more in touch with your gut feelings both physically and mentally. Again, practice the wise-mind meditation for at least three to five minutes a day, or longer if you want to.

Instructions

To begin, find a comfortable place to sit in a room where you won't be disturbed for as long as you've set your timer. Turn off any distracting sounds. If you feel comfortable closing your eyes, do so to help you relax.

Now locate the bottom of your sternum on your rib cage. You can do this by touching the bone at the center of your chest and then following it down toward your abdomen until the bone ends. Now place one hand on your abdomen between the bottom of your sternum and your belly button. This is the center of wise mind.

Take a few slow, long breaths and relax. Now slowly breathe in through your nose and then slowly exhale through your mouth. Feel your abdomen rise and fall as you breathe. Imagine your belly filling up with air like a balloon as you breathe in, and then feel it deflate as you breathe out. Feel the breath moving in across your nostrils and then feel your breath blowing out across your lips. As you breathe, notice any sensations in your body. Feel your lungs fill up with air. Notice the weight of your body as it rests on the seat in which you're sitting. With each breath, notice how your body feels, and allow your body to become more and more relaxed.

Nose, as you continue to breathe, let your attention focus on the spot underneath your hand. Let your attention focus on the center of wise mind. Continue to take slow, long breaths. If you have any distracting thoughts, just allow those thoughts to leave you without fighting them and without getting stuck on them. Continue to breathe and focus on the center of wise mind. Feel your hand resting on your stomach.

As you focus your attention on your center of wise mind, notice what appears. If you've had any troubling thoughts, problems, or decisions that you have to make in your life, think about them for a few seconds. Then ask your center of wise mind what you should do about these problems or decisions. Ask your inner intuitive self for guidance, and then notice what thoughts or solutions arise out of your center of wise mind. Don't judge whatever answers you receive. Just note them to yourself and keep breathing. Continue to focus your attention on your center of wise mind. If no thoughts or answers come to your questions, just continue breathing.

Now continue to notice your breath rising and falling. Keep breathing and returning your focus to the center of wise mind until the timer goes off. Then when you've finished, slowly open your eyes and return your focus to the room.

Doing Tasks Mindfully

And finally, your mindfulness regimen will include doing tasks mindfully. Doing tasks mindfully means doing all the things you normally do in your life, like talking, walking, eating, and washing, while also staying focused on your thoughts, emotions, physical sensations, and actions in the present moment, and without judging what is happening.

To do tasks mindfully, you need to do the following:

- Focus and shift your attention between your thoughts, feelings, physical sensations, and actions in order to be mindful of your present-moment experience.
- Let go of distracting thoughts and judgments by allowing them to float past without getting stuck on them so that you don't get distracted from what's happening in the present moment.
- Use radical acceptance [you observe situations in your life without judging or criticizing yourself or others] to remain nonjudgmental.
- Use wise mind to make healthy decisions about your life.
- Do what's effective in order to accomplish your goals.

Some people find it helpful to use the following memory device to remind themselves to do tasks mindfully:

"Mindfulness is like a FLAME."

Focus and shift your attention to be mindful of the present moment

Let go of distracting thoughts and judgments

Use radical Acceptance to remain nonjudgmental

Use wise Mind to make healthy decisions

Do what's Effective to accomplish your goals

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Mindfulness Journal

Use the following two pages every day to track your use of mindfulness.

Date	Mindful Breathing 3-5 minute min. (minutes spent)	Wise-mind Meditation 3-5 minute min. (minutes spent)	Doing Tasks Mindfully At least one task (Yes/No)

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Mindfulness Journal

Date	Mindful Breathing 3-5 minute min. (minutes spent)	Wise-mind Meditation 3-5 minute min. (minutes spent)	Doing Tasks Mindfully At least one task (Yes/No)

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Appendix B

Sample nutrition education materials

What is Nutrition Education?

According to the Society for Nutrition Education and Behavior, nutrition education is “any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being.”

The United States Department of Agriculture provides a large array of resources involving nutrition education. We will review some of those resources that may be applicable to you.

Nutrition Education Regimen

Your will involve keeping a food journal in which you write down what you had for each major meal (breakfast, lunch, and dinner).

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10
tipsNutrition
Education Series

choose MyPlate

10 tips to a great plate

**Making food choices for a healthy lifestyle can be as simple as using these 10 Tips.**

Use the ideas in this list to *balance your calories*, to choose foods to *eat more often*, and to cut back on foods to *eat less often*.

1 balance calories

Find out how many calories YOU need for a day as a first step in managing your weight. Go to www.ChooseMyPlate.gov to find your calorie level. Being physically active also helps you balance calories.

2 enjoy your food, but eat less

Take the time to fully enjoy your food as you eat it. Eating too fast or when your attention is elsewhere may lead to eating too many calories. Pay attention to hunger and fullness cues before, during, and after meals. Use them to recognize when to eat and when you've had enough.

**3** avoid oversized portions

Use a smaller plate, bowl, and glass. Portion out foods before you eat. When eating out, choose a smaller size option, share a dish, or take home part of your meal.

4 foods to eat more often

Eat more vegetables, fruits, whole grains, and fat-free or 1% milk and dairy products. These foods have the nutrients you need for health—including potassium, calcium, vitamin D, and fiber. Make them the basis for meals and snacks.

**5** make half your plate fruits and vegetables

Choose red, orange, and dark-green vegetables like tomatoes, sweet potatoes, and broccoli, along with other vegetables for your meals. Add fruit to meals as part of main or side dishes or as dessert.

6 switch to fat-free or low-fat (1%) milk

They have the same amount of calcium and other essential nutrients as whole milk, but fewer calories and less saturated fat.

**7** make half your grains whole grains

To eat more whole grains, substitute a whole-grain product for a refined product—such as eating whole-wheat bread instead of white bread or brown rice instead of white rice.

8 foods to eat less often

Cut back on foods high in solid fats, added sugars, and salt. They include cakes, cookies, ice cream, candies, sweetened drinks, pizza, and fatty meats like ribs, sausages, bacon, and hot dogs. Use these foods as occasional treats, not everyday foods.

9 compare sodium in foods

Use the Nutrition Facts label to choose lower sodium versions of foods like soup, bread, and frozen meals. Select canned foods labeled "low sodium," "reduced sodium," or "no salt added."

**10** drink water instead of sugary drinks

Cut calories by drinking water or unsweetened beverages. Soda, energy drinks, and sports drinks are a major source of added sugar, and calories, in American diets.

**10
tips****Nutrition
Education Series****stay fit on campus****10 tips** for college students to stay active

Between classes and studying, it can be difficult to find time to be active. Even if you only exercise for a short period of time, you will feel more energized and better about your health. Get up and move!

1 **walk or bike to class**

If you live close enough to campus, avoid driving or spending money on public transportation by walking or biking to class. If you drive to campus, park your car farther away from the building to lengthen your walk.

**2** **take the stairs**

As tempting as the elevators and escalators are, avoid them by using the stairs. This exercise is a great habit to start and will help tone your legs at the same time!

3 **join a sport**

Find a sport that interests you the most and one that will keep you active during your spare time. If you played a sport in high school such as basketball or soccer, you can continue playing in college!

4 **join an intramural team**

Another fun way to remain active is by joining an intramural team. Most universities offer classic sports such as basketball or baseball. But some campuses also offer activities such as ultimate frisbee and bowling.

5 **hit the gym!**

Visit your school's gym or recreation center. Go for a run on an indoor track or grab a basketball and shoot some hoops. Try to vary your routine each time to avoid boredom.

6 **be active with friends**

Go for a walk, hike, or bike ride with friends to catch up and have fun!

7 **take a fitness class**

Most universities offer a wide range of fitness classes for little or no charge. Find a schedule online and choose a class that you enjoy such as yoga, spinning, kickboxing, or aerobics.

8 **fitness for credit**

Elective classes such as swimming are a great way to remain active while also earning school credit. Not only are these classes fun, but they offer you a scheduled workout once or twice a week. Sign up with friends or try out a new class that strikes your interest.

9 **sign up for an adventure trip**

Many universities also offer adventure trips, such as hiking and whitewater rafting, to their students at a discounted price. Check out your university's recreation Web site for a list of upcoming events, and sign up for an active trip.

10 **balance calories!**

What you eat is just as important as how active you are. Keep track of how much you eat and your daily physical activity to help you to maintain a healthy weight. Use the free SuperTracker online application to track your fitness goals: www.SuperTracker.usda.gov.



United States
Department of
Agriculture

Go to www.ChooseMyPlate.gov
for more information.

DG TipSheet No. 28
April 2013
Center for Nutrition Policy and Promotion
USDA is an equal opportunity provider and employer.

10
tipsNutrition
Education Series

build a healthy meal

10 tips for healthy meals



A healthy meal starts with more vegetables and fruits and smaller portions of protein and grains. Think about how you can adjust the portions on your plate to get more of what you need without too many calories. And don't forget dairy—make it the beverage with your meal or add fat-free or low-fat dairy products to your plate.

1 make half your plate veggies and fruits

Vegetables and fruits are full of nutrients and may help to promote good health. Choose red, orange, and dark-green vegetables such as tomatoes, sweet potatoes, and broccoli.

2 add lean protein

Choose protein foods, such as lean beef and pork, or chicken, turkey, beans, or tofu. Twice a week, make seafood the protein on your plate.



3 include whole grains

Aim to make at least half your grains whole grains. Look for the words "100% whole grain" or "100% whole wheat" on the food label. Whole grains provide more nutrients, like fiber, than refined grains.

4 don't forget the dairy

Pair your meal with a cup of fat-free or low-fat milk. They provide the same amount of calcium and other essential nutrients as whole milk, but less fat and calories. Don't drink milk? Try soy milk (soy beverage) as your beverage or include fat-free or low-fat yogurt in your meal.



5 avoid extra fat

Using heavy gravies or sauces will add fat and calories to otherwise healthy choices. For example, steamed broccoli is great, but avoid topping it with cheese sauce. Try other options, like a sprinkling of low-fat parmesan cheese or a squeeze of lemon.

6 take your time

Savor your food. Eat slowly, enjoy the taste and textures, and pay attention to how you feel. Be mindful. Eating very quickly may cause you to eat too much.

7 use a smaller plate

Use a smaller plate at meals to help with portion control. That way you can finish your entire plate and feel satisfied without overeating.

8 take control of your food

Eat at home more often so you know exactly what you are eating. If you eat out, check and compare the nutrition information. Choose healthier options such as baked instead of fried.

9 try new foods

Keep it interesting by picking out new foods you've never tried before, like mango, lentils, or kale. You may find a new favorite! Trade fun and tasty recipes with friends or find them online.



10 satisfy your sweet tooth in a healthy way

Indulge in a naturally sweet dessert dish—fruit! Serve a fresh fruit cocktail or a fruit parfait made with yogurt. For a hot dessert, bake apples and top with cinnamon.

Food Journal

Use the following two pages every day to track your meals.

Date	Breakfast	Lunch	Dinner

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Food Journal

Date	Breakfast	Lunch	Dinner

Albright College Gingrich Library