DREAMS AND LEARNING

A RESEARCH PROPOSAL

by Cody Mebane Gibbons

Project Summary

This study is being done to test one aspect of how paying attention to one's dreams may influence our waking lives. The idea was inspired by research linking the brain processes involved in long-term memory storage to qualities of dreaming, as well as the potential for learning in lucid dreams. It is hypothesized that the more conscious one is of one's dreams and dream world, the better one will be at learning. In order to test this, the dreaming ability of 300 Cal Poly students will be analyzed via dream questionnaires with the purpose of seeing if any correlation exists between their variation in dreaming and their variation in grade point average (GPA). Dreaming will be assessed in terms of dream recall frequency and dream intensity. Data analysis will be done via three regression analyses, which will be made with respect to (1) dreaming intensity and GPA, (2) dream recall frequency and GPA, and (3) total dream score and GPA. Furthermore, an experimental group (n=25) of students will listen to a weekly dream education podcast as well as keep a daily dream journal for three quarters. A control group (n=25) will listen to weekly podcasts on random topics pertaining to dreams, but with no content about how to better improve their dreaming abilities and will be instructed to keep a journal about daily thoughts and occurrences. Both groups will retake the dream questionnaire and submit their new GPA at the end of each quarter, for a total duration of three quarters. Change in dreaming abilities as well as change in grade point average will be measured via one-way repeated measures analysis of variance (ANOVA) for each group and each factor (GPA and total dream score). The experiment will cost $500 and will be completed in under a year on campus at California Polytechnic State University in San Luis Obispo, California. The expected results will be used as evidence supporting the implementation of dreaming as a core subject in the nation's school system.

Foreward

I designed the following experiment for my senior project proposal class one year ago. It was my best attempt at the time to question the relationship I had observed between dreams and learning. Much has changed since that time, so my hope is that readers keep in mind the most basic thing I am questioning, which is the potential of the tool of dreaming itself. The following is a little introduction into my thought process with respect to my dream ideas.

All systems are permeable. That is how rocks, water, gases and light combined to make biology happen. How the system of the psyche came to be is a different rabbit hole altogether, but there is no doubt that the system of biology is intimately related to it. I see dreaming as an entity that is permeable into both of these systems. This is why I think it offers important clues worth paying attention too.

I targeted the relationship between learning and dreams in the following proposal because the act of learning requires real changes in both our biology and psyche. I proposed the hypothesis that if one works to strengthen their dreaming abilities they will also strengthen their ability to learn.

I never completed the proposed senior project below, but can only hope it resonates with a student with more time left in their college career. I also hope their findings lead them to pursue similar studies. I would make plenty of changes if I were to ever run this experiment, but I am still inspired by the basic idea of teaching people how to become better dreamers and observing how this changes the way they approach their studies. I have offered this write-up as an example of a senior project proposal that could have been completed relatively inexpensively and fully on campus.

I encourage anyone who sees potential with this idea to begin their own exploration into the world of dreams.

Introduction

The dreaming abilities of humans vary from person to person in terms of dream intensity and dream recall (Yu, 2012). Some people can lucidly catapult themselves through the cosmos in their dreams while others tend to forget their dreams before they have rolled out of bed (Waggoner, R, 2008). Little work has been done to determine what effect this variation has on people, especially since the biological function of dreaming is still itself being debated. One prominent theory suggests that dreaming plays a key role in how the brain stores long-term memories (Payne, J., and J. Nadel, 2004).

Long-term memory consists of both declarative memory and non-declarative memory. Declarative memory is the conscious recollection of facts and of specific personal experiences. Non-declarative memory is the "heterogeneous collection" of memories that can't consciously be recalled and are expressed through performance; this kind of information is acquired as one learns a skill or as one learns more about their emotions (Squire, L., and S. Zola, 1996). A simple way to think of the two subcomponents of long-term memory is that declarative memories enable us to "know what," while non-declarative memories enable us to "know how."

The most popular theory of how these types of memories are consolidated in the brain is that the hippocampus and cortex are in a form of dynamic communication that transfers memories accumulated during the day in the hippocampus into the cortex where they are stored as long-term memory.

(Hasselmo, M., and J. McClelland, 1999). This is due to the computational strategies employed by each of these regions. In the hippocampus, similar patterns of input are stored separately from each other, and a number of partial inputs can be pieced together to complete a larger pattern. The cortex functions to take similar patterns and mesh them together in an overlapping way where more associated patterns have higher degrees of overlap– almost like a complex, three dimensional web of Venn diagrams (Payne, J., and J. Nadel, 2004).

Sleep cycles are believed to coordinate this communication. During slow wave sleep (SWS), the specific patterns of stimulation in the hippocampus, representing the short term memories formed during the day, replay themselves within the hippocampus in a conditioning fashion. As SWS transitions into rapid eye movement (REM) sleep, these replayed memories undergo hippocampal-cortical interactions as they begin to associate themselves into the cortical networks.

Finally during REM, the hippocampus is no longer active and cortical-cortical interactions promote the integration and assimilation of fresh information into pre-existing networks created by past experiences in an effort to create new and better webs of association (Ji, D and M. Wilson, 2007). Although dreams are commonly thought to only occur during REM sleep, studies have shown that a more fragmented type of dream associated with declarative memories occurs during SWS (Cavallero, C., et al, 1992). However, REM sleep lends more to the phenomenological nature of dreaming, because communication has been severed to the hippocampus. All facts of life no longer govern the dreamers mentation processes, and they are only subject to the limits of their brain's imagination– this has been shown to increase the creativity of the mind (Cai, D.J., et al, 2009).

While there is validity to the argument that this memory consolidation process will get the job done regardless of whether or not people are conscious of its outputs (dreams), paying attention to these outputs could aide in learning. Participants trained in a virtual maze task and then given a five-hour break before being retested showed the greatest degree of improvement when they recalled having a dream during the dormant period relating to the virtual maze (Wamsley, E., et al, 2010). Also, the answers to many famous problems, such as the structure of the benzene ring and periodic table of elements, have come to the problem solver in their dreams (Barret, D, 2010).

Lucid dreaming, or a state of dreaming where one becomes conscious that one is in a dream yet remains inside the dream with full access to cognition and memory, also has potential to be used as a tool for learning. Identical areas of the brain are stimulated as one lucidly dreams a physical task, like clenching the fist, just as if one were performing the task in waking life (Dresler, M., et al, 2011). Moreover, rehearsing a skill or activity in a lucid dream, lucidly practicing so to speak, enhanced performance of that skill in waking hours following the dream practice more so than participants who mentally rehearsed the task during the day (Erlacher, D., and M. Schredl, 2010).

College students are an appropriate population to do dream studies on with this specific question in mind, because they are at a point in life where they are constantly rearranging philosophies as they are exposed to new information and ideas inside and outside of their classes. They are in an intense period of learning and are constantly seeking the most efficient way to digest all the information they are receiving. Students want the new information to be more than just ephemeral glimpses of knowledge, and therefore are constantly readjusting their learning strategies. Learning how to learn is very important to their fitness. This ongoing learning process is also being constantly evaluated by third

parties in the form of testing and grading, which provides objective measurements of the effectiveness of a particular learning strategy. Therefore, a portion of the effects of one's dreaming abilities on one's learning abilities can be reasonably measured within this population.

Hypothesis

The more conscious one is of one's dreams and dream world, the better one will be at learning.

Predictions

(i) Students who are more active dreamers and who report a higher dream recall frequency will perform better in their classes than students who have poor dreaming abilities.

(ii) Students who train to become better dreamers will significantly improve their class performance compared to students who have undergone no dream training.

Methods

Recruitment: Students will be recruited for the study via ads in the Mustang Daily, posted flyers around campus, short presentations before classes promoting enrollment, word of mouth, and through social networks. The goal is to recruit up to 300 students consisting of 50 students per college at Cal Poly: College of Agriculture, Food & Environmental Studies, College of Architecture & Environmental Design, College of Engineering, College of Liberal Arts, Orfalea College of Business, and College of Science & Mathematics.

Prediction (i): To test prediction (i), students who enroll in the study will be issued a baseline dream questionnaire (Appendix). The questionnaire was developed using the Dream Intensity Scale (DIS) (Yu, C, 2012), along with added questions (24-30) pertaining to gender, year in college, major, GPA, prior research into dreaming techniques, and drug and alcohol use.

Questions 1 to 9, 22, and 23 are designed to indicate dream recall frequency (DRF) on a standardized 10-point scale (0=never to 9=almost every day). The raw scores will then be converted into a number that will represent each DRF factor in terms of frequency per month. The conversion factors are as follows: 0 to 0, 1 to 0.042, 2 to 0.083, 3 to 0.333, 4 to 0.75, 5 to 1, 6 to 2.5, 7 to 4, 8 to 16, and 9 to 28 (Yu, C, 2012). These scores will then be summed with a higher score indicating a higher dream recall frequency.

Questions 10-21 are designed to indicate dream intensity (DI) and will be analyzed following the same guidelines as above, with raw scores converted using the same conversion factors listed above. The total dream score (TDS) will consist of the sum of the DRF score and the DI score, with higher scores representing better dreaming abilities.

Data analysis for prediction (i) will be done via three regression analyses, which will be made with respect to (1) DI and GPA (2) DRF and GPA and (3) TDS and GPA.

A fourth regression analysis will be done comparing drug and alcohol use to GPA to test for possible confounding factors. A higher drug/alcohol score will mean the subject uses drugs and alcohol more.

Prediction (ii): To test prediction (ii), 50 of the 300 participants from the first part of the experiment will be used, except that the students will then be split into an experimental group (n=25) and a control group (n=25), with equal representation of each college in each group. Students must have at least three quarters left of schooling at Cal Poly in order to be part of this study. All other factors will be determined at random.

The experimental group will be given access to weekly podcasts on dreaming directed to instruct them on how to become better dreamers. They will be told to keep dream journals and to try and stick to the three following dream journal guidelines: 1) write or record every dream or dream fragment remembered immediately upon waking, 2) try and report the dream from the first person point of view without elaborating into possible meanings of the dream content, and 3) try and note every detail that they can remember including dream characters, stimulations of the senses, dream environment, and important dream imagery.

The control group will be given access to weekly podcasts on random topics pertaining to dreams, but with no content about how to better improve their dreaming abilities. They will be instructed to keep a journal about their thoughts and experiences during the day with no specific guidelines on what they should focus on writing about. Both groups will fill out the dream questionnaire once more at the end of the quarter after the participants have received their final grades. This process will continue for three quarters.

Data analysis for prediction (ii) will consist of a one-way and repeated measures ANOVA of average TDS scores for both the control and experimental groups, with time being the independent variable. Therefore there will be a total of four levels to the test (baseline, quarter 1, quarter 2, quarter 3). The hypothesis for the control group is that experimental mean TDS scores will be equal in each level, while the null hypothesis is that mean TDS scores will not be equal. The hypothesis for the experimental group is that the experimental mean TDS scores will increase from baseline to quarter 3, while the null hypothesis is that mean TDS scores will be equal. This will test to see if the dream training had any significant effect on participants' dreaming ability.

A second set of one-way and repeated measures ANOVA of average change in GPA for both the control group and experimental group will also be determined. The hypothesis for the control group is that experimental mean GPA scores will be equal in each level, while the null hypothesis is that mean GPA scores will not be equal. The hypothesis for the experimental group is that the experimental mean GPA scores will increase from baseline to quarter 3, while the null hypothesis is that mean GPA scores will not be equal. This will determine if changes in GPA varied significantly between each group. The four total repeated measures ANOVA tests will then be used to relate the changes in dreaming abilities to changes in GPA.

Timeline

The entire study will be completed in one academic year. Ten weeks would be devoted to recruitment and to the development and creation of the dream podcasts. The baseline test will be performed before the start of the tenth week (which is aligned with the beginning of the quarter), and all re-testing periods (three total) will occur once grades have been released at the end of each quarter. An additional

three weeks time would be required at the end of the data collection period to analyze the data and generate conclusions.

Budget

The total budget required for the entire study is $500. $300 of that total would go towards advertisement and recruitment of participants. $120 would go towards purchasing storage space online for podcast episodes, and $80 would provide the means to purchase the ink and paper to print questionnaires.

Expected Outcomes

If this study is successful and the results support the hypothesis, that the more conscious one is of one's dreams and dream world, the better one will be at learning, then I think that more emphasis should be put into the development of students' dreaming abilities. This would involve educating students on the fundamentals of dreaming within the nation's school systems, which would pave the way for more sophisticated conversations about dreaming and the nature of dreams. If students begin discussing and sharing their dream experiences in elementary school on a regular basis, and continued doing so through high school, I would expect an increase in the dreaming ability of the average student, which would correspond to an increase in learning ability. Thus, by the time students entered the university system, they would already be comfortable using dreaming as a tool, and it could be utilized to maximize the learning experience that college has to offer.

I would expect this system to lead to a whole new type of learning. An example of what I mean by this follows:

I imagine a biology major walking home from class reflecting on a lecture in cell biology, where her professor had brought in a plastic bag and stuffed it with spaghetti and meatballs to help the students visualize what it is like inside of a cell. This demonstration stimulated her imagination to an extent, but she is still left wondering what the inside of a cell would look like if she could be scaled down to fit inside of a cell, and explore it like she would a new landscape. After falling asleep later that night, she becomes lucid, and uses learned dream techniques to manifest her idea of a cell into her dream environment and begins to explore it inside her mind. She would see her brain's current idea of what a cell looks like based on all the information she had learned in her classes, read in her textbooks, and studied with her classmates, along with whatever else her brain had associated with those things. She could move around and check out various organelles and aspects of the cell that she was curious about.

She awakes in the morning and goes over the dream in her head, strengthening her waking imagination of the cell. In class that day, she shares the most interesting aspects from the previous night's dream with her professor and classmates. Together they would question what she perceived in the dream about the cell to check for inaccuracies, as well as discuss new insight received from the dream. Maybe another student had tried a similar thing in a prior dream, and had experienced a totally different result. Arguments and discussions would be had in the effort to find common understanding, which would expand everyone's imagination and knowledge concerning the cell, and the next time she begins to daydream about cells, her imagination will be full of more than just a bag of spaghetti.

Appendix

Dream Survey:

1. Although some people may forget the details of their dreams after waking from sleep, they still retain a notion that they have dreamed. How often have you dreamed over the past few years on average, irrespective of whether you remember the actual content of your dreams?

 0...... Never
 1...... Less than once a year
 2...... About once a year
 3...... Two to six times a year
 4...... Seven to eleven times a year
 5...... About once a month
 6...... Two to three times a month
 7...... About once a week
 8...... Two to six times a week
 9...... Almost every night

2. On average, how often have you been able to remember the main content of your dreams immediately after waking from sleep in the morning?

 0...... Never remember any main dream content
 1...... Remember main dream content less than once a year
 2...... Remember main dream content about once a year
 3...... Remember main dream content two to six times a year
 4...... Remember main dream content seven to eleven times a year
 5...... Remember main dream content about once a month
 6...... Remember main dream content two to three times a month
 7...... Remember main dream content about once a week
 8...... Remember main dream content two to six times a week
 9...... Remember main dream content almost every morning

3. How often do you experience nightmares?

 0...... Never
 1...... Less than once a year
 2...... About once a year
 3...... Two to six times a year
 4...... Seven to eleven times a year
 5...... About once a month
 6...... Two to three times a month
 7...... About once a week
 8...... Two to six times a week
 9...... Almost every night

4. How often do you experience nightmares that are so frightening that they wake you up, and after awakening are still vivid?

 0...... Never
 1...... Less than once a year
 2...... About once a year
 3...... Two to six times a year
 4...... Seven to eleven times a year
 5...... About once a month
 6...... Two to three times a month
 7...... About once a week
 8...... Two to six times a week
 9...... Almost every night

5. Have you ever had two dreams or more in a single night?

 0...... Never
 1...... Less than once a year
 2...... About once a year
 3...... Two to six times a year
 4...... Seven to eleven times a year
 5...... About once a month
 6...... Two to three times a month
 7...... About once a week
 8...... Two to six times a week
 9...... Almost every night

6. Have you ever become aware or known during a dream that you are dreaming?

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost every night

7. Have you ever been able to control the content of your dreams, and make things happen at will?

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost every night

8. Have you ever experienced the following situation: Upon awakening from a dreaming sleep, you have the feeling that you want to continue and reconnect with the dream. After attempting to return to the dreaming state, you actually do reconnect with the dream.

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost every night

9. Have you ever experienced the following situation: You have had some dreams that make you wish to dream them once again. Some days later, these dreams actually turn up again.

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost every night

10. Do you see colors in dreams?

    0...... Almost every dream of mine is colorless.
    1...... The majority of my dreams are colorless.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams have colors.
    4...... Almost every dream of mine has colors.

11. Do you hear sounds in dreams?

    0...... Almost every dream of mine is soundless.
    1...... The majority of my dreams are soundless.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams have sounds.
    4...... Almost every dream of mine has sounds.

12. Do you smell anything in dreams?

    0...... Almost every dream of mine is odorless.
    1...... The majority of my dreams are odorless.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams have odors in them.
    4...... Almost every dream of mine has odors in them.

13. Do you taste anything in dreams?

    0...... Almost every dream of mine is tasteless.
    1...... The majority of my dreams are tasteless.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams have tastes in them.
    4...... Almost every dream of mine has tastes in them.

14. Do you feel emotions in dreams?
    0...... I do not feel emotions in almost every one of my dreams.
    1...... I do not feel emotions in the majority of my dreams.
    2...... Both appear with similar frequency.
    3...... I feel emotions in the majority of my dreams.
    4...... I feel emotions in almost every one of my dreams.

15. Do you have, in general, more pleasant dreams, more unpleasant dreams, or do pleasant and unpleasant dreams appear with similar frequency?
    0...... Almost every one of my dreams is unpleasant.
    1...... The majority of my dreams are unpleasant.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams are pleasant.
    4...... Almost every one of my dreams is pleasant.

16. In general, are your experiences in dreams coherent (narrative), fragmentary, or do both coherent and fragmentary dreams appear with similar frequency?
    0...... Almost every one of my dreams is fragmentary.
    1...... The majority of my dreams are fragmentary.
    2...... Both appear with similar frequency.
    3...... The majority of my dreams are coherent.
    4...... Almost every one of my dreams is coherent.

17. Have several characters in the real world ever combined into a single one in your dreams?
    0...... This situation has almost never happened.
    1...... This situation has not happened in the majority of my dreams.
    2...... Both have occurred with similar frequency.
    3...... This situation has happened in the majority of my dreams.
    4...... This situation has happened in almost every one of my dreams.

18. Has a certain person in the real world ever been represented by another character in your dreams?
    0...... This situation has almost never happened.
    1...... This situation has not happened in the majority of my dreams.
    2...... Both have occurred with similar frequency.
    3...... This situation has happened in the majority of my dreams.
    4...... This situation has happened in almost every one of my dreams.

19. Have any characters that do not belong to the real world or that you have never seen appeared in your dreams?
    0...... This situation has almost never happened.
    1...... This situation has not happened in the majority of my dreams.
    2...... Both have occurred with similar frequency.
    3...... This situation has happened in the majority of my dreams.
    4...... This situation has happened in almost every one of my dreams.

19a. If yes (you choose from options 1 to 4 in the above question), in general, do you have any familiar feeling toward those characters that do not belong to the real world, or that you have never seen?
    0...... No
    1...... Yes

20. Have any animals capable of speaking or thinking ever appeared in your dreams?
    0...... This situation has almost never happened.
    1...... This situation has not happened in the majority of my dreams.
    2...... Both have occurred with similar frequency.
    3...... This situation has happened in the majority of my dreams.
    4...... This situation has happened in almost every one of my dreams.

20a. If yes (you choose from options 1 to 4 in the above question), in general, do you have any familiar feeling toward those animals that can speak or think?
    0...... No
    1...... Yes

21. Have any objects (e.g., trees, rocks, etc.) that can speak or think ever appeared in your dreams?
    0...... This situation has almost never happened.
    1...... This situation has not happened in the majority of my dreams.
    2...... Both have occurred with similar frequency.
    3...... This situation has happened in the majority of my dreams.
    4...... This situation has happened in almost every one of my dreams.

21a. If yes (you choose from options 1 to 4 in the above question), in general, do you have any familiar feeling toward those objects that can speak or think?
    0...... No
    1...... Yes

22. Have you experienced the following situation: You have memories that, upon reflection, feel as if they were of events that had actually happened in real life, but you truly know that they merely happened in dreams?

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost everyday

23. Have you ever experienced the following situation: You have memories that, upon reflection, you simply do not know whether they are of events that actually happened or were part of dreams?

    0...... Never
    1...... Less than once a year
    2...... About once a year
    3...... Two to six times a year
    4...... Seven to eleven times a year
    5...... About once a month
    6...... Two to three times a month
    7...... About once a week
    8...... Two to six times a week
    9...... Almost everyday

24. What sex are you?

    1......Male
    2......Female

25. What year are you in college?

    0...... Freshman
    1...... Sophomore
    2...... Junior
    3...... Senior
    4...... 5th Year and beyond

26. What is your major (and/or minor) at Cal Poly? _____

27. Have you done any research on your own in any efforts to become a better dreamer?
    0...... Never
    1...... A few times
    2...... I have spent a lot of time trying to learn about my dreams
    3...... I know all about my dreams

28. What is your relationship with alcohol?
    0...... I don't drink
    1...... I drink but rarely get drunk
    2...... I get drunk once or twice every two weeks
    3...... I love to party

29. What is your relationship with marijuana?
    0...... I've never tried it
    1...... I've tried it but have only been stoned a few times
    2...... I use marijuana at least once every two months
    3...... I use marijuana at least once every two weeks
    4...... I use marijuana more than once per week
    5...... I get stoned every day

30. How long since you started this trend of marijuana use?
    0...... I've never tried it
    1...... One year
    2...... Two years
    3...... Three years
    4...... Four plus years

31. What is your current grade point average?
    0...... 4.0
    1...... 3.5-3.9
    2...... 3.0-3.4
    3...... 2.5-2.9
    4...... 2.0-2.4
    5...... 1.5-1.9
    6...... 1.0-1.4
    7...... 0-0.9

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About the Author

Cody Mebane Gibbons is a senior biological sciences student graduating this Spring 2014. His professional goal is to attend medical school, but he would first like to explore different career options and gain skills that will help him in the years to come. He enjoys studying biology because it explains a lot of questions that he had about life. "The mystery is still there, but studying biology has really helped shaped my imagination and now I think I have the ability to ask even better questions," he said. He would like to go into medicine because sickness is universal. Cody looks for variety in a profession to keep him moving. He is drawn to the health and medical field because he is bound to learn from all kinds of people and have the opportunity to work in many environments. Cody developed his interest in lucid dreaming through a friend in his early high school years. To get the most out of your dreams, Cody advises to drink a lot of water before you go to bed and use the voice memo app on your phone to record dreams when you wake up. "You'll be surprised what those dreams will come to mean to you as the years go on," Cody said.