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Dream Recall, Sleep Quality, and Short-Term Memory

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Introduction

Dreams and sleep occupy nearly one-third of people's lives, yet they remain some of the least understood phenomena of the human experience (Buzaki & Watson, 2015). Whereas some people recall almost all of their dreams from the night before, 3% – 7% of people claim to never have dreamed at all (Herlin, Leu-Semenescu, Chaumereuil, & Arnulf, 2015). The current study examines the frequency of dream recall of individuals in relation to short-term memory (STM).

Despite much research dedicated to dreams, scientists still do not know why some remember their dreams and others do not. Several theories attempt to explain why people dream, from Lyon Research Neuroscience Center's (2014) research showing a positive relationship between wakefulness during sleep and dream recall, to WebMD's (2003) report on the relationship between dream recall and creativity. The connection between dream recall and STM is far less studied. Many people recall the content of their dreams upon waking, and forget them later in the day, contributing to the idea that dream recall is related to STM.

When considering research on dream recall, sleep quality and STM, we must first understand how these variables are operationally defined. Sleep quality usually refers to how well an individual sleeps at night, whether this be how rested they feel, the number of times they were disturbed from their sleep, amount of time slept, or how long it took to fall asleep. Dream recall assesses whether an individual can recall the content of their dreams. For the purpose of this study, we define memory as a way for the brain to store and refer back to information. Many different types of memory exist, such as short-term, long-term, working, and explicit memory. Researchers seek to understand the correlation between dreaming and memory in order to uncover the reasons for dream recall ability; however, previous studies found inconsistencies when examining these two variables. Our current study institutes a possible connection between these three specific variables to extend the research in this field.

Literature Review

In the first half of the twentieth century, little research existed on dream recall frequency and dream recall failure. After the discovery of rapid eye movement (REM) sleep in 1953, investigations into the relationship between dreaming and memory led to a swift increase in research regarding its effects (Koulack & Goodenough, 1976). Despite the exponential growth of dream research in the field of psychology, few studies examine the relationship between dream recall and STM. Prior research has also suggested an association between dream recall frequency and memory. A study conducted with groups of individuals who exhibited high recall ability and those who exhibited low recall ability showed that those who exhibited high recall ability performed significantly better than those who exhibited low recall ability on a memory task, indicating a link between dream recall ability and STM (Martinetti, 1983). Researchers have also found a positive relationship between dream recall and ability to recall

early childhood memories (Robbins & Tanck, 1978). This study focused on the act of recalling dreams distinctly from recalling content of dreams, thus focusing ongoing research in the direction of recall ability alone, as opposed to dream content recall ability. However, not all research has indicated a clear connection between dream recall and memory. Indeed, several studies even suggest there may be no relationship. For example, previous studies found no relationship between dream recall frequency and visual memory (Cohen, 1971).

The potential relationship between sleep quality and memory, however, has been well documented by research from the past 50 years. Researchers have found that sleep-deprived students scored significantly worse on a memory-recognition test than non-sleep-deprived students (Elkin & Murray, 1974). A similar study found that self-reported insufficient sleepers performed significantly worse on a memory-span task than those who reported sufficient amounts of sleep (Gradisar, Terrill, Johnston, & Douglas, 2008). LeWine (2015) conducted a longitudinal study over 14 years involving female nurses who were interviewed about their sleep habits, memory, and thinking skills. The study found that those who had less than five hours of sleep or more than nine hours performed significantly worse on cognitive tests. The link found between poor cognitive functioning and low sleep amount was expected, but the link between poor functioning and *too much* sleep was surprising. These studies indicate that there is a potential link between sleep amount or quality and memory, and this warrants further research on their relationship.

Various methodological limitations may explain these differences. Multiple studies in this body of research have relied on self-report data only, raising issues about their validity. Further, this data comes from a small, mostly homogeneous sample, suggesting conclusions drawn may not be representative of all people. For example, a study by Martinetti (1983) not only had an extremely small sample of thirty participants, but also the participants were all women of roughly the same age and education status, and this harmed the generalizability of the findings. Additionally, Robbins and Tanck's research (1978) relied on self-reports to measure long-term memory from the ages of four to six, raising concerns about the accuracy of these early memories and the validity of their memory measure. Given these concerns, it is worthwhile to extend past work on sleep, memory, and dream recall, incorporating certain methodological improvements.

Current Study

To address some of the concerns in previous research, the current study moves away from long-term memory because of the difficulties in practically and accurately recording such memories. Further, we committed to a larger sample with a more diverse demographic makeup, to capture more reliable and generalizable estimates of the relationships among these variables. In addition, we used established, continuous scales that more accurately capture

these measures. By employing more appropriate measures and a larger sample, the present study aimed to replicate and improve upon previous research with dream recall and memory.

Considering a similar study that found a relationship between dream recall and STM (Martinetti, 1983), the current study tested three hypotheses. First, we predicted that we would find a positive relationship between sleep quality and dream recall. Second, we predicted a positive relationship between sleep quality and STM. Lastly, we hypothesized that individuals who display better STM will recall dreams more frequently, even when controlling for sleep quality and age. In short, we expected a positive relationship between sleep quality and STM, dream recall and sleep quality, and dream recall and STM.

Method

Participants

In this study, 229 individuals completed some or all of the measures most relevant to our research questions. Of these, 24 (13%) individuals were excluded from analyses due to failure to complete more than 50% of the survey, making their data unusable for most analyses. The remaining 205 participants (87%) were included in the analyses.

The present sample consists of 44 (21.5%) males, 158 (77.1%) females, and 3 (1.5%) non-binary participants. Participants ranged in age from 18 to 85 years, and on average were 38.55 years old (SD = 16.35). Frequencies of age within our sample are represented in Figure 1. The majority of the sample (78.6%) was White or Caucasian, with smaller subsets of the sample identifying as Asian (6.8%), American Indian or Alaska Native (1.5%), Black or African American (.5%), or multiracial (5.8%). A small percentage (3.9%) identified as a race other than those listed, and the remainder either did not respond (1.9%) or declined to answer (1%). In addition, 9.3% identified as Hispanic, Spanish or Latino/a, with the remaining 88.3% not identifying with those ethnicities, (1.5%) not responding, (0.5%) preferring not to say, or (.5%) not knowing. The majority of the participants included 46% full-time employees, followed by 20% students. Of our sample size, 41% were married and 38% were single. The majority of participants (41%) had some college experience, with 21% of participants holding a Bachelor's Degree.

Procedure

A survey was created on the online survey program, Qualtrics. The online survey was posted on Seattle University's subject pool website, and shared on the authors' personal Facebook pages. On Facebook, a "snowballing" sampling method was implemented, in which those who saw the post were encouraged to share it with their Facebook friends. Participants were required to provide their consent to participate before beginning the survey, and they were thanked after completing the survey. Individuals participating via the university subject

pool were awarded research participation credit in their courses; otherwise, no compensation was provided for participation.

Measures

Demographics: to examine the sample makeup and establish the generalizability of the present study, we assessed the following demographic variables: race, age, gender, education level, employment status, and relationship status. A summary of these statistics is available for reference in the Participants section. We recoded the values for age so that the established value was the same as the actual age, because the minimum age for participation in this study was 18 years old (e.g., changing the value of 1 to a value of 18, 2 to a value of 19, etc.).

Sleep Quality: sleep quality was defined as subjective satisfaction with one's nightly sleep, not including naps (short periods of sleep during the day). We used the PROMIS Sleep Questionnaire to assess for sleep quality (Yu et al., 2011). Questions within this measure included variables like amount of sleep, the number of disturbances to sleep, how long it took the participant to fall asleep, and how rested they felt after waking. These topics were assessed on a five-point scale: beginning with "not at all," then moving to "a little bit," "somewhat," "quite a bit," and finally ending with "very much." These reports were averaged, providing each participant with a single score to represent their sleep quality (M=2.71, SD=.82). These questions were reverse coded (e.g., two responses were recoded in the PROMIS questionnaire so that 1 (very poor sleep) became 7 (very good sleep) and 7 became 1, in order to follow with the instructions of scoring the answers to the survey. We further assessed sleep quality with the following items: questions about amount of sleep on weeknights, weekend nights, and whether or not participants take naps and for how long. However, these additional questions were ultimately not included because they lowered the PROMIS sleep questionnaire's internal consistency (α = .89).

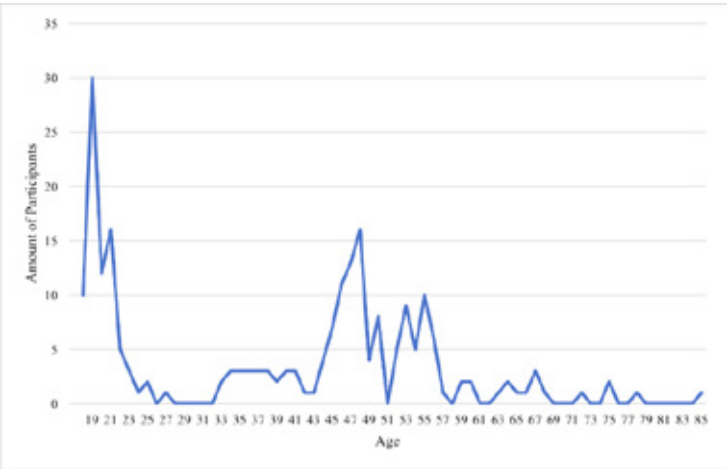

Figure 1 *This line graph represents the prevalence of the ages of the participants involved in this study.*

Dream Recall Frequency: dream recall was defined as the frequency at which a person could recall their dreams within a two-week period. Dream recall was measured with a self-report questionnaire that examined the frequency with which the participant is able to recall their dreams within a two-week timeline ($\alpha = .69$). This eight-item measure accounted for frequency on a seven-point scale—every morning (1), about every morning (2), every other morning (3), about two mornings a week (4), one morning a week (5), once during two weeks (6), and not once (7). For the purpose of running a regression, the answers for this questionnaire were computed for a mean and this mean was given a separate variable to serve as the dream recall frequency score (M=2.49, SD=3.51).

Short-Term Memory: STM is information stored for a temporary amount of time, typically ranging from 15 to 60 seconds. To assess STM, participants were told to try to memorize as much as they can in 30 seconds from a list of 15 words: eggs, flag, drawing, trial, rock, partner, apple, house, focus, life, mission, chair, favor, ice, and brain. Participants were not told that they would be recording the words from memory. After observing the words for 30 seconds, participants were redirected to a page that asked them to list as many of the words as they could remember. In order to run a regression, we had to compute the mean scores for the STM test, therefore adding a separate variable for the measure that was a calculation of the participants' mean. Their performance was calculated as the number of words correctly recalled, with higher scores indicating greater STM.

Results

Hypothesis 1: Dream Recall & Sleep Quality

We conducted a standard regression analysis to observe the relationship between dream recall and sleep quality. The results from these analyses can be referenced in Table 1. Sleep quality accounted for 1.1% of the variance in dream recall, $F(1, 203) = 2.27$, $p = .134$. Sleep quality did not make a significant contribution to the explanation of variance, and there was no relationship detected between sleep quality and dream recall ($\beta = .105$, $p = .134$).

Hypothesis 2: Sleep Quality & STM

We conducted another standard regression analysis to investigate the relationship between sleep quality and STM. Sleep quality accounted for 0.0% of the variance in STM, $F(1, 203) = .006$, $p = .938$. Sleep quality also did not predict with statistical significance STM scores ($\beta = -.005$, $R = .000$, $p = .938$).

Table 1 *Standard Linear Regressions on Sleep Quality, Dream Recall, and STM*

	R^2	R^2 Change	F Change	Beta
Sleep Quality & DR	.011	.011	2.265	.105*
Sleep Quality & STM	.000	.000	.006	-.005**

*p = .134

**p = .938

Hypothesis 3: Dream Recall & STM

We ran a hierarchical regression analysis in order to examine the relationship between dream recall and STM while controlling for sleep quality and age. The results are displayed in Table 2. Sleep quality and age were entered in the first step and they explained 3.3% of the variance in STM, $F(2, 202) = 3.49$, $p = .032$. For the second step of the regression we added dream recall. This did not explain any additional variance (0%), F change (3, 201) = .064, p = .075. The total variance explained by the model as a whole was 3.4%, F (3, 201) = 2.34, $p = .075$. In the final model, dream recall did not predict with statistical significance STM ($\beta = -.018$, $p = .80$). The control variable of age was a statistically significant predictor in STM ($\beta = -.183$, $p = .009$), but sleep quality did not predict with statistical significance STM ($\beta = -.008$, $p = .91$). There were no additional findings beside the variables assessed from the hypotheses.

Table 2 *Hierarchical Multiple Regression on Dream Recall and STM After Controlling for Age and Sleep Quality*

	R^2	R^2 Change	F Change	Beta
Dream Recall	.034	.000	.064	-.018*

*p = .80

Discussion

Our findings indicate that there is no relationship between dream recall and STM. The results also indicate that sleep quality does not predict dream-recall frequency or STM, thus

allowing us to reject all three of our hypotheses. We did, however, find a relationship between age and STM, implying that as a person ages, the quality of their STM decreases. This was not an initial focus of the present study; however, we found it important to recognize our demographic and control for this within our regression. We acknowledge that our findings differ from those of past literature and encourage those who with access to different resources to access these results.

Our first hypothesis—that dream recall is linked to sleep quality—was not supported. This contrasts prior research that an individual's recall ability was impacted by sleep quality (Elkin & Murray, 1974; Gradisar, Terrill, Johnston, & Douglas, 2008). However, many of the results from prior studies were based on an experimental method, which may have influenced the differences between our findings. Moreover, the current study indicates that if people are looking to improve the frequency with which they recall their dreams, they should not be concerned with their quality of sleep at night.

Our second hypothesis—that sleep quality is related to STM—was also not supported by our data. This again opposes prior research, which suggests that sleep quality may have a significant impact on performance of a STM task (Elkin & Murray, 1974; Gradisar, Terrill, Johnston, & Douglas, 2008). The differences in these findings are most likely due to the varying methods in each study, as previous research was often done via a controlled experiment many years prior to the introduction of research on measures for assessing sleep (Elkin & Murray, 1974). The present findings propose that people should not be concerned with their quality of sleep in regard to the testing of their STM. If one is looking to improve STM, they should look elsewhere, to other factors.

Lastly, we found no relationship between dream recall frequency and STM, and therefore must reject our third hypothesis. This implies that an individual's ability to recall their dreams does not predict the quality of STM. This is contrary to the majority of the previous literature that found significant differences in memory scores depending on dream recall frequency (LeWine, 2015; Martinetti, 1983). Our research indicates that dream recall frequency does not predict STM.

There are many potential explanations as to why we found these results, especially as to why they are different from those of previous literature. One of the main reasons is that a majority of previous research connecting dream recall and memory did not look at STM specifically, but other types of memory as well, such as long-term, explicit, or working memory. When formulating our hypotheses, we wanted to extend past research into other types of memory to see if we would find similar results. However, there was little to no past research that evaluated the relationship specifically between dream recall frequency and STM. By introducing the relationship between recall of dreams and short-term recall of words, we were inspecting a specific type of memory being recalled in terms of our contribution to this

area of research. Considering that what we were evaluating varied from that of previous research, it is understandable that our results varied. We also recognize that other factors that we did not account for may have impacted our results. Whether this be academic background, career, or overall intelligence, it is important to examine all factors in order to potentially uncover an unrecognizable similarity or component that may have more impact on a variable than we initially anticipated.

Another way to interpret these results is to accept that dream recall and STM are indeed not related. Although our conclusion is flawed by limitations, it is also possible to conclude that there is no relationship between these variables, especially considering that our research is more methodologically sound than previous research. Great efforts and attention were focused on developing a more rigorous study design than those of previous literature. When replicating similar research questions to past studies, we wanted to assure that our results were applicable to a broader population. To do this, we incorporated a broader sample size, set a wider age range, and did not limit participants to explicit genders or locations. We did do our best to avoid limitations, but limitations still may have impacted our results. Nonetheless, our study is an improvement in terms of diversity of the sample.

Limitations

Our research suffered from several limitations, which provides opportunities for improvement of future research. The measures of our research were limited because we did not have access to a sleep lab, nor did we expect participants to maintain a dream journal. We recognize that with these more objective measures the results would have more accurately captured the measurement of sleep quality and dream recall frequency, and they may have been more applicable to a broader population. Previous research sometimes used these features, which might account for part of the inconsistency between our findings and past work.

Our lack of demographic diversity could also have had an impact on our results. Our sample was primarily women, indicating that our findings may be most applicable to women rather than to men. Further, despite our participant ages ranging from 18 to 85, our survey predominantly collected data from young adults and midlife adults. Another limitation was our inability to find an established dream recall frequency scale that was not also seeking information regarding dream content.

Although our methods were robust against violations of assumptions, it is important to note that the multiple regressions conducted for STM and sleep quality violated the linearity assumption as shown by non-linear points on the normal P-P plot, suggesting deviations of normality. This is also true for the regressions conducted for sleep quality and dream recall. The scatter plot for the standard multiple regression with sleep quality and dream recall also

showed a violation of the normality and homoscedasticity assumptions represented on the plot, thus indicating that the variables could be maintaining the same finite variance.

In terms of future research, we first propose that a similar concept regarding our hypotheses be replicated, but use measures that more accurately capture the constructs for which we sought information by improving on our limitations. In order to validate our findings, we first propose that future research limits the restrictions that the current study was affected by. This body of research promotes the use of experimental studies to distinctively capture a causal relationship. This could come from measuring sleep quality in a sleep lab so as to more accurately capture sleep quality.

Conclusion

The most cogent interpretation of the current research indicates that there is no relationship between dream recall, sleep quality, and STM. Although no relationship was found, these results are still valuable to the research community within this field, particularly because it examined a new approach by testing the relationship between those three variables. This introduces more questions regarding the relationship between these variables, and further research is warrented. Because the results in this study declare inconsistent outcomes in comparison to past literature, they question prior findings and indicate that there are ties between dream recall, sleep quality, and STM. Future research should be conducted that avoids the limitations of our study as well as the other methodological flaws of previous research in order to validate which findings best capture the posed hypotheses and which are more accurately representative of a population.

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