

Running head: SHORT-TERM MENTAL HEALTH EFFECTS OF YOGA

The Short-Term Mental Health Effects of Yoga on College Students

by

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A thesis presented to the Honors College of Middle Tennessee State University in partial fulfillment of the requirements for graduation from the University Honors College

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SHORT-TERM MENTAL HEALTH EFFECTS OF YOGA

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Acknowledgements

I would like to thank all my family, friends, and supporters throughout my college career. You all have no idea how much you have helped me, and I wouldn't be here without each and every one of you. I wish you all the best and send my love.

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Abstract

Exercise is necessary for individuals in our society today, not only for its physical benefits but for its mental and emotional benefits as well. Yoga has been an up-and-coming exercise for people of all ages. Yoga has been shown to improve physical health in many ways for different age groups; there has also been correlation between yoga and improved mental health. In this research study, the relationship between yoga and the mental health of college students is examined. The participants underwent a working memory, attention-interference, and stress test before and after their semester of yoga. The purpose of this study is to test the short-term benefits of yoga on the mental health of college students after 1 month of practicing yoga.

Keywords: working memory, attention-interference, aerobic exercise

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The Short-Term Mental Health Effects of Yoga on College Students

There is vast evidence showing the health benefits of yoga for individuals of all ages. Examples include improvements in heart function, blood pressure, and kidney disease (Ross & Thomas, 2010). Yoga is known to alleviate the effects of anxiety, depression, and stress. On a cognitive level, studies have demonstrated that the practice of yoga improves mental health (Nangia & Malhotra, 2012). The purpose of this research study is to evaluate the relationship between yoga, working memory, attention-interference, and stress levels in college students after participating in yoga for one month, twice a week.

Literature Review

In light of our growing population from a body mass standpoint, there has been substantial research and evidence of the benefits of physical activity and exercise.

Health Benefits

ACSM guidelines state that everyone should be physically active for at least 150 min./week at moderate intensity or 75 min./week of vigorous intensity. If this continues for at least 3 months, an individual is considered to be physically active. There is an inverse relationship between physical activity and various health issues. For example, more physical activity and/or exercise is associated with a decrease in all-cause mortality, cardiovascular disease, metabolic diseases, and diabetes. As seen in Table 1.1, all the different health outcomes as related to exercise are listed (Riebe, Ehrman, Liguori, & Magal, 2018).

Along with this inverse relationship, ACSM explains there is a dose-response relationship between the risk of CVD and physical activity or physical fitness. When one

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is active, his/her risk of having a cardiovascular disease decreases continuously the more he/she is active. Furthermore, if an individual is physically fit, there is a dramatic drop in CVD risk (see figure 1.0, Riebe et. al., 2018).

Cognitive testing. One's mental capacity can be divided into multiple subsections. An individual's IQ is split up into Verbal and Performance IQ. Performance IQ is broken up into perceptual organization and processing speed index. The Verbal IQ is split into verbal comprehension and working memory index (Mireles, 2016). For this study, working memory—which deals with the amount of information one can hold in his/her mind like remembering a phone number—will be examined. Research studies have tried to measure the effects of small bouts of aerobic exercise on working memory. The participants with the least amount of working memory benefited most from exercise (Sibley & Beilock, 2007). According to a different study with long-term physical activity, cardiorespiratory fitness has been found to improve the cognitive functions in preadolescent children (Kamijo, Pontifex, O'Leary, Scudder, Wu, Castelli, & Hillman, 2011).

Besides working memory, attention-interference will be tested using the Stroop Test. The Stroop Effect website states that reading was automatic and a conflict arises when the color of the word and the name of the color do not match. This causes interference (The Stroop effect). MacLeod (1991) states the association between the two is involuntary, and when the idea and name contrast one another, it takes a conscious effort. However even with interference, improvements in attention can be made. Through continuous maintenance, the effects of interference can be diminished and retrieving information can be easier (Kane & Engle, 2002).

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Yoga. Yoga has been around for centuries and practiced by various peoples in numerous countries. It encompasses a multitude of different breathing techniques, meditation and inner reflection as well as the known physical movements and positions. When the general population wants to get in shape, most go running, jogging, cycling, bicycling, etc., which are all aerobic exercises. However, yoga can have the same benefits—such as reducing heart rate and blood pressure—and more than aerobic exercises. According to Ross and Thomas (2010), diabetes, multiple sclerosis, menopause, kidney disease, and schizophrenia symptoms have been alleviated through yoga. Another study found that short bouts of yoga had shorter reaction times and better accuracy than that after aerobic exercise (Gothe, Pontifex, Hillman, & McAuley, 2013).

The mental health benefits have been studied in teenagers and suggested that yoga could be used as a preventative method to retain their mental health (Khalsa, Hickey-Schultz, Cohen, Steiner, & Cope, 2012). Cognitive skills and mental health has also been researched by Nangia and Malhotra (2012) with yoga teachers that practiced for a long duration. In a different study, 17 college professors had been trained for 3 months, and there were significant improvements in intelligence, memory span, and attention (Anantharaman & Kabir, 1984).

The purpose of this study was to test the college students' working memory, attention-interference, and stress levels after one month of yoga classes. Participants engaged in 55 minute yoga sessions two days per week for 4 weeks.

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Methods

During the first week of school, the researcher attended two of Mrs. Craze's yoga classes to discuss the research study and ask for participants. The participants were obtained at this time due to not having started any practice of yoga. This allows the data not to be biased and show an accurate difference for the study. A brief description was given explaining the study:

I am working on my honors thesis which is contingent on the participants from yoga classes. This study is voluntary and will not affect your grade in the class. However, any participation will be greatly appreciated as I need this study in order to graduate. I am examining the effects of yoga on short-term cognitive function. If you are interested in participating in my study, please raise your hand, and we can begin.

Out of both classes, 17 participants volunteered. The participants were then walked to the AMG computer lab in order to fill paperwork and perform the pre-test. Before starting the test, paperwork including the informed consent, PAR-Q, and demographic data sheet was explained and filled out. Each participant was given an ID number that was only known by that individual and the researcher. On the demographic data sheet, they were asked to fill out: age, ethnicity, gender, year in college, physically active, and stress level based off of a chart given. 1 being Calm, and 5 being Agitated.

Next, the participants completed the first cognitive test called the Working Memory Test. This test had various symbols appear subsequently and had the participant remember these symbols. After the last symbol was shown for that set, they were given choices as to which symbols were shown out of 8-10 total symbols. Not all the symbols

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that appeared on the screen were in the choices, and some choices were not shown at all. The test went through multiple sets of symbols before giving each participant their score which they recorded.

The second test was called the Stroop's Test. This test demonstrated a word that matched or did not match with the color shown. For example, the computer would show the word red, but the word itself was in blue. The participants must select the correct color as fast as possible. The only options of colors and words for this test were: red, blue, orange, purple, and green. At the end of this test, two median times were given-the median for words that matched the color and the median for words that did not match the color.

All values were recorded and turned into the researcher for storing the information. This completed the pre-test. After this stage in the study, the researcher waited one month while the classes performed yoga as designed by Mrs. Craze for her beginner classes. One month later, the participants that completed the pre-test were asked to complete the post-test. They were reminded that this study was voluntary, and there would be no consequences for wishing not to complete the study on their end. Due to this fact, only 4 participants out of the 17 completed the post-test. The post-test was compiled of the same tests: stress level, Working Memory Test, and Stroop's Test. All values were recorded by participants, and they were told they could contact the researcher for further statistics regarding the group as a whole later. With this study, there was no need for debriefing. This completed the data collection for the research study.

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Results.

Pretest analyses of the 17 participants that started the study demonstrated a significant difference in performance from those who met ACSM physically activity standards versus those who did not, $F(4,13) = 4.668, p = .015$. Post-hoc independent sample t -tests revealed that the Stress Level Test was significantly high in students that did not meet Physical Activity standards compared to students that did meet Physical Activity standards, $t(16) = 3.08, p = .007$.

Descriptive statistics are found in Table 2.1. Each individual's scores for all the tests are displayed in Table 2.2. The means for each test improved from pretest to posttest as seen in Table 2.3. Based off of this information with a sample size of 4, according to Wilks' Lambda, the Working Memory, Stroop's Matched and Unmatched results did not see a statistically significant difference from the pre-test to post-test, $F(3,1)=8.05, p=.25$.

Table 2.1

Descriptive Variables of Participants

ID	Age	Sex	Ethnicity	Year	Physically Active
1	21	M	African American	Senior	No
2	22	F	Caucasian	Senior	No
3	20	F	African American	Senior	No
4	18	F	Caucasian	Freshman	Yes

Note: Physically Active is characterized as exercising at moderate intensity for 30 min. 3 times a week for 3 months.

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Table 2.2

Individual Results for Pre-and Post-test Stress, Working Memory, and Stroop's Test

ID	Pretest				Posttest			
	Stress	WM	Stroop's		Stress	WM	Stroop's	
			Matched	Unmatched			Matched	Unmatched
1	1	32	1003	1490	2	32	894	1268
2	4	51	841	1131	2	53	759	1006
3	4	43	941	1360	2	47	1060	1215
4	1	33	1302	1430	1	58	916	1189

Note: Stroop's test results are in milliseconds. The stress level results are based on a scale found in Appendix C

Table 2.3

Mean and Standard Deviation for Pre-and Post-test on the Short-term Mental Health Effects of Yoga on College Students

	Mean	Standard Deviation
Pre-Working Memory	39.75	8.995
Post-Working Memory	47.50	11.269
Pre-Stroops-Matched	1021.75	198.396
Post-Stroops-Matched	907.25	123.238
Pre-Stroops-Unmatched	1352.75	157.089
Post-Stroops-Unmatched	1169.50	113.849

Table 2.4

Wilks' Lambda Multivariate Test for Physical Activity

Value	F	Hypothesis		p	η_p^2
		df	Error df		
.410	4.668	4.000	13.000	.015	.590

Note: computed using alpha = .05

Table 2.5

Post-Hoc Independent Samples T-Test for Equality of Means for Stress Level Pretest

	t	df	p	Mean Difference	Std. Error Difference
Equal variances assumed	3.08	16	.007	1.519	.493

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Discussion

As stated earlier, a decrease in health issues can be seen as a result of an increase in physical activity up to a point (Riebe et al., 2018). One study looked at the effect of long-term physical activity for young children and found cardiorespiratory fitness improved their cognitive function (Kamijo et al., 2011). For this study, yoga was used as the form of exercise due to all the benefits researched prior. Through yoga, symptoms of menopause, diabetes, kidney disease, and more were alleviated by practicing this type of exercise (Ross & Thomas, 2010). In another study, accuracy and reaction times improved greater due to short bouts of yoga instead of aerobic exercise (Gothe et al., 2013). The previous studies point to yoga having the same if not better benefits than aerobic exercise. Having this in mind, it was the best choice to use yoga as the exercise prescription for the participants in this study. All of the issues above were physiological whereas this study focuses on mental benefits. This study wanted to examine the short-term, cognitive effects of yoga after college students practiced for one month.

The working memory was the easiest section of an individual's IQ to test under the time restraints and receiving accurate data without participant or researcher error. Working memory has been used in past studies to show the effects of aerobic exercise on participants. The individuals with the least working memory showed the greatest improvement (Sibley & Beilock, 2007). The other cognitive test administered was the Stroop's test. According to the Stroop Effect, when the color of the word does not match up with the actual word, interference occurs (The Stroop effect). This association can be such an automatic response that our brains have to consciously make a decision. This

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conscious effort can be improved and trained over time, and information can be recovered faster and easier (MacLeod, 1991).

With the research found on these two tests, the tests were chosen to see the cognitive effects of yoga on the college aged individuals. The studies performed prior have not focused on the young adult or college-aged population. Studies have been performed to observe the mental health effects of yoga on teenagers (Khalsa et al., 2012). Another study focused on college professors and the effects of yoga after 3 months. The study showed significant improvements in intelligence and memory for the participants (Anantharaman & Kabir, 1984). This research study branched off of these to see what effects or benefits could appear for healthy college-aged individuals.

Based on the statistics, there was no significant difference between the pre-and post-test results for Working Memory, Stroop's Test Matched and Unmatched, $F(3,1) = 8.05, p = .25$. With the sample size being extremely small, a statistically significant difference was not found; however, the mean for each test showed improvement. With this information and a greater sample size, a significant difference could be a possibility for the future.

Improvements. If any adjustments could be made to this study, the obvious change would be a larger sample size. Due to only 17 participants completing the pretest, only those individuals could be used for the posttest. With college students, the Fall and Spring semester is extremely busy, so there might be more participation during the Summer semester. Also, with more of Mrs. Craze's classes involved and completing the pretest, the population to pull from for the posttest will increase. With a greater sample size, the

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standard deviations should decrease as well as the p-value. More statistics will be available to analyze by comparing the age, gender, ethnicity, etc.

One factor that caused low participation was the opportunities given to the students. If they did not participate in the study, there was no consequence, and they were allowed to leave class early. If they did participate, no extra credit or monetary reward was given. The participants, also, had to walk to a different building to use the computer lab since there were no computers to use at their classroom location. These factors contributed to students not participating, and solutions should be considered for future research.

The last revision that would be valuable for the future is the Stress Test. The Stress Test used had descriptive words accompanied by their numeric value. This test showed a decrease in stress for 3 out of 4 of the participants. By labeling the test on a least to most stressed scale, more accurate results would be received. With more clear descriptors and more participants, a more significant difference-either statistically or realistically- could be found for stress.

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References

- Anantharaman, R. N., & Kabir, R. (1984). A study of Yoga. *Journal of Psychological Researches*, 28(2), 97-101.
- Gothe, N., Pontifex, M. B., Hillman, C., & McAuley, E. (2013). The acute effects of yoga on executive function. *Journal of physical activity and health*, 10(4), 488-495.
- Kamijo, K., Pontifex, M. B., O'Leary, K. C., Scudder, M. R., Wu, C.-T., Castelli, D. M. & Hillman, C. H. (2011). The effects of an afterschool physical activity program on working memory in preadolescent children. *Developmental Science*, 14(5), 1046-1058. <http://doi.org/10.1111/j.1467-7687.2011.01054.x>
- Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin & Review*, 9(4), 637-671. doi: <https://doi.org/10.3758/BF03196323>
- Khalsa, S. S., Hickey-Schultz, L., Cohen, D., Steiner, N., & Cope, S. (2012). Evaluation of the Mental Health Benefits of Yoga in a Secondary School: A Preliminary Randomized Controlled Trial. *The Journal of Behavioral Health Services & Research*, 39 (1), 80-90. Retrieved January 20, 2018
- MacLeod, C. M. (1991). Half a century of research on the Stroop effect: an integrative review. *Psychological bulletin*, 109(2), 163.
- Mireles, F. (2016, June 12). *Overview of Wechsler Intelligence Test* [Video file]. Retrieved from <https://www.youtube.com/watch?v=mwT4BReli5U>
- Nangia, D., & Malhotra, R. (2012). Yoga, cognition and mental health. *Journal of the Indian Academy of Applied Psychology*, 38.2 (2012): 262-269.

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Open Cognition Lab. (n.d.). Retrieved February 11, 2018, from

<http://opencoglab.org/memtest1/>

Riebe, D., Ehrman, J. K., Liguori, G., & Magal, M. (Eds.). (2018). *ACSM's Guidelines for Exercise Testing and Prescription* (10th ed.). Philadelphia, PA: Wolters Kluwer.

Ross, A., & Thomas, S. (2010). The health benefits of yoga and exercise: a review of comparison studies [Abstract]. *The journal of alternative and complementary medicine*, 16(1), 3-12.

Sibley, B. A., & Beilock, S. L. (2007). Exercise and Working Memory: An Individual Differences Investigation [Abstract]. *Journal of Sport and Exercise Psychology*, 29(6), 783-791. Retrieved January 31, 2018

The Stroop effect – The Stroop effect – Is your mind playing tricks on you? (n.d.).

Retrieved February 10, 2018, from

https://d21.deakin.edu.au/d21/eP/presentations/presentation_preview_popup.d21?presId=67655

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Appendix A

Tables

Table 1.1

Evidence for Dose-Response Relationship between Physical Activity and Health Outcome

Variable	Evidence for Inverse Dose-Response Relationship	Strength of Evidence ^a
All-cause mortality	Yes	Strong
Cardiorespiratory health	Yes	Strong
Metabolic health	Yes	Moderate
Energy balance:		
Weight maintenance	Insufficient data	Weak
Weight loss	Yes	Strong
Weight maintenance following weight loss	Yes	Moderate
Abdominal obesity	Yes	Moderate
Musculoskeletal health:		
Bone	Yes	Moderate
Joint	Yes	Strong
Muscular	Yes	Strong
Functional health	Yes	Moderate
Colon and breast cancers	Yes	Moderate
Mental health:		
Depression and distress	Yes	Moderate
Well-being:		
Anxiety, cognitive health, and sleep	Insufficient data	Weak

^aStrength of the evidence was classified as follows:

“Strong” – Strong, consistent across studies and populations

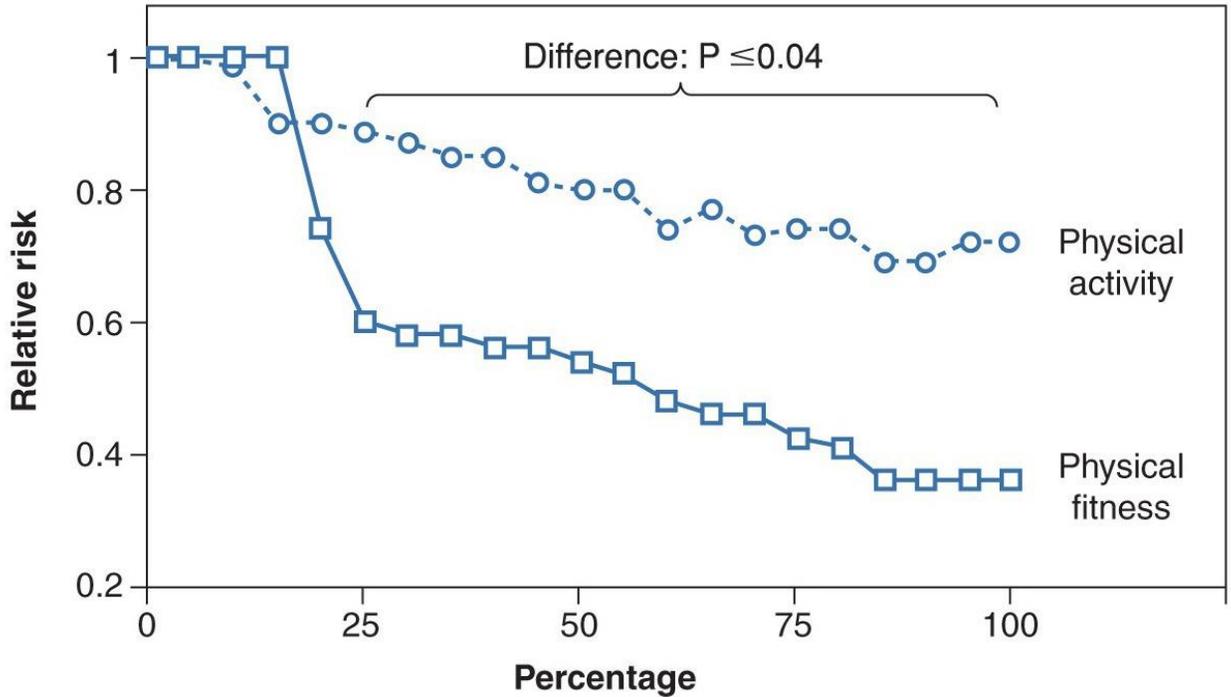
“Moderate” – Moderate or reasonable, reasonably consistent

“Weak” – Weak or limited, inconsistent across studies and populations

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Appendix B

Figure 1.0



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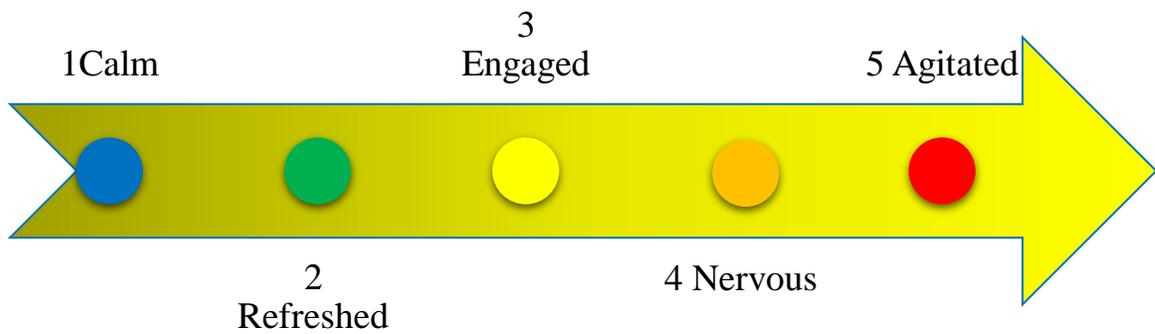
Note: Estimated dose-response curve for the relative risk of atherosclerotic cardiovascular disease by sample percentages of fitness and physical activity. Studies weighted by individual-years of experience. Used with permission from (104).

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Appendix C

Stress Scale Test

Circle the number that best describes your stress level right now.



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Appendix D

Working Memory Symbols Test

Symbols shown below one at a time for 1 second. Symbols will vary.



Choose all the symbols shown previously.



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Appendix E

Stroop Test

Press the correct letter for the color font of the word below. Words and colors will change continuously.

RED

Press these keys based on the colour the word is printed in...

R: RED, G: GREEN, B: BLUE, O: ORANGE, P: PURPLE

1/85 done

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129



IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Friday, July 27, 2018

Principal Investigator **Whitney Ingle (Student)**
 Faculty Advisor John Coons
 Co-Investigators NONE
 Investigator Email(s) *wmr2d@mtmail.mtsu.edu; john.coons@mtsu.edu*
 Department Health and Human Performances

Protocol Title ***The short-term mental health effects of yoga on college students***
 Protocol ID **18-2277**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category (7) *Research on individual or group characteristics or behavior*. A summary of the IRB action and other particulars in regard to this protocol application is tabulated below:

IRB Action	APPROVED for one year from the date of this notification
Date of expiration	7/31/2019
Sample Size	60 (SIXTY)
Participant Pool	General Adults (18 years or older) - MTSU Students
Exceptions	Jennifer Craze - MTSU Yoga Instructor - is allowed to access research records
Restrictions	1. Mandatory active (signed) informed consent; the PI must provide each participant with a copy of the informed consent signed by the PI. 2. Implementation of the proposed inclusion/exclusion criteria is mandatory. 3. No identifiable data is permitted.
Comments	NONE

This protocol can be continued for up to THREE years (**7/31/2021**) by obtaining a continuation approval prior to **7/31/2019**. Refer to the following schedule to plan your annual project reports and be aware that you may not receive a separate reminder to complete your continuing reviews. Failure in obtaining an approval for continuation will automatically result in cancellation of this protocol. Moreover, the completion of this study **MUST** be notified to the Office of Compliance by filing a final report in order to close-out the protocol.

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Institutional Review Board

Office of Compliance

Middle Tennessee State University

Continuing Review Schedule:

Reporting Period	Requisition Deadline	IRB Comments
First year report	6/30/2019	NOT COMPLETED
Second year report	6/30/2020	NOT COMPLETED
Final report	6/30/2021	NOT COMPLETED

Post-approval Protocol Amendments:

Only two procedural amendment requests will be entertained per year in addition to changes allowed during continuing review. This amendment restriction does not apply to minor changes such as language usage and addition/removal of research personnel.

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

The investigator(s) indicated in this notification should read and abide by all of the post-approval conditions imposed with this approval. [Refer to the post-approval guidelines posted in the MTSU IRB's website.](#) Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident. Amendments to this protocol must be approved by the IRB. Inclusion of new researchers must also be approved by the Office of Compliance before they begin to work on the project.

All of the research-related records, which include signed consent forms, investigator information and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

[Click here](#) for a detailed list of the post-approval responsibilities.
More information on expedited procedures can be found [here](#).