<u>The Effect of High-Stakes Rewards on Performance in High-Stress Situations</u>

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May 6, 2016

Key Words: Blood Pressure, Cognitive Recall, Comprehension, Heart Rate, Incentive, Performance, Recall, Respiration, Stress

Abstract

Studies have shown that when individuals are motivated - either externally or internally - to complete a task, their respective performance increases relative to the non-reward groups. However, few studies have looked at the effect of introducing rewards while participants are under stressful stimuli and the effect that this may potentially have on performance and physiological parameters. To study this, we used two different groups of participants, one that was offered a high-quality reward and the other a control with no knowledge of any reward. Participants were put under a four-and-a-half-minute time restraint to read a passage and a subsequent 90-second time constraint to answer seventeen multiple choice questions about the passage. We hypothesized that the introduction of the high-quality reward would negatively affect performance which would be seen physiologically by an increased heart rate, blood pressure, and respiration rate after the introduction of the high-quality reward. This in turn would negatively alter their overall exam performance. The results displayed a statistically significant increase in heart rate between the reward and nonreward groups; however, a significant increase was not observed in mean arterial pressure or respiration rates. The average test scores between the reward and non-reward group also did not demonstrate a statistical significance. Our results demonstrate that stress physiological parameters may increase from the introduction of high rewards and overall this may increase test performance. However, further studies are needed to test more participants and narrow potential external variables that may affect these results.

Introduction

Rewards are commonly employed throughout many aspects of today's society, from the workforce to the classroom and seemingly everywhere in between, in an attempt to increase performance. The logic behind this notion is simple: rewards motivate individuals to increase performance and thus success in their environments (MSG, 2016). Recent studies have demonstrated that with the right kinds of rewards, students' achievement can improve by as much as six months beyond what would normally be expected (Harms, 2016). In a 2003 study, sixty undergraduate students were faced with the task of solving a factorial puzzle. These students were divided into two groups: one that received a stipend for every correct answer and one that did not. The authors found that the group that was presented with the reward spent more time on the puzzle in order to get it correct. The correctness of the puzzle, however, did not differ between groups (Pierce, 2016). This concept has also been studied in terms of the level of reward offered. In a 1965 study, kindergarten students were separated into four groups that varied by the level of reward offered. They were presented with between one and five M&Ms, depending on their group, and were asked to complete the task before them. The researchers again found that those students who were given the smaller reward completed the task more quickly than those given the larger reward (Brunning, 2016). When a person is motivated - either externally or internally - to complete a task, his or her time taken to complete the task increases, along with his or her respective performance. However, none of these studies look at the effect of introducing a reward with time constraints for both experimental groups. By introducing a time constraint alongside the completion of a specific task, we hope to determine if the task performance and physiological measurements differ between groups of varying reward levels as well as from the results of published literature.

One can study the effects of stress and anxiety during performance situations by observing respiration rate, heart rate, and blood pressure. For example, researchers in a 1980 study examined what effects psychological stress had on respiration rate and heart rate. The measurements were taken as participants moved through phases, each designed to increase the level of anxiety. Their results demonstrated that there was a statistically significant increase in heart rate from one phase to the next, even if the participants admitted they felt no increase in anxiety. Additionally, the researchers found a statistically significant increase in respiration rate in all but one of the phases (Suess, 1980). Researchers in a 1980 review described that stress in the workplace, as well as stress due to a number of other conditions, can cause an increase in blood pressure that may eventually lead to hypertension (Kulkarni, 1998). Therefore, in an attempt to build on prior research and experimentation, we will be using heart rate, blood pressure, and respiration rate as indicators of stress that are caused by the introduction of a high-quality reward. We hypothesize that the introduction of the high-quality reward under given time constraints will negatively affect performance due to an increase in anxiety as indicated by an increase in heart rate, blood pressure, and respiration rate.

Materials and Methods

Participants

Volunteer participants were sampled based on their enrollment in Physiology 435 in the Spring of 2016. Participants' ages ranged from twenty-one to twenty-four. Twelve participants were randomly assigned to a control group that did not receive information about the reward and thirteen participants were randomly assigned to an experimental group that was informed of the high-quality reward. After signing the consent form, participants were assigned an identification number and letter in order to ensure confidentiality depending on which group they were randomly assigned to. The control group was arbitrarily labeled as group one and the experimental group as group two.

Equipment

Physiological measurements were collected using a pulse oximeter and carbon dioxide detector, an automatic blood pressure monitor, and a respiration belt. A Nonin Medical Inc. Pulse Oximeter and Carbon Dioxide Detector (Model 9843, SN# 118102926, Plymouth, MN) was used to measure the heart rate of each participant in beats per minute (BPM). An Omron Healthcare Inc. Automatic Blood Pressure Monitor (Model BP791IT, SN# 20141004280LG, Lake Forest, IL) was used to measure the participants' blood pressure in mmHg. Respiration rate in breaths per minute was measured using a BIOPAC BSL Respiratory Effort Xdcr belt (Model SS5LB, SN#1602007568, Goleta CA) connected to the Biopac Student Labs 4.0 software.

Procedure

After signing the consent form, the participants were told what their participation would involve and what measurements would be taken. Participants were given six minutes to read a passage and complete an exam based on the reading. The first four and a half minutes were devoted to reading the passage, and the exam was then given during the last minute and a half of the study. Participants were allowed to keep the passage with them while they were taking the exam. Heart rate was recorded using the pulse oximeter and recorded before the experiment began and at every minute for the duration of the experiment. Blood pressure was recorded three times total - before the experiment began, at the four and a half minute mark, and at the end of the exam. Respiration rate was taken constantly throughout the experiment, and breaths per minute were recorded (**Figure 12, Figure 13**). The measurement for breaths per minute was extrapolated by counting the number of peaks within a ten second interval within the time parameter and multiplied by six. A video was played before the exam was given at the four and a half minute mark for the group that received information about the high-quality reward; those who did not see the video were immediately handed the exam. In the video, the reward was introduced by Dr. Andrew Lokuta, one of the professors for Physiology 435. He explained to the participants that a reward of $50 would be given to the top three scores on the exam portion of the experiment. After the video was shown, blood pressure and heart rate were recorded, and the exam was presented to the participants. Blood pressure and heart rate were also recorded immediately after the exam was given to to the control group, which did not receive information about the reward. At the end of the six minute time limit, the exam was collected and the participants completed a survey based on what group they were randomly assigned to. The results from their exam were tabulated and analyzed. The procedures for both the no reward group (**Figure 1**) and high-quality reward group (**Figure 2**) are summarized below.

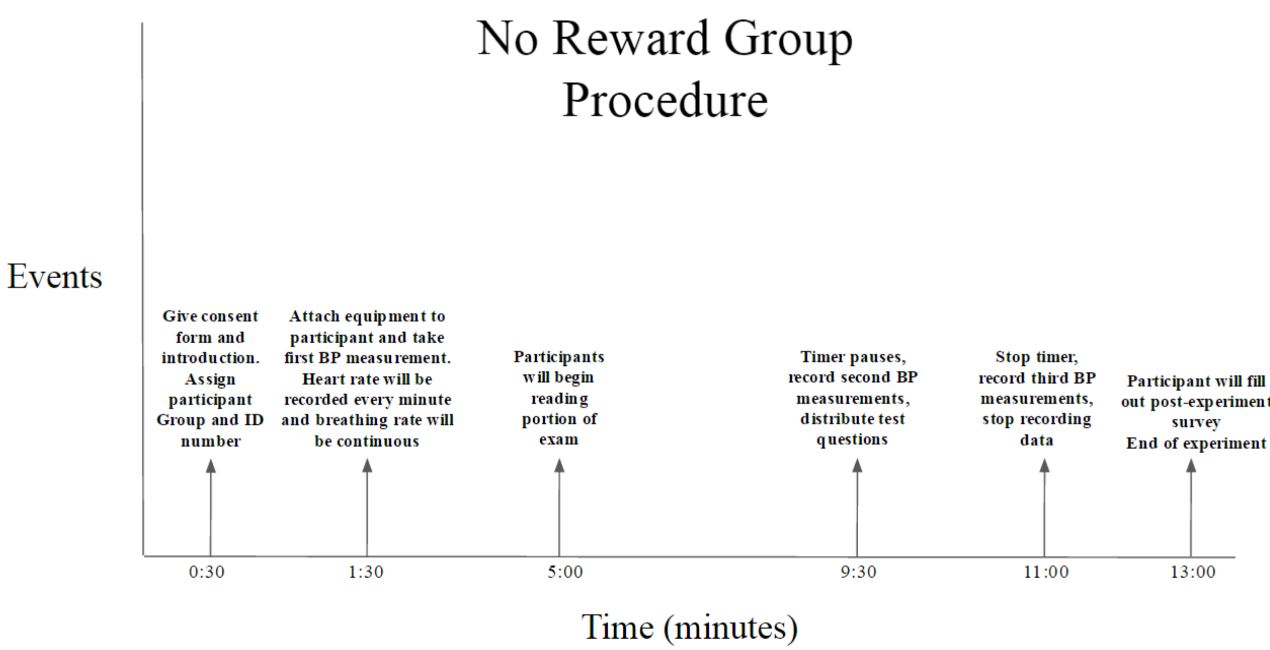

Figure 1. The experimental procedure for the group that did not receive the incentive.

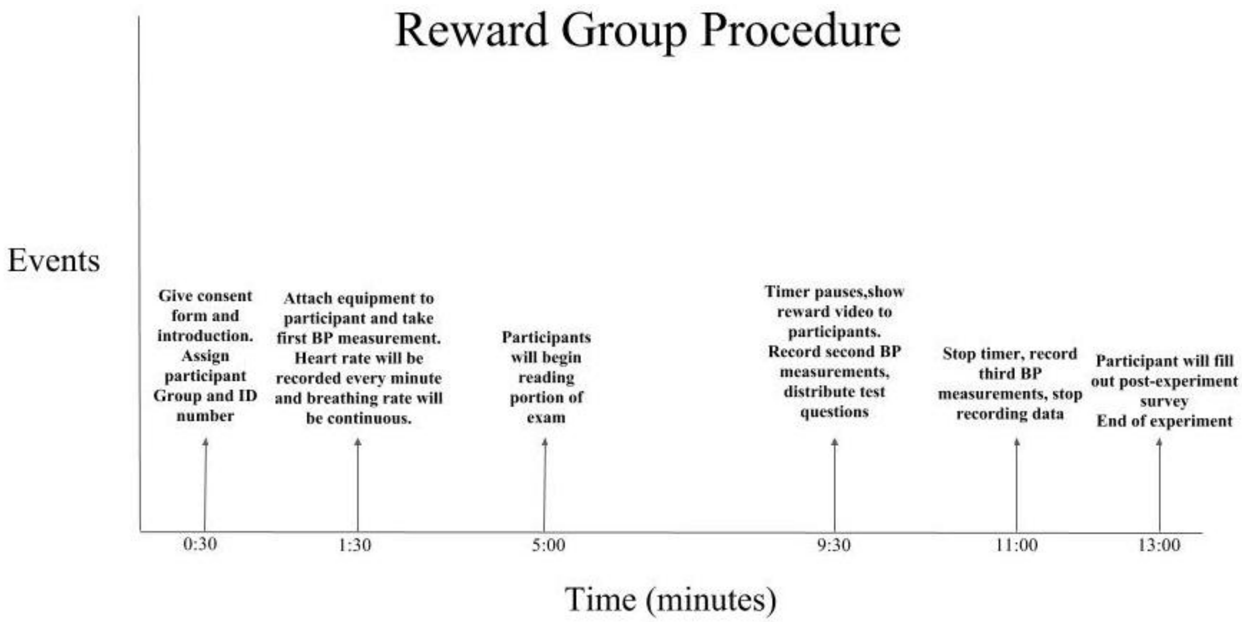

Figure 2. The experimental procedure for the group that received the incentive.

Pilot Study

The pilot study was conducted with a participant in the no reward group. The goal of the pilot study was to correct experimental design before officially collecting data from participants. After this first pilot study, we found that the participant had a surplus of time to complete both the reading and the exam portion of the experiment. Due to this observation, the amount of time that the participants were allocated to read and answer the exam portion was shortened from nine minutes down to six minutes total - four and a half minutes of reading and one and a half minutes to answer the exam questions. This ensured that the participants experienced the effects of pressure through the given time constraints. Also, the decrease in time made it impossible for the individuals to check their work after completing the exam.

Positive Control

A positive control was performed, in order to demonstrate that the equipment was fully functioning and that changes in heart rate (**Figure 3**), blood pressure (**Figure 4**), and respiration rate (**Figure 5**) could be observed. Measurements were taken initially and after the presentation of a fear stimulus through a video. The results of the positive control are in the graphs shown below.

Results

All of the data reported here is being presented as the mean ± SE.

Heart Rate and Experimental Group

Each individual's heart rate data points in the experimental group, measured by the pulse oximeter in beats per minute (BPM), collected before the announcement of the reward were averaged. The individual's data points collected after the announcement of the reward were also averaged. The same was done for the control group. The resulting before and after averages were then subtracted from one another to calculate the change in heart rate for each individual. The average change for each individual was compiled to get the average group change, and compared against one another. For the control group, the average change in heart rate was 5.33 ± 1.39 BPM. The average change in heart rate for the experimental group was 13.02 ± 2.16 BPM (**Figure 6**). A paired t-test was performed using the two values and was determined that there was a statistically significant difference between the two ($p=0.0199$).

Blood Pressure and Experimental Group

Blood pressure measurements were recorded before the experiment started, after the announcement of the reward or presentation of the exam, and post-exam. Both systolic pressure (SP) and diastolic pressure (DP) measurements were recorded. Measurements that were recorded after the presentation of the reward or exam were averaged to get a single, post-presentation value. The mean arterial pressure (MAP) was calculated using the formula, MAP=DP+(⅓)(SP-DP), and values were recorded for both before and after the presentation. The difference of these two values was recorded for each groups and compared. The average change in MAP for the group that did not receive the reward was -2.78 ± 4.01 mmHg, and the average change in MAP for the group that received knowledge of the reward was -3.31 ± 4.12 mmHg (**Figure 7**). A paired t-test was again conducted on the two values, and there was no statistically significant difference (p=0.8745).

Respiration Rate and Experimental Group

Respiration rate was taken constantly throughout the experiment, and rates were recorded both before and after presenting the reward (**Figure 14)**. The rates before and after the presentation were compiled for each participant, and they were subtracted from one another to get the change in respiration rate for each individual. The average rates of change for each group were then calculated and compared against one another. The average change in respiration rate for the experimental group was 3.33 ± 0.48 breaths per minute, and the average change in respiration rate for the control group was 5.38 ± 1.20 breaths per minute (**Figure 8**). The values were compared using a paired t-test, and there was not a statistically significant difference (p=0.0760).

Performance and Experimental Group

After each participant completed the exam, their score was calculated out of a total of 17 possible questions and recorded. The average score for each group was calculated by taking the mean of all scores in that group. The average score for the control group was 9.58 ± 1.18 points out of 17. The average score for the experimental group was 11.31 ± 1.00 points out of 17

(**Figure 9**). A paired t-test was conducted on the two values, and no statistically significant difference was detected (p=0.2767).

Change in Physiological Variables and Performance

The change in heart rate and the performance for each individual were plotted to determine if there was a correlation between change in heart rate and performance (**Figure 10**). A linear regression was performed on both individual sets of data. The regression for the control group had an R^2 value of 0.135. The regression for the experimental reward group had an R^2 value of 0.01997. The change in MAP was also plotted against performance for each individual to determine a correlation between the two variables (**Figure 11**). A linear regression was also performed on both individual sets of data. The regression for the no reward group had an R^2 value of 0.04492. The regression for the reward group had an R^2 value of 0.58195.

Discussion

We hypothesized that the introduction of a high-quality reward would negatively affect the performance of those participants who received the reward, which would be displayed physiologically by an elevated heart rate, blood pressure, and respiration rate post-reward. Consequently, we said this would decrease their overall exam performance. After carefully analyzing the data, we have found that parts of our original hypothesis can be supported and other parts require further experimentation to provide a clearer understanding.

The most significant sources of data came from the average change in heart rate between the two groups before and after the reward was presented. Although both groups showed an increase in heart rate, there was a statistically significant difference in the amount of change between both groups. We believe that this change is due to increased anxiety with the introduction of the reward in the experimental group. Data points were taken immediately after the reward was presented to the individual, and this increase in heart rate was indicative of the participant processing the reward. This increase in heart rate is in agreement with our hypothesis. Another source of data came from the differences in the change in respiration rate between the two groups. On average, the experimental reward group showed a higher increase in respiration rate than the control group. However, this difference was not statistically significant ($p=0.0760$).

The other sources of data provided no significant difference between the two groups. The average change in MAP was almost identical between the groups, and had a p-value of $p=0.8745$. There are a few reasons that this may be due to. A few of the participants were left handed, but the blood pressure cuff was always placed on their left bicep so the experimenter could record the data without moving around the participant. Due to the movement of the participant while they wrote, the blood pressure monitor resulted in an error recording. For these participants, we could not determine a difference in MAP because we did not have a second blood pressure measurement to compare it to. Another reason that may have caused the insignificant data is that some of the blood pressure measurements were taken closer to the end of the exam period by the time the monitor had finished recording a measurement. Due to the time delay, blood pressure measurements of the participants were not measured immediately after the introduction of the reward. Thus, the blood pressure measurements could be attributed to other factors rather than solely the reward.

With respect to the performance on the exam, we found that the participants in the experimental group tended to score better than those who were not offered the reward ($p=0.2767$). A main reason that this may be due to is motivation. There have been studies that say the introduction of a reward improves motivation (Chen, 2010) and decreases motivation (Deci, 1999). This change in motivation could be due to the type of reward offered (Marinak, 2008). Offering a reward of $50 to a college student may increase the motivation compared to offering a reward to someone with a full time job, or offering a reward of lower monetary value. College students are typically of lower income, and this type of a reward may provide more help to them. We also observed that participants in the experimental reward group were verbal in how much it would mean to them to win and were consistently saying to the experimenter that "[they] better win that reward" after the experiment. This increase in motivation may have been an outside factor that was not taken into account upon creating the parameters of the experiment. This insignificant result may be due to the simplicity of the passage. In future experiments, to find a correlation between the introduction of a reward and performance, one may choose to assess the participants on something they may not have a lot of background knowledge about. This may be plausible by having participants fill out surveys on their interests before the experiment.

We believe that a reasonable explanation of the increased heart rate and lower blood pressure in both groups may be due to actions of the sympathetic nervous system. Because of the introduction of the high stakes reward, the individuals were primed to feel the effects of increased levels of stress. This increase in stress would activate the sympathetic nervous system, which would lead to increased levels of norepinephrine and epinephrine being released from the sympathetic nerves and adrenal medulla, respectively. Norepinephrine acts on β_1 receptors on the heart, which leads to an increased heart rate and cardiac output (Widmaier, 2016). Conversely, epinephrine is released from the adrenal medulla following stressful situations, such as taking an exam. When physiological levels of epinephrine are released, they bind to β_2 receptors on the blood vessels, which leads to dilation of the blood vessels and a reduction in total peripheral resistance (Widmaier, 2016). The equation relating cardiac output (CO), total peripheral resistance (TPR), and mean arterial pressure (MAP) is: MAP = CO x TPR (Widmaier, 2016). Because all of these are related, a reasonable explanation is that epinephrine released elicited a stronger response than the norepinephrine released, which led to a decreased MAP in both groups. The larger increase in heart rate in the experimental group may be due to higher levels of stress when the reward was introduced. The increased stress levels would cause more norepinephrine and epinephrine to be released, and this elevated concentration would proportionally increase heart rate and decrease MAP in the experimental group compared to the control group. Also, since the respiration rate increases proportionally to the increasing heart rate, the sympathetic innervation caused the respiration rates of both groups to increase, with a slightly higher increase in the group receiving the extra incentive (APA, 2016).

Our group made several major assumptions throughout the duration of our experiment. One major assumption was that each participant had some sort of background knowledge about and/or interest in the reading that was given to them. It was assumed that all participants possessed some degree of prior knowledge of Wisconsin Badger Football because the participants recruited were students enrolled at the University of Wisconsin-Madison. Some participants may have been able to complete the exam based off of prior knowledge, which may have lead to increased test scores and smaller changes in physiological measurements. With a greater interest in Wisconsin Football, participants may have stayed more focused on the information presented in the reading and consequently may have scored better than those with limited interest in the passage.

In the case of experimenter error, if the participant laughed or talked while wearing the respiration belt, the respiration rate graph would report irregular patterns of respiration. Thus, the data during that time interval would be invalid for analysis. Also, how securely the respiration belt was fitted on the participant varied greatly due to the participants fitting the belt themselves. Due to unforeseen issues, the automatic blood pressure monitor did not collect the blood pressure of several participants during various times throughout the data collection. The sensation of recording the participant's blood pressure could have also independently influenced the heart rate.

In the future, there are some changes that we would make for experimental design and data collection. First, we believe in the need to increase the amount of participants in our study. Due to the time constraint, we were unable to recruit the desired amount of participants to develop statistically relevant data. Increasing our sample size will better reflect the impact that a high reward and stressful situations has on physiological data and overall performance. Secondly, we will make sure to select other potential reading topics that may be of more interest to all our participants. For this experiment, we decided to pick a topic (Wisconsin Badger football) that we assumed many people had some interest in and potential knowledge of on our campus. However, after looking over our post-experimental surveys we found that not all readers expressed interest in it, thus potentially affecting their overall performance. We would also pick a topic that would limit the amount of background information the participants had in that area. Since all the participants are in Physiology 435, a reading of a topic outside of the sciences may provide the most equal distribution of background information, giving all participants an equal chance to score without prior knowledge affecting the results. We will ensure to minimize confounding variables and to have one individual running the experiment to minimize error.

Lastly, this study could further explore the effects of anxiety that the participants felt during the experiment. An additional post-experiment survey question could be added to investigate to what extent participants experienced anxiety. They would self-report the levels of anxiety they experienced, and further analysis of this data could explain the discrepancies seen between physiologic responses and performance. Self-reported data may possibly be analyzed by creating a separate coding scheme that compares the self-reported data with the physiological data collected in the study for each participant. Further statistical analysis would be needed to confirm the correlation between anxiety levels and physiological data.

Acknowledgements:

We would like to thank the University of Wisconsin-Madison Department of Physiology for giving us this opportunity to perform the research presented. We would also like to thank Dr. Andrew Lokuta for his insight, help with planning the experiment, and for creating the video that was used to describe the reward. Finally, we would like the thank the teaching assistants, student mentors, and participants for their invaluable help during the course of the study.

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Figures and Graphs

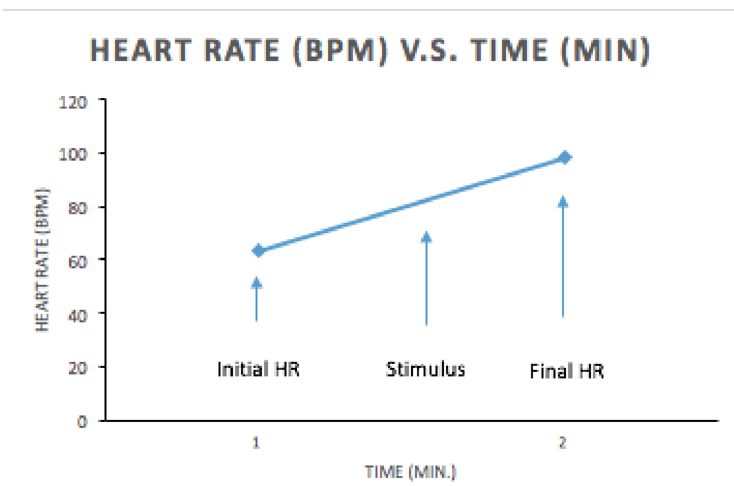


Figure 3. Heart rate (BPM) over time (minutes) after the introduction of a stimulus for the positive control showing the change in heart rate after introducing a stimulus.

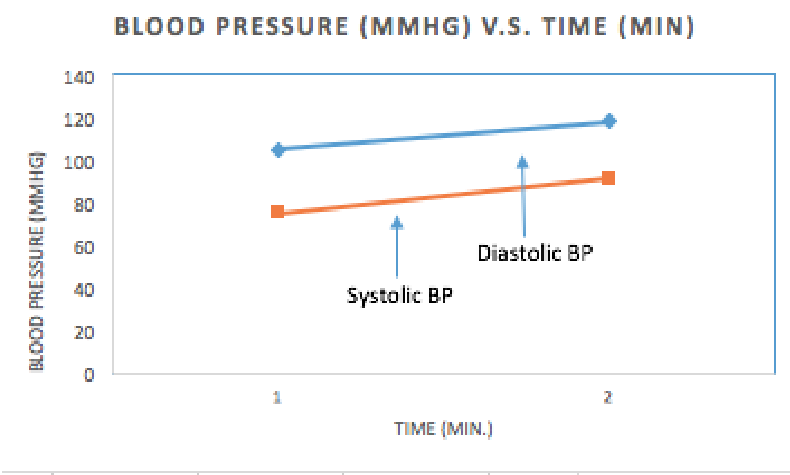


Figure 4. Blood pressure (mmHg) over time (minutes) after the introduction of a stimulus for the positive control showing the change in systolic and diastolic blood pressure after introducing a stimulus.

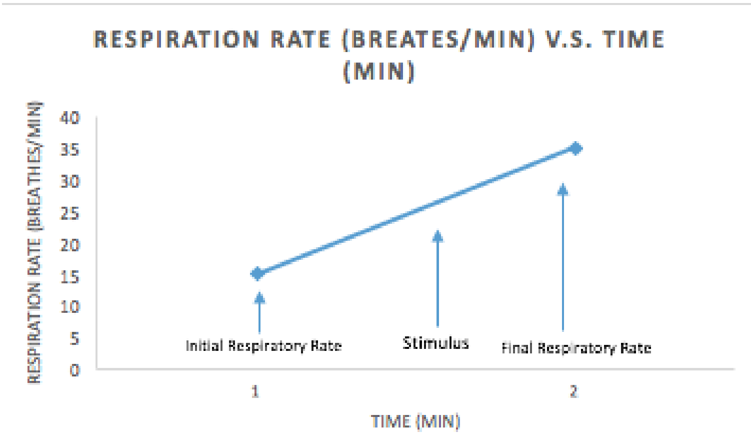


Figure 5. Respiration rate (breaths/min) over time (minutes) after the introduction of a stimulus for the positive control showing the change in respiration rate after introducing a stimulus.

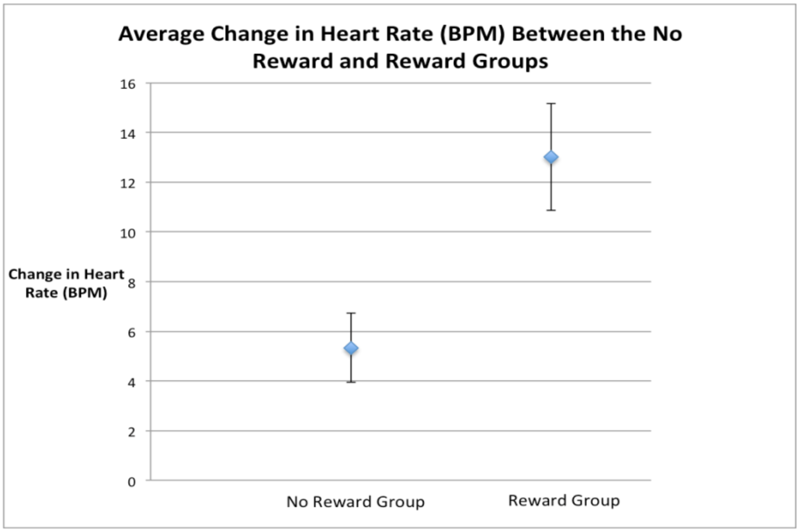


Figure 6. The average change in heart rate, mean ± SE, compared between the no reward (5.33 ± 1.39 BPM) and the reward groups (13.02 ± 2.16 BPM) did provide a statistically significant difference (p=0.2767)

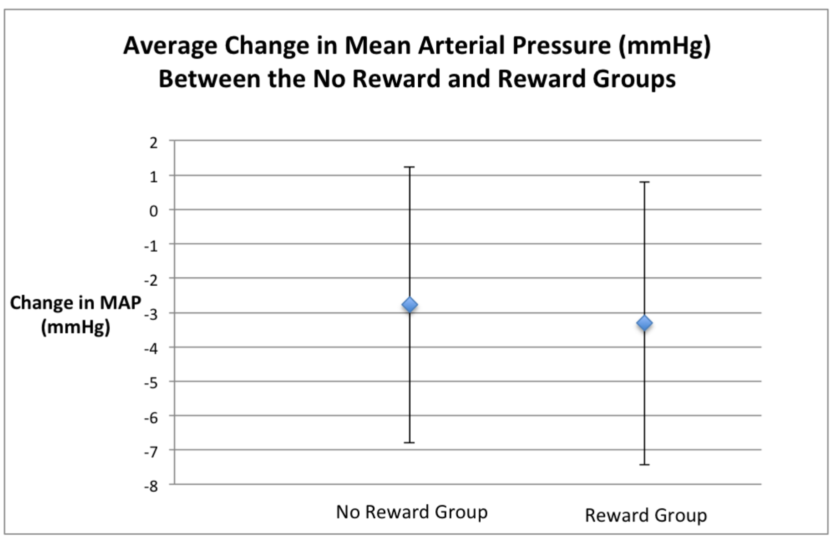


Figure 7. The average difference in mean arterial pressure (MAP) in mmHg, mean ± SE, compared between the no reward group (-2.78 ± 4.01 mmHg) and the reward group (-3.31 ± 4.12 mmHg). After performing a paired t-test, the difference was not statistically significant (p=0.8745).

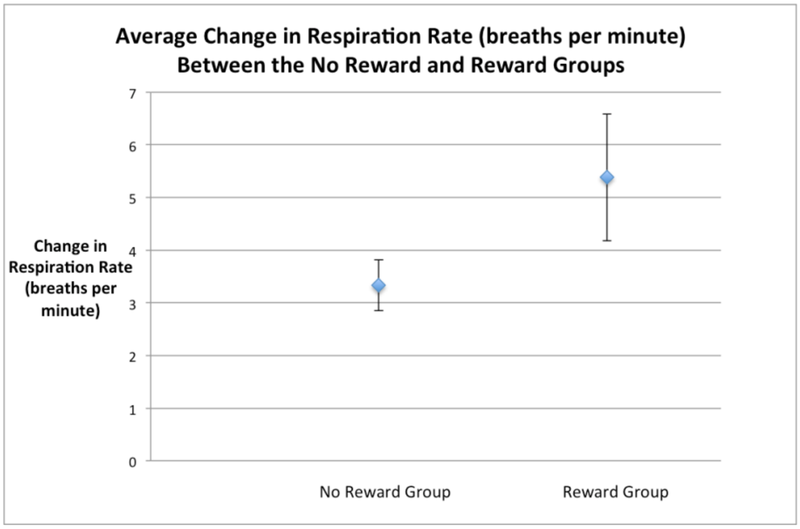


Figure 8. The average difference in respiration rate in breaths/minute, mean ± SE, compared between the no reward group (3.33 ± 0.48 breaths/minute) and the reward group (5.38 ± 1.20 breaths/minute). After performing a paired t-test, the difference was close to a p-value of 0.05, but not statistically significant (p=0.0760).

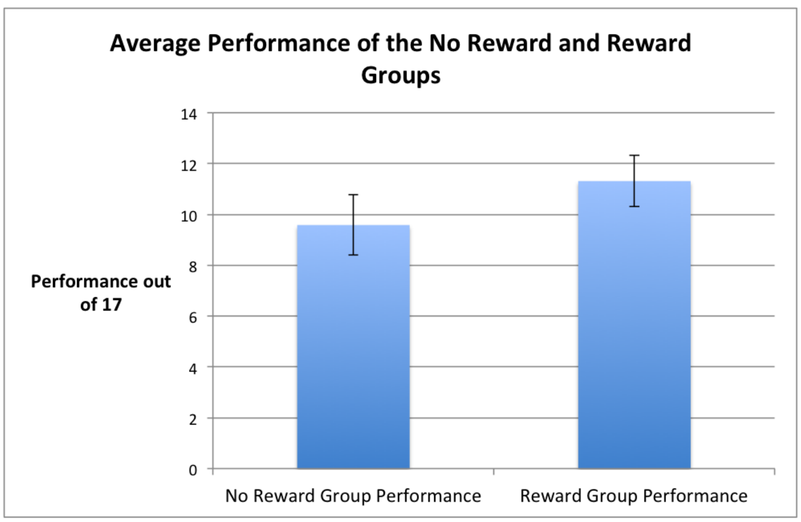


Figure 9. The average performance on the exam out of 17 points, mean ± SE, compared between the no reward group (9.58 ± 1.18 points out of 17) and the reward group (11.31 ± 1.00 points out of 17). After performing a paired t-test, the difference was not statistically significant (p=0.2767).

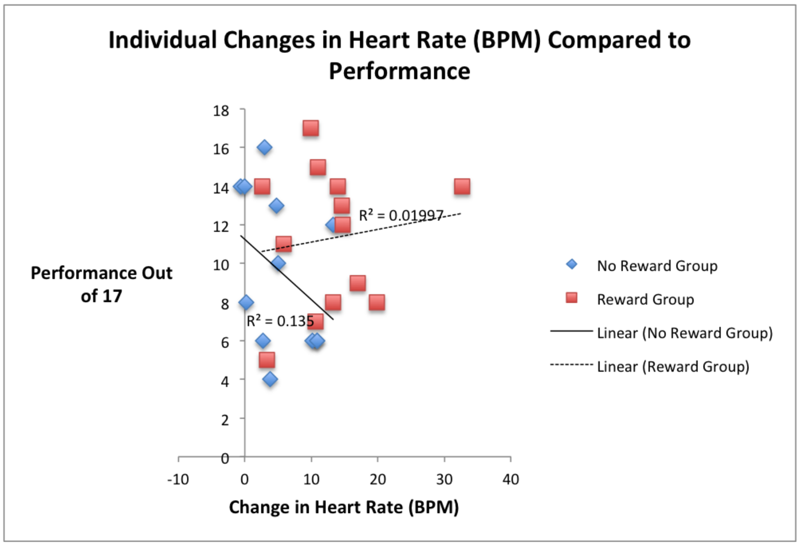


Figure 10. The individual changes in heart rate (BPM) from each participant in both group were plotted in comparison to their performance out of 17 with linear regressions performed on each set of data independently.

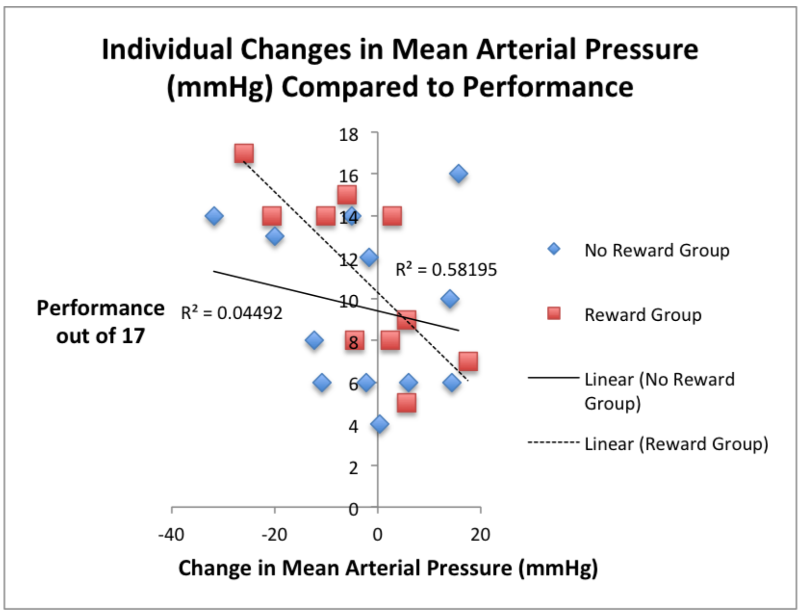


Figure 11. The individual changes in mean arterial pressure (MAP, mmHg) from each participant in both groups were plotted in comparison to their performance out of 17 with linear regression performed on each set of data independently.

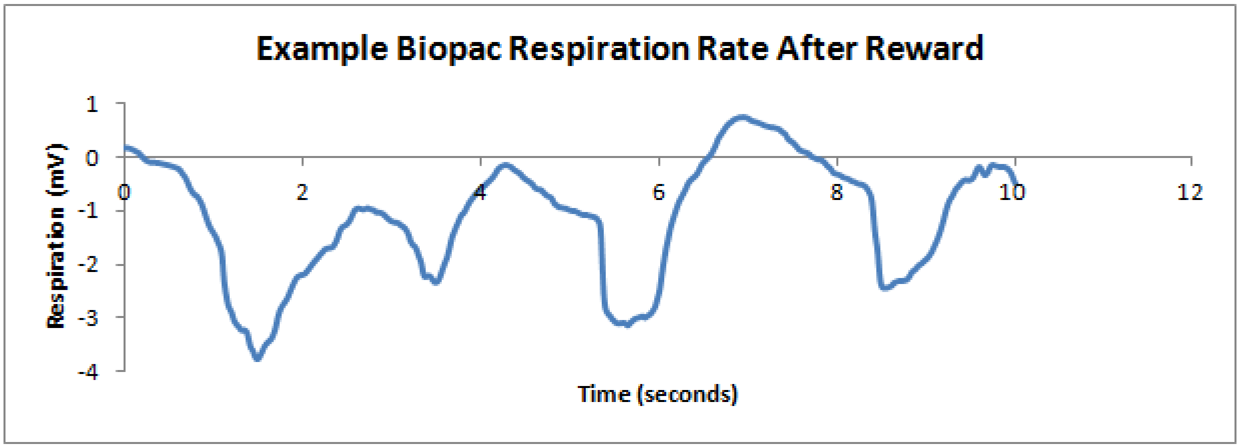
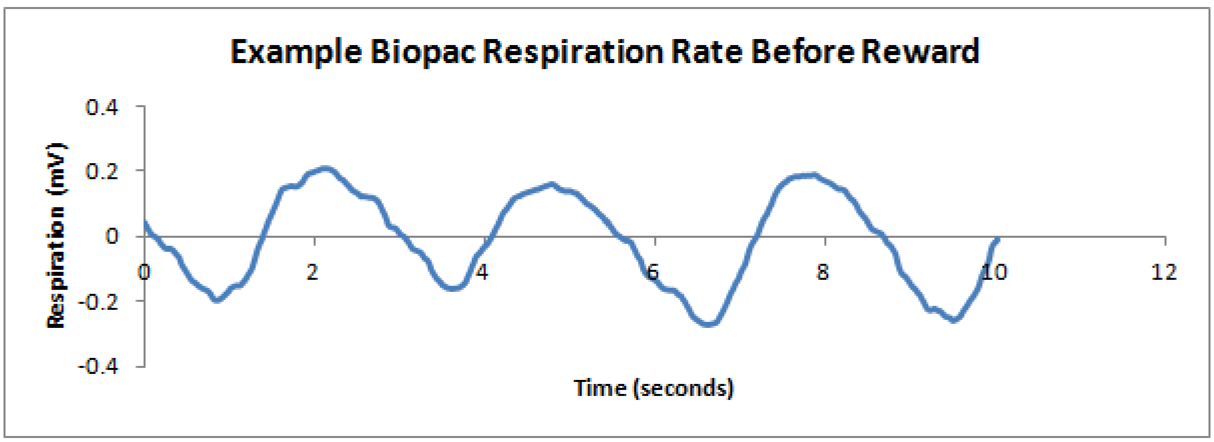


Figure 12. The individual changes in respiration rate, as recorded through the Biopac data after the reward was given to participant. The peaks seen represent the lungs expansion while the troughs represent the lungs compression



throughout a 10 second interval of normal respiration.

Figure 13. The individual changes in respiration rate, as recorded through the Biopac data before the reward was given to participant. The peaks seen represent the lungs expansion while the troughs represent the lungs compression throughout a 10 second interval of normal respiration.

Experimental Reward Group	Pre-Reward Respiration Rate (Breaths per Minute)	Post-Reward Respiration Rate (Breaths per Minute)
Participant 1	16	28
Participant 2	21	29
Participant 3	15	21
Participant 4	21	27

Figure 14: The respiration rate values here show that they change with the introduction of the reward.

Appendix:

Reading Excerpt

Excerpt from "Wisconsin Badgers football," courtesy of Wikipedia[1]

The first Badger football team took the field in 1889, losing the only two games it played that season. In 1890, Wisconsin earned its first victory with a 106–0 drubbing of Whitewater Normal School (now the University of Wisconsin–Whitewater), still the most lopsided win in school history. However, the very next week the Badgers suffered what remains their most lopsided defeat, a humiliating 63–0 loss at the hands of the University of Minnesota. Since then, the Badgers and Gophers have met 122 times, making Wisconsin vs Minnesota the most-played rivalry in the Football Bowl Subdivision.

Upon the formation of the Big Ten conference in 1896, Wisconsin became the first-ever conference champion with a 7–1–1 record. Over the next ten years, the Badgers won or shared the conference title three more times (1897, 1901, and 1906), and recorded their first undefeated season, going 9–0–0 (1901). With the exception of their second undefeated season in 1912, in which they won their fifth Big Ten title.

In 1990, Barry Alvarez became the head coach of the Badgers and, following three losing seasons (including a 1–10 campaign in his first year), Alvarez led the Badgers to their first Big Ten championship and first Rose Bowl appearance in over 30 years. On January 1, 1994 Wisconsin defeated UCLA 21–16 to claim its first Rose Bowl victory. Over his 16-year tenure as head coach, Alvarez led the Badgers to two more conference championships (one outright, one shared), eleven bowl games (going 8–3), two more Rose Bowl victories (1999 and 2000), and a #4 ranking in the final AP Poll of the '99 season.

Barry Alvarez has served as interim head coach two times. Wisconsin lost the 2013 Rose Bowl to Stanford and defeated Auburn in the 2015 Outback Bowl.

Following the 2005 season, Alvarez resigned as head coach in order to focus on his duties as athletic director, a position he had assumed in 2004. He named his defensive coordinator, Bret Bielema, as his successor. From 2006 to 2011, Bielema led the Badgers to six consecutive bowl appearances, going 2–4. In 2010, the Badgers won a share of the Big Ten Championship and returned to the Rose Bowl for the first time since 2000. There they were defeated 21–19 by the #3 ranked TCU. In 2011, the Badgers were once again crowned Big Ten Champs when they defeated Michigan State in the first-ever conference championship game. The victory sent Wisconsin back to the Rose Bowl for a second consecutive year, where they were defeated by the Pac-12 champion Oregon Ducks, 45-38.

The 2012 season ended with the Badgers winning a third consecutive Big Ten title. Despite finishing with a 7-5 record and third in the Leaders Division, the Badgers advanced to the Big Ten Championship game by virtue of the fact that Penn State and Ohio State were ineligible for postseason play. A dominating rushing performance led Wisconsin to a 70-31 victory over #12 ranked Nebraska in the Big Ten Championship game. Only days later, Brett Bielema resigned to become the head coach of the Arkansas Razorbacks. Gary Andersen, formerly coach of Utah State University, was named head coach on December 19, 2012. At the request of the team captains, Barry Alvarez named himself interim coach for the 2013 Rose Bowl, where the Badgers lost, 20-14 to Stanford.[5]

Gary Andersen was hired in December 2012 after Bret Bielema resigned to become the head coach for the University of Arkansas. Andersen was previously the head coach for Utah State where he went 26-23 in his four years at Utah State with his last season being 11-2 and finishing first in the Western Athletic Conference. Andersen's first win as the Badgers coach was a 45-0 win against Massachusetts. His first Big Ten football victory was a 41-10 victory over Purdue. The Badgers ended 2013 with a 9-4 record after losing to #8 South Carolina Gamecocks in the Capital One Bowl.

The Badgers started out the 2014 season ranked #14 in the AP Poll and their season opener was against #13 LSU Tigers in Houston, after leading the Tigers through three quarters the Tigers came back from a 24-7 deficit to defeat the Badgers 28-24.[6] The Badgers recorded their first road shutout since 1998 in a 37-0 victory over the Big Ten newcomers Rutgers Scarlet Knights.[7] On November 15, junior running back Melvin Gordon broke the all-time FBS single-game rushing yards record with 408 yards in a 59-24 victory against the Nebraska Cornhuskers.[8] However that record only lasted a week as Samaje Perine from Oklahoma rushed for 427 yards the very next week. The 2014 regular season ended with the Badgers taking 1st place in the West Division with a 10-2 record. Wisconsin played Ohio State for the conference title in the 2014 Big Ten Championship Game where the Badgers lost to Ohio State 59-0. It was the first time since 1997 that the Badgers were shutout and the worst loss since 1979 when Ohio State defeated the Badgers 59–0.[9]

Andersen departed Wisconsin four days later, taking the vacant head coaching position at Oregon State.[10] Andersen cited family as his rationale for taking the Oregon State position; however, it was reported by some media outlets, such as *Fox Sports* and *Sports Illustrated*, that Andersen was frustrated with the University's high academic standards for athletes.[11][12] Those reports turned out to be accurate, and were confirmed by Andersen in January 2015.[13]

Andersen had to pay a $3 million buyout for departing within the first two years of his contract, which was set through January 2019.[14]

At the request of the teams' seniors, Barry Alvarez named himself interim coach for the 2015 Outback Bowl vs. Auburn on January 1, 2015.[15] Wisconsin won the game 34–31 in overtime.[16]

After the departure of Gary Andersen former Badgers offensive coordinator (2005-2011) and Pitt head coach (2012-2014), Paul Chryst, was hired as the next head coach of the Wisconsin Badgers. The only assistant coach to remain on the coaching staff after Andersen's departure was defensive coordinator Dave Aranda. Chryst brought over six coaching staff from the University of Pittsburgh, Joe Rudolph (OC), John Settle (RB coach), Inoke Breckterfield (D-line), Chris Haering (special teams), Mickey Turner (TE coach) and Ross Kolodziej (strength and conditioning). From 2005 to 2011 Rudolph (TE coach) and Settle (RB coach) were assistant coaches under Chryst (OC). Mickey Turner and Ross Kolodziej are both former Badgers players, Turner was a tight end from 2006-2009 and Kolodziej was a defensive tackle from 1997-2000.[17]

In Chryst's first season the Badgers went 10–3. All three losses came to teams that were in the AP top 25 at the end of the season, eventual national champions #1 Alabama, #9 Iowa and #23 Northwestern. Chryst also won the Holiday Bowl against USC, whom the Badgers had a 0-6 record against before the game, with their last meeting being the 1963 Rose Bowl. Two days after their victory over USC it was announced that the Badgers defensive coordinator, Dave Aranda, would be taking the same role for the LSU Tigers, whom the Badgers open the 2016 season against at Lambeau Field.

"Running Back U" is a nickname that has emerged during the regime of Hall of Fame college football coach Barry Alvarez ('90–'05) and continued by his successors. Running plays have become a staple of the Wisconsin offensive attack ever since. The Badgers have produced a number of top-rated players at the running back position, including two Heisman Trophy winners and three Doak Walker Award winners. Standouts have included Howard Weiss, Elroy Hirsch, Alan Ameche, Joe Dawkins, Rufus "Roadrunner" Ferguson, Brent Moss, Terrell Fletcher, Ron Dayne, Michael Bennett, Anthony Davis, Brian Calhoun, Montee Ball, James White and Melvin Gordon.

"Jump Around" made its debut at Camp Randall on October 10, 1998 when the Badgers hosted the Purdue Boilermakers and their star Quarterback Drew Brees.

1. “Wisconsin Badgers football.” *Web.* Accessed 2 Feb 2016.
<https://en.wikipedia.org/wiki/Wisconsin_Badgers_football>.

Reading Comprehension Exam

1. What is Wisconsin’s mascot? (You should get this one right!)
    a. Bucky the Badger
    b. Brutus Buckeye
    c. Goldy Gophers
    d. Hawkeye
2. Where did most of Paul Chryst’s coaching staff at UW Madison come from?
    a. Pittsburgh
    b. Florida State
    c. Alabama
    d. Canada
3. When did Wisconsin first start playing football?
    a. 1700
    b. 1865
    c. 1889
    d. 1900
4. Who did Wisconsin play in their first ever victory?
    a. University of Wisconsin-Whitewater
    b. University of Minnesota
    c. Purdue University
    d. USC
5. What was Barry Alvarez’s win-loss record in his first year of coaching at UW?
    a. 9-3
    b. 6-6
    c. 4-8
    d. 1-10
6. What year did the Badgers win their first Rose Bowl?
    a. 1880
    b. 1994
    c. 2002
    d. 2015
7. Where do the Badgers play LSU next season?
    a. Camp Randall
    b. Baton Rouge, Louisiana
    c. Rose Bowl
    d. Lambeau Field
8. Who was the next coach after Barry Alvarez?
    a. Paul Chryst
    b. Bucky the Badger

c. Gary Andersen
d. Bret Bielema

9. In what years did Barry Alvarez come out of retirement and coach in Bowl Games?
    a. 1993 and 2013
    b. 2005 and 2008
    c. 2013 and 2015
    d. 1941 and 1960
10. Where did Bret Bielema leave to become the head coach after coaching at Wisconsin?
    a. Minnesota
    b. Oregon
    c. Alabama
    d. Arkansas
11. How many consecutive times did the Badgers win the Big Ten Championship under Bret Bielema?
    a. 0
    b. 1
    c. 2
    d. 3
12. Where did Gary Anderson coach at before coming to Wisconsin?
    a. Utah
    b. Utah State
    c. Michigan
    d. Northwestern
13. How many times have UW-Madison and University of Minnesota played against each other?
    a. 50
    b. 92
    c. 122
    d. 262
14. Melvin Gordon broke the all-time single game rushing record with 408 yards.
    a. True
    b. False
15. Who was Wisconsin playing when Jump Around was started?
    a. Illinois
    b. Indiana
    c. Purdue
    d. Northwestern
16. Wisconsin was the first ever Big Ten Conference Champion (not the championship game, regular season champion).
    a. True
    b. False

17. What is the nickname given to the University of Wisconsin?
    a. The "U"
    b. Running Back U
    c. Big Red
    d. Bucky's House

<u>Consent Form</u>

UNIVERSITY OF WISCONSIN-MADISON
Research Participant Information and Consent Form

Title of the Study: Effects of time constraints on test performance

Principal Investigators: Larissa Gabler, Amber Kim, Kaitlin McCuskey, Brad Morgan, Joey Seliski, Matt Semler____

<u>DESCRIPTION OF THE RESEARCH</u>

You are invited to participate in a research study about that will explore the effects and correlation of physiological data and test performance.

You have been asked to participate because you are enrolled in Physiology 435.

The purpose of the research is to analysis how heart rate, blood pressure, and respiration rate are associated with obtaining various test performances.

This research will take place within Physiology 435 laboratory sections.

<u>WHAT WILL MY PARTICIPATION INVOLVE?</u>

If you decide to participate in this research you will be asked to read a preselected article and respond to 17 multiple choice questions, within 6 minutes and fill out a survey after. Whilst reading and responding, the variables (heart rate, blood pressure, and respiration rate) will be monitored throughout the six minutes. These measurements will be monitored by a NONIN pulse oximeter, blood pressure cuff, and BioPAC system respiration band respectively.

______

Your participation will last approximately 10 minutes.____________________________
After the semester is completed, you will not be compensated for your time but the results may be published in a journal keeping your identity confidential.

______

No credit will be assigned for your complete and voluntary participation. If you do not wish to participate, simply return this blank consent form.

ARE THERE ANY RISKS TO ME?
If you have any known conditions of high blood pressure or elevated heart rate please refrain from participating in this study, otherwise there are no risks.

ARE THERE ANY BENEFITS TO ME?
Possible sense of happiness after helping a fellow classmate (depending on individual).

HOW WILL MY CONFIDENTIALITY BE PROTECTED?

While there may be printed reports as a result of this study, your name will not be used. Only group characteristics will be reported – that is results with no identifying information about individuals will be used in any reported or publicly presented work.______

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS?

If you are not satisfied with the response of research team, have more questions, or want to talk with someone about your rights as a research participant, you should contact Dr. Andrew Lokuta, 608-263-7488, ajlokuta@wisc.edu.

Your participation is completely voluntary. If you decide not to participate or to withdraw from the study it will have no effect on your grade in this class.

Your signature indicates that you have read this consent form, had an opportunity to ask any questions about your participation in this research and voluntarily consent to participate.

Name of Participant (please print):______________________________

Date:

Signature: