

Learning Lucid Dreaming and its Effect on Depression in Undergraduates

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Abstract

The present study tested two hypotheses: 1) that lucid dreaming could be effectively taught through an online intervention, and 2) that lucid dreaming can alleviate depression as mediated by LOC. Surveys consisting of (lucid) dream frequency and recall scales (Schredl & Erlacher, 2004; Doll, Gitter, & Holzinger, 2009), Rotter's LOC scale (1966), and the most recent Beck Depression Index (BDI-II) were completed by college students. The experimental group was instructed to keep dream diaries throughout the whole study. Two weeks after the preliminary survey they were presented with a lucid dreaming intervention, which instructed them to practice reality checks throughout the day in order to attain lucidity at night. Lucid dreaming frequency was found to be directly correlated with depression ($p < 0.001$). Implications for therapy and suggestions for further research are suggested.

Keywords: depression, locus of control, lucid dreaming, control dreaming, BDI-II

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Sleep is an integral part of life. Animals will die in the lab if deprived of total sleep (Rechtschaffen & Bergman, 1995). Not even humans can avoid sleep and remain alive and sane. Sleep is necessary, and so are the functions that occur during sleep, particularly dreaming.

While not all dreams are recalled, everyone dreams. Research starting in the mid 20th century correlated dreaming with the sleep stage of Rapid Eye Movement (REM), which is commonly recorded from normal subjects in a lab setting (Aserinsky and Kleitman, 1953). Therefore, unless individuals suppress REM by drinking alcohol or taking antidepressants, it is safe to assume that most people dream. In fact, studies have shown that dreaming is necessary for health and wellbeing. For example, one study showed that rats deprived of REM-sleep will die of caloric and thermal dyscontrol, and even when impaired immunity was treated, the rats still died of “sleep deprivation” within an average of 35 days (Rechtschaffen, et.al. 1989). Such findings suggest that REM sleep, correlated with dreaming, is important for maintaining body weight, temperature, and immunity in homeothermic animals. Furthermore, in a study on humans, 3-5 days of REM-sleep deprivation resulted in cognitive deterioration and an involuntary bodily tendency for homeostatic catch up (Dement, 1960). Rechtschaffen et. al.’s (1989) study also revealed that total sleep deprivation killed rats within 19 days. Van Dongen et. al. (2003) reveals that total sleep deprivation seriously impairs waking neurobiological functions such as psychomotor vigilance, working memory and cognition. Though both REM and non-REM sleep are essential, and debate still centers around existence of non-REM dreams, this study looks at the self-reflectiveness found more in REM sleep (Purcell et. al., 1986).

Lucid dreaming is one form of dreaming just beginning to be explored and understood. A small but emerging body of research suggests that in addition to getting a full night of sleep

and dreaming, added benefits come to those who dream lucidly. Lucid dreaming is the awareness of being in a dream while continuing that dream without waking up (Blagrove & Tucker, 1994). Lucid dreaming is also complementary to and interactive with “control dreaming” (Purcell, Moffit, & Hoffmann, 1993), the ability to consciously control aspects of a dream such as flight, transmuting the body, summoning characters, changing scenes, or otherwise interact with the dream (LaBerge, 1985; Gackenbach & Bosveld, 1989). Evidence for the distinct nature of lucid dreaming from REM sleep comes from studies utilizing research technology such as that conducted by Aerinsky and Kleitman (1953), who illustrated that eye movements in REM sleep can be measured by electrooculogram (EOG) - electrodes near the eyes measuring the cornea-retinal electrical potential. Stephen LaBerge (1990) utilized the EOG in his doctoral thesis to confirm the existence of lucid dreaming by asking lucid dreamers to roll their eyes in a pattern distinct from regular REM. EEG evidence illustrates that “lucid dreaming constitutes a hybrid state of consciousness with definable and measurable differences from waking and REM sleep, particularly in the frontal region” (Voss et. al, 2009, 1191). FMRI studies have revealed that lucid dreaming involves dorsolateral prefrontal cortex activation (Nofzinger, et. al, 1997), an area that is inactive in normal REM sleep and is considered to be the site of executive function.

In addition to being a fascinating experience, lucid dreaming has been shown to have mental health benefits. Lucid Dreaming Treatment, LDT, is a therapeutic tool that has led to decreased levels of nightmare frequency (Spoormaker & van den Bout, 2006; Zadra & Pihl, 1997). Lucid dreaming has also been associated greater mental health (LaBerge, 1987; Gackenbach & Bosveld, 1991). For example, in a study by Doll, Gitter, and Holzinger (2009), Viennese volunteers were given surveys measuring mental health via the Trier Persönlichkeitsfragebogen (TPF, Becker, 1989), an Austrian measure of mental health, as well

as dream recall frequency and control (lucidity). The results of the study illustrated that frequent lucid dreamers, those with 2 lucid dreams a month or week, showed significantly better mental health (with depression as a sub-category) compared to rare-lucid and non-lucid dreamers.

Though Doll et. al.'s study illustrates the benefits of already being lucid, the researchers suggest that learning how to dream lucidly may have similar benefits for mental health and wellbeing, and articulate the need for a research agenda in this area.

Though many studies have utilized self-trained lucid dreamers, the skill can be learned. There are two main types of lucid dreams: dream induced (DILD) and wake induced (WILD). WILD requires the difficult task of maintaining steady awareness from waking through sleeping and into dreaming; since “transitions directly from the waking state to the REM sleep state are very rare” (LaBerge & DeGracia, 2000), this study focused on teaching DILD, an easier form of lucid dreaming to teach and learn. The two main approaches to DILD are a) self-inducing techniques and b) induction devices like Dreamlight (LaBerge & Levitan, 1995) or magnetic brain stimulation (Noreika, 2010), both of which are rather costly. The most successful self-induction techniques are, in turn, comprised of two approaches: a) critical state testing (Tholey, 1983; Zarda, 1992) and b) reflection-intention (LaBerge & Rheingold, 1990). Critical state testing involves “reality testing” (LaBerge & Levitan, 1989), the act of continuously asking oneself “am I dreaming?” while awake, so as to continue to do so while dreaming and become lucid. Reflective-intention techniques involve reflecting on one’s major dream signs (unstable text, fantastical imagery, etc.) before bed and intending to recognize them next time and become lucid (prospective memory). This technique is also known as Mnemonic Induction of Lucid Dreaming (MILD) (LaBerge, 1980; LaBerge & DeGracia, 2000; LaBerge & Levitan, 1995). Another technique is the Wake-Back-to-Bed (WBTB) technique in which participants schedule

an alarm to wake themselves an hour before their natural wake time, and upon wakening, focus on entering the upcoming or re-entering the previous dream. Although the (WBTB) technique (LaBerge, 1994) is effective in heightening lucidity, it involves disturbing the sleep cycle and may thus be less appealing to (or healthy for) college students. Both reality-testing and MILD techniques are proven methods of teaching lucid dreaming; they pose relatively little interference with sleep or daily functioning of the learners, and were thus selected as the methods of choice for this study. Furthermore, although many individuals learn to dream lucidly from reading about such techniques online, this study will be first to test the effectiveness of such an impersonal approach, as well as the effects of lucid dreaming, once learned.

Studies have shown a positive link between lucid dreaming and internalized locus of control (LOC) (Blagrove & Hartnell, 2000). LOC is the measure of how in control of their life an individual feels (Bar-Tal, 1977). Individuals with a strong internal LOC see themselves as active agents in shaping their external environments, whereas those with external LOC feel that outside forces (e.g. fate, chance, powerful others) control them (Rotter, 1966). Burger (1984) asserts that individuals with a high desire for control over their lives but an externalized locus of control are more likely to have suicidal thoughts and maladaptive behavioral patterns (i.e. seeking nonprofessional, rather than professional, help for depression). Empirical evidence also suggests that an individual's LOC is not set in stone; rather, it can be changed. For example, autogenic relaxation, a biofeedback technique of observing one's control over their own level of relaxation (measured by finger temperature & blood pressure), has shown significant success in moving from an externalized to internalized locus of control in adolescent alcoholics (Sharp, et.al 1997). In addition to other biofeedback-based relaxation methods (Derkowski, Derkowski, & Omizo, 1983), shifting from externalized to internalized LOC can be achieved through natural

methods like meditation (Bowen et. al., 2006) or physical activity (Parsons & Betz, 2001; Nir & Neumann, 1995). Being a natural biofeedback system with its own virtual reality component, lucid dreaming could prove to be an effective method to internalizing locus of control.

Just as lucid dreaming combines the natural process of sleep with the biofeedback system of dreaming, which may internalize LOC, lucid dreaming and LOC may combine to improve depression. An externalized LOC has been primarily correlated to depression in college students (Sandler & Lakey, 1982; Burger, 1984; Lefcourt, 1983; Benassi & Sweeney, 1988), whereas an internal locus of control is a prerequisite to adaptive functioning and is regarded among many researchers as an initial therapeutic goal (Lefcourt, 1966). The prevalence of depression and anxiety disorders in college students is estimated to be 15.6% for undergraduates and 13% for graduate students (Eisenberg, et.al., 2007). Moreover, not only is depression common, studies of changes in depression over time suggest that they have increased significantly. For example, in one study using a cohort of Midwestern schools, depression rates doubled significantly between 1989-2001 (Benton, Robertson, Tseng, Newton, & Benton, 2003), a trend mirrored in the Spring 2000 National College Health Assessment Survey (Kisch, Leino, & Silverman, 2005). Finally, depression has a negative effect on academic performance (Andrews & Wilding, 2004), is an enormous economic burden (Wang, Simon, & Kessler, 2003), and inhibits relational ability (Carnelley, Pietromonaco, & Jaffe, 1994). Although some researchers believe that depression is an evolved response in order to focus analytical skills on, and garner outside help towards, solving an individual's problem (Thomson, 2009): it is a detriment to the lives of college students, who could greatly benefit from alleviating their depressive symptoms, regardless of severity.

This study is intended to assess whether lucid dreaming can be effectively taught online to a group of college students and whether, once mastered, lucid dreaming can increase internal LOC and, in doing so, reduce depression scores. It will test two hypotheses: a) Lucid Dreaming can be effectively taught online and b) depression scores are mediated by increases in internal LOC scores that change as a function of enhanced lucid dreaming.

I expect that some of the proposed relationships will vary by demographic group. As females experience more emotionally distressing dreams per year and lack of perceived control over dreams (Wolcott & Strapp, 2002), it is expected that females will find lucid dreaming more challenging to master. On the other hand, a lack of gender bias is possible, as Holzinger (2009) found no significant gender difference for lucid dreamers and non-lucid dreamers. Although a few studies mention the effect of personality differences (Gackenbach, 1994; Prescott & Pettigrew, 1995; Blagrove & Hartnell, 2000; Schredl & Erlacher, 2004), most have been minimal in their statistical significance. LOC has been shown to change depending on race and ethnicity (Perry & Morris, 2006). Depression is clearly affected by counseling (Robinson, Berman, & Neimeyer, 1990), but less obviously so by spirituality (Nelson, et al., 2002), and such sleep factors as medication and sleep time (Argargun, Kara, & Solmaz, 1997).

This study aims to build upon lucid dreaming and depression research. Beyond studying the effectiveness of lucid dream induction techniques, this study looks at the efficacy of teaching it through an online medium. In addition, although most research of LD include samples of self-trained lucid dreamers, all of whom may have come to learn the ability in different ways, this study will control for such variability by assuring that each participant who attains lucidity does so through the same instruction. Moreover, in developing a model of lucid dreaming's effect on depression as mediated by LOC, this study will replicate Doll et al.'s (2009) which examined the

link between lucid dreaming and mental health (including depression). Their study used a German mental health scale called the TPF (Becker, 1989), whereas mine will quantify the results of lucid dreaming according to a scale widely used in America (BDI-II). The results of my thesis may add to the theories of LOC, LD and depression by developing a working model between the three. Furthermore, there are researchers who are trying to utilize lucid dreaming as a therapy against Post Traumatic Stress Disorder, but without any significant results so far (Spormaker & van De Bout, 2006). I am advocating utilizing this strategy against a more generalized mental issue - depression. If just the activity of learning to dream lucidly could ameliorate some of the symptoms of depression, it is worth further research. Perhaps directed lucid dreaming therapy, with patients confronting certain unapproachable family members (deceased or abusive) or overcoming phobias in the safety of their own mind, could be a new and useful way for individuals to improve their lives. Furthermore, self-directed lucid dreaming could improve general depression levels in large populations, all while they sleep.

Method

Participants

Study participants were recruited from Cornell university using three strategies: a web-based program for matching students with study participation opportunities (SUSAN), class-based recruitment by advertizing extra credit opportunities (in Human Development, Communications, Design and Environmental Analysis and Psychology courses) and through snowball sampling in which students with awareness of the study were also asked to invite their peers. Eligible students were 18 years or older, with no prior LD experience, and who were able to commit to participating for the entirety of the study. The initial sample consisted of 211

people, from which 14 were disqualified due to personal lucid dreaming training, 20 for high lucid dreaming frequency, and 2 for being under age 18, leaving a final sample of 175. Of these, 14.3% were males ($n=25$), 85.7% were females ($n=150$). Participants Races/Ethnicities included: 57.1% White ($n=100$), 21.1% Asian/pacific islander ($n=37$), 9.7% Other/biracial ($n=17$), 8.0% African American/Black ($n=14$), and 4.0% Hispanic/Latino ($n=7$).

Measures

Locus of Control Scale. Rotter's (1966) Internal/External Locus of Control scale was used to assess locus of control. The scale includes 22 paired statements, each denoting high or low LOC. For each pair of statements, participants are asked to choose which one they identify with most (e.g. "Capable people who fail to become leaders have not taken advantage of their opportunities" versus "Without the right breaks one cannot be an effective leader"). External LOC statements are scored as "1" and internal LOC as "0." The average grade determines LOC: above .5 indicates external and below .5 indicates internal. Rotter's scale is the most widely used in clinical tests. Internal reliability coefficients for the Rotter scale are between .65 and .79 (Rotter, 1966). Friedland et al. (1992) found Rotter's LOC scale to have a test-retest reliability, with a one-month time lag, between .60 and .83.

Beck Depression Inventory-II (BDI-II). The test consists of 21 multiple choice questions on how participant felt within the past two weeks. For example, the question of "Past Failure" has 4 answers choices varying in degree with corresponding point values (values not shown to participants) – I do not feel like a failure (0), I have failed more than I should have (1), As I look back, I see a lot of failures (2), I feel I am a total failure as a person (3). Level of depression is determined by score: minimal (0-14), mild (14-20), moderate (20-29), and severe

(29-63). This test is the second and most recent version of the reputable Beck Depression scale, and is correlated to DSM-IV criteria for depression (Brantley, Thomas, & Mehan, 2000). The coefficient alphas of the BDI-II for college samples ranges from .89 (Wisman, Perez, & Ramel, 2000) to .93 (Beck, Steer, & Brown, 1996). Validity and reliability were heavily supported by Whisman et al., (2000) and Beck et al., (1996).

Lucid Dream Recall & Control Questionnaire. A section of the Dream Recall & Control Questionnaire was dedicated to measuring frequency of control and lucid dreams. Likert scale questions were adapted from Doll, Gitter, & Holzinger's (2009) questionnaire and asked participants how frequently they "Become aware of being in a dream and continue it without waking up (lucid dream)" and "Take control of the dream." Follow-up fill-in numerical questions were included to avoid potential ceiling effects of the seven-point scale. After the intervention, a participant fidelity question, "how often do you practice reality checks?" was presented to any participants attributing their lucidity to deliberate training, with a numerical scale to answer. "Which reality checks did you use?" was also added, with options for "finger stretching, light switching, and time/small text checking."

Dream Recall Questionnaire. In addition to measuring lucidity, the rest of the questionnaire was used to monitor the dream recall frequency of all dreamers as well as other relevant aspects of sleeping and dreaming. Dream recall frequency (DRF) was measured by a seven-point scale modified after Schredl's (2002) dream questionnaire, "how often do you remember your dreams?" (0 = never, 1 = less than once a month, 2 = about once a month, 3 = twice or three times a month, 4 = about once a week, 5 = several times a week and 6 = almost every morning.) The questionnaire was recoded to determine the DRF per week: 0 = 0, 1 = 0.125, 2 = 0.25, 3 = 0.5, 4 = 1.3, 5 = 3.0, 6 = 7 mornings with dream recall per week. Additional

fill-in numerical questions were included to avoid potential ceiling effects. Also, a question about *déjà rêvé*, the sensation one is experiencing an event previously dreamt, was added due to its significant correlation to DRF (Funkhouser & Schredl, 2010). In addition, a seven-point scale question was included to determine nightmare frequency, assumed to be the colloquial definition of a scary REM dream, as it has been significantly correlated with lucid dream frequency (Stepansky et al., 1998; Schredl & Erlacher, 2004).

Later surveys also included questions to determine participant fidelity. Such questions included, “when did you write down your dreams?” (morning, randomly, I didn’t write down my dreams). An additional question adapted from Schredl, Nußberg and Weiler (1996), was posed to determine attitude towards dreams as either positive - “some dreams give me creative ideas or insight for my daily life,” “I like talking with others about my dreams,” neutral - “I am indifferent to my dreams,” or negative - “dreams are a waste product of the brain.”

Demographics/Controls. In the demographic portion, participants entered information regarding their gender, age, race/ethnicity, sleep or psychological medication/therapy intake, meditation frequency, alcohol/drug opinions, average weekday and weekend sleep times, sleep schedule consistency, and lightness of sleeping. The question “have you been sick this week and what have you been using for it?” was added as well.

Procedure

Initial group was invited to fill out a preliminary survey (see appendix). The survey consisted of a basic demographic questionnaire, Rotter’s (1966) LOC scale, Beck Depression Index - II, and the dream recall/control questionnaire. Upon the first survey, participants who already showed a high lucidity were pinpointed as lucid dreamers and disqualified. As I wish to

illustrate the beneficial effects of learning lucid dreaming, currently lucid dreamers would not have expressed the learning effects I hoped to observe.

At the end of the first survey, participants were randomly grouped. The control group was instructed to continue their normal sleeping routine while the experimental group was initially instructed to keep a notebook or pen and pad of paper by their bed, and to write as much of their dream as they remember in the morning. I did not ask for dream reports due to the high correlation between dream diaries and questionnaires in reporting dream recall ($r = .557$, $N = 285$) (Schredl, 2002). Both groups received 4 more weekly surveys with LOC, BDI-II, and Dream questionnaires along with reminders to either continue sleeping normally or writing in their journal, as well as to avoid personal research about lucid or control dreams.

After 2 weeks, the experimental group was then given additional instructions on Reality Testing techniques of lucid dream induction (Tholey, 1983; Levitan, 1989), as explained in the literature review above. Participants were told that they would be taught how to control their dreams, that they should repeat “reality checks” throughout their waking day, in order to continue doing so while dreaming. Although previous research suggested to do reality checks randomly throughout the day, the best times were advised as when something bizarre occurs: a discontinuity, an improbable combination, or an improbable identity, or pretty much whenever they believe they might be dreaming. Participants were told that in dreams there are certain constancies that can be revealed through reality checks. Participants were given a brief description of the following reality checks (hands, print, and light) and their waking and dreaming reactions. In dreams, hands will appear abnormal (pixilated/blurry/disfigured) and can be stretched like rubber, relative to normal skin elasticity. Small print, particularly text and time, are inconsistent and change at a second glance (Lagerbe, 1992), double takes on clocks and

reading material would reveal such oddities. Furthermore, light levels in dreams are constant and cannot be changed by a light switch (Hearne, 1981); though participants were asked to practice only on-off tests, as an inability to turn on a light may be due to reasons other than being in a dream. Participants were also instructed to tell themselves before going to sleep that they will do a reality check and become lucid. In addition, participants were told to remain calm upon becoming lucid through deep breathing, and to either continue the dream with newfound awareness or change it however they wish. Participants were advised to rub their hands (LaBerge, DeGracia, & Zimbardo, 1999) together if the dream or their dream vision began to fade and to attempt to resist distraction from lucidity by the dream. After 2 more weekly surveys, participants were then debriefed and thanked for their participation.

Statistical Analysis

All data was uploaded onto a spreadsheet and analyzed using PASW Statistics 18 package (SPSS) as well as STATA/MP 11.1. The descriptive statistics were initially explored, with an eye towards missing data, mis-entered data, and outliers. Cross tabulations of all continuous variables, frequencies of categorical variables, means, and standard deviations were determined. Participants were culled from the data-set due to initial deliberate lucid dream training (n=14) or being underage (n=2); there was no major demographic shift upon their absences. Univariate ANOVA tests were used to correlate multiple demographics to the variables of interest: LDF, LOC, and BDI-II in order to determine confounding variables. Means and standard deviations of variables of interest were also compared between experimental and control groups at 3 time points, to determine pre-test and post-test differences.

For the first hypothesis, a Generalized Linear Mixed Model with fixed and random effects (i.e. this repeated measure) was used to determine the correlation between group and lucid dreaming frequency. This analysis accounts for participants' repeated measures over time as correlated with their earlier data, a common longitudinal study problem.

For my second hypothesis, the Generalized Linear Mixed Model was again used to illustrate the mediation model between Lucid Dreaming, Depression, and LOC. This method established the regression relationships between LD (predictor) and BDI (as the outcome), LD and LOC (the predicted mediator), LOC and BDI, and finally between LOC+LD and BDI, which would have allowed for identification of a change in the coefficient between LD and BDI when the mediator is included. Coefficients reduced to 0 were deemed full mediation, whereas coefficients not fully changed were labeled partial mediation. After all the tests were run, a causal diagram (Baron & Kenny, 1986) was drawn to illustrate the mediation model.

Results

Preliminary analysis

The first analysis conducted was to determine that the control group and experimental group were not significantly different at the onset of the study. Comparing the counts and percentages of each demographic and their sub-groups reveals slight yet insignificant differences between the control and experimental groups.

Insert Table 1

Lucid Dream Induction Training

The first hypothesis was intended to test whether lucid dreaming could be taught or enhanced via online intervention. First, demographic data was analyzed by univariate ANOVA to find confounding variables correlated with lucid dreaming frequency (LDF). I found that dream recall frequency ($F(1,55)=4.479, p < 0.05$) and control dreaming frequency ($F(1,55)=23.513, p < 0.01$), and dream journaling ($p < 0.05$), were positively correlated with LDF such that those with better dream journaling and (control) dream recall frequency were more likely to report lucid dreams. In addition, sleep schedule consistency trends towards a negative correlation with LDF ($p = 0.059$). The rest of the demographic variables were not significantly correlated to LDF. To test the hypothesis itself, a repeated measure, generalized linear mixed model (GLMM) with fixed and random effects was used to account for participants' repeated measures as correlated with their earlier data, a common longitudinal study problem. The analysis revealed no significant correlation between group and lucid dreaming frequency. The average number of lucid dreams for the experimental group at the end of the survey was neither a significant increase from the experimental group at the beginning of the study nor significantly different than the control group at the end of the study.

Insert Table 2.

LD, LOC, and BDI-II

For the second hypothesis, a generalized linear mixed model was used to illustrate the mediation between lucid dreaming, depression, and LOC. First, demographic data was analyzed by univariate ANOVA to find variables confounding with LOC and BDI. The results show that ethnicity was significantly correlated with LOC ($F(4,47) = 3.75$ ($p < 0.05$)), and the following variables were positively correlated with BDI-II ($p < 0.05$): sleep medication $F(1,50) = 6.98$, counseling $F(1,50) = 5.10$, meditation $F(2,50) = 3.94$, average weekend sleep $F(5,50) = 3.45$, and spirituality $F(2,50) = 5.27$. Controlling for these confounding variables (fixed effects), as well as variation/variability among individuals over time (random effects), a generalized linear mixed model analysis was used: between LDF (predictor) and BDI (as the outcome), LDF and LOC, LOC and BDI, and finally between LOC+LDF and BDI. The GLMM revealed a significant correlation between LDF and BDI-II as well as between LOC and BDI-II, but not between LDF and LOC, therefore no mediation was possible and the regression between LDF+LOC and BDI-II was not run.

Insert Figure 3.

Discussion

In this study, I set out to test two hypotheses. The first hypothesis was that lucid dreaming could be effectively taught through an online medium. Since the online intervention used did not significantly increase the lucid dreaming frequency of the experimental group, this hypothesis is not supported, but results did echo previous finding that lucid dreaming is correlated with dream recall frequency (Schredl, 2004) and control dreaming frequency (Purcell,

Moffit, & Hoffmann, 1993). The second hypothesis was that lucid dreaming could alleviate depression as mediated by locus of control. While not supported, this hypothesis did yield some interesting results. Testing of the second hypothesis showed no relationship between locus of control and lucid dreaming, invalidating any mediation model. The linear relationship between locus of control and depression supports previous findings, which show that LOC, moving from internal to external, predicts greater depression (Sandler & Lakey, 1982; Burger, 1984; Lefcourt, 1983; Benassi & Sweeney, 1988). A novel finding, however, is that depression is positively correlated with lucid dreaming frequency. These findings depart from previous literature by Doll, et. al. (2009), stating that lucid dreaming is beneficial for mental health (depression included). Rather, it seems as though lucid dreaming and depression are very curious bedfellows, as the results suggest that individuals with greater depression have more lucid dreams.

How might this finding be explained? The link between depression and lucid dreaming may come as a function of the fact that depression has been associated with greater REM sleep (Berger, 1993), the stage associated with lucid dreaming. Depressed individuals either sleep more (hypersomnia), and therefore dream more and have more chances to become lucid, or go right into REM sleep between bouts of insomnia, which could allow for a Waking Induction of Lucid Dreaming. Or perhaps training for lucidity, attempting to force consciousness at a time of passive rest, is stressing the student mind? Studies have shown the harm of extensive focused attention, and the necessity of non-directed attention (Kaplan, 1995). Could it be that the mind needs randomness, to let go of control and follow the dream like a white rabbit down its hole? Another possible explanation is that lucid dreaming is an evolutionary adaptation to the need for high introspection during times of stress and struggle. Such an explanation is in keeping with the

theory of functional depression (Andrews and Thomson, 2009), which argues that depression serves an evolutionary purpose of forcing individuals to self-reflect on sources of distress as a step toward remediation. This theory suggests that the very symptoms of (general) depression: anhedonia, social isolation, rumination and hypersomnia limit the individual from focusing their analytical thinking on anything other than the source of depression, thus enhancing likelihood of problem focused action. Hagen (2003) states that the social costs to those dependent on the depressed individual increase the desire to help find a solution, either through their direct assistance or through professional help. Since dreaming is also known to function as a problem solving vehicle for the unconscious, lucid dreaming could be one more facet of this theory of functional depression, wherein the individual can actively and mindfully sort through their inner world, confer with their dream characters, find insight and bring resolution to the issues at hand.

So does lucid dreaming cause depression or does depression cause lucid dreaming? Since this intervention did not cause lucidity, there can be no claim to causality of depression. Before any implications and theoretical claims can be made, the relationship between lucid dreaming and depression requires further illumination. In order to do that, this study needs to be replicated.

Future researchers should note the strengths of this study, which include the fact that the on-line nature of the study gathered twice as many participants as expected. With e-mails reminding and linking to online surveys, and no need to physically go to a lab, participants were able to answer whenever was convenient for them during each study weekend. The fact that the survey, based on the latest dream-based blockbuster hit, "Inception," was advertized throughout campus and presented before relevant classes likely enhanced response as well. The combination of ease of participation, intrigue at the theme of sleep, and the large amount of extra

credit attracted a large sample size to the study, allowed for a greater sample size to work with. Despite the higher than expected sample size, however, this study's college sample is still not a generalizable population. In order to produce more generalizable results, I suggest generating a larger sample size through widespread recruiting across multiple campuses, offering monetary incentives to students outside the psychology-related majors, and testing for between-major differences. Perhaps utilizing a population with a more consistent sleep schedule (i.e. high school students or undergraduates at summer school) would allow for better results. In addition, missing data, particularly in the LOC and BDI scales, may have biased results. Informal assessment of the cases of this missing data suggest that it is due to either forgetfulness, indecision between LOC statements, or discomfort with depression questions. Perhaps a Likert scale version of Rotter's (1966) LOC scale and another, less threatening depression survey would reduce missing data. Beyond missing data and sample size, the intervention method requires further reworking.

Although the intervention did not significantly improve the lucid dreaming frequency of the experimental group, these results do not invalidate lucid dreaming as a learnable skill. I believe that the weaknesses of this lucid dreaming intervention were those of time, participant fidelity, and measurement. While LaBerge & Levitan (1989) state that non-lucid psychology students can learn to dream lucidly within two weeks, Tholey (1983) argues that the process takes up to a month or more for individuals at baseline; for the sake of future studies, a longer training period may be necessary to see a significant increase in lucid dreaming frequency. To improve the chances of participant fidelity, future researchers should consider supplying notebooks and pens/pencils, which would allow more participants to write down their dreams, especially if the notebook is titled "Dream Journal." Whereas this study did not monitor fidelity

(rate of dream journaling or reality checking) an online dream journal such as that found on lucidipedia.com could be useful as it can be checked for intervention compliance, although it is less accessible than a physical notebook and may also require dream journal judging. For reality check fidelity, perhaps a pager system could be used to remind participants to conduct reality checks. Finally, although EEG was economically unfeasible at this stage, future studies should consider a longer term sleep study using EEG recording devices, looking for LaBerge's (1990) eye-rolling or Voss et. al.'s (2009) lucid dreaming 40Hz EEG signature, for more reliable LDF scores than self-report measures. The ZEO sleep trainer is a portable EEG device that could be modified to signal lucidity. As REM is more powerful in the morning (Carskadon & Dement, 2000), the ZEO device would also record sleeping and waking times (unchecked in this study) in its in-depth, non-obtrusive sleep records. With these modifications in place, I truly feel that lucid dreaming can be learned online and better analyzed in respect to LOC and depression.

The results of this experiment did not support Blagrove & Harnell's (2000) correlation between LOC and LDF, but there may yet be a mediation model between LDF, LOC, and BDI to discover. Future research should continue to look into the relationship between lucid dreaming and depression through the same lens of LOC, but from another angle. Pyszczynski and Greenberg (1987) have speculated that depressed individuals think a great deal about themselves (Rude 2004), therefore, depression has more to do with simply LOC but valence as well. Do the good things happen because of fate? Do the bad things happen because of me? In addition, Burger (1984) asserts that individuals with a high desire for control over their lives but an externalized locus of control are more likely to have suicidal thoughts and maladaptive behavior patterns (i.e. seeking nonprofessional, rather than professional, help for depression). Future studies should utilize a more nuanced version of LOC, accounting for more factors and giving a

clearer, more lucid picture on the effects of lucidity as it pertains to locus of control - perhaps even a mediation model could be extrapolated from this future data.

Finally, if these findings could be replicated by future studies, it may lead to interesting changes in the field of dream research as well as some therapeutic implications. Lucid dreaming is more complicated than a means to an end of depression; rather, it may be a way for the mind to look within itself and learn something, while perhaps defying the laws of reality and having a bit of fun, too. Instead of immediately popping pills when signs of depression arise, the general population could use their natural introspection (and the lucid dreaming that comes with it) to seek resolution of their issues. Individuals could challenge the stigma of depression as a disease to be cured (a major issue in medication adherence), and consider the function of this condition as a path to further self-discovery and conflict resolution. In addition to lucidly interacting with one's own dream characters for answers and assistance, individuals can realize "depression" as a time to ask for help. As Cornell president David Skorton so aptly stated in response to the heightened need for improved mental health on campus, "if you learn anything at Cornell, please learn to ask for help. It is a sign of wisdom and strength" (university statement, March 12, 2010). Reducing the stigma of depression as an unmentionable topic would allow more depressed individuals to reach out to psychiatrists and psychologists for the treatments that will best help them understand themselves, their dreams, and their depression. Therapists may also consider utilizing lucid dreaming therapy in their practice, especially with depressed patients, as lucid dreaming is higher in the depressed population, LDT may be more effective for the more severely depressed population. Though the field of lucid dream research requires additional study before implementation, this dream of a more lucid population should be a recurring one. If

individuals will themselves to be free of depression, it is no dream; it is a lucid dream (Herzl, 1997).

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Appendix

Demographic Data

Please tell us about yourself

1. Gender

Please tell us your gender

(participants selected one of the following choices from a drop down menu)

- a. Male
- b. Female
- c. Female-to-male transgender
- d. Male-to-female transgender
- e. Other (please specify):

2. Race/Ethnicity

Please describe your race/ethnicity below.

(participants selected one of the following choices from a drop down menu)

- a. White/Caucasian
- b. African-American/Black
- c. Hispanic/Latino
- d. Asian or Pacific Islander
- e. Native American
- f. Other (please specify):

3. Health

Please let us know any health issues and treatments you are receiving.

(participants could check off any or none)

- a. Taking prescription medication
- b. Taking medication for sleep (ambien, etc.)
- c. Taking medication for anxiety, depression, or any other mental health issue
- d. Receiving counseling/therapy
- e. None
- f. Other (please specify):

4. Alcohol Opinions

Please give us your opinion on alcohol consumption. Alcohol is best consumed:

(participants selected one of the following choices from a drop down menu)

- Not at all
- Once a month
- Socially on weekends (1-3 drinks a night)
- 1 drink with a meal
- 4+ a weekend night
- At least one drink a day
- No opinion

5. Other Drug Opinions

Please give us your opinion. Other acceptable drug usage includes:

harder drugs include: cocaine, methamphetamines, prescription drugs, etc.

(participants selected one of the following choices from a drop down menu)

- Marijuana socially
- Marijuana daily
- Harder drugs socially
- Harder drugs daily
- One should never use drugs
- No opinion

6. Average Sleep Weekends

What is the average amount of time (in hours) you get to sleep per night on Weekends?

- a. (participants selected a number between 1 and 14 from a drop-down menu)

7. Average Sleep Weekday

What is the average amount of sleep (in hours) you get per night on weeknights?

- a. (participants selected a number between 1 and 12 from a drop-down menu)

8. Sleep Schedule Consistency

How consistent is your sleep schedule?

- a. Very consistent
b. Somewhat consistent
c. Somewhat inconsistent
d. Very inconsistent

9. Meditation frequency

How often do you meditate?

- a. Not at all
b. Infrequently
c. Frequently

|

Dream Frequency/Attitude/Control Questionnaire:

Please tell us how often you:

	Never	Less than Once a Month	Once a Month	2-3 Times a Month	Once a Week	2-3 Times a Week	Almost every Morning / Daily
Remember your dreams?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have nightmares?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Find yourself in a situation that you have already dreamed of in a similar way (déjà reve)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Become aware of being in a dream and continue it without waking up (lucid dream)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take control of the dream?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1. How many dreams did you remember this week? (please type number)
2. How many dreams did you remember this week where you were aware of dreaming and continued the dream (had a lucid dream)? (please type number, or skip if none occurred)
3. How many dreams did you remember this week where you were in control of the dream? (please skip if none occurred)
4. How did you become lucid or in control of your dream?
 - Spontaneous
 - Deliberate training
 - relaxation techniques

LOC Scale

Please choose which answer of the pair resonates with you the most.

1.
 - a. Many of the unhappy things in people's lives are partly due to bad luck.
 - b. People's misfortunes result from the mistakes they make.
2.
 - a. One of the major reasons why we have wars is because people don't take enough interest in politics.
 - b. There will always be wars, no matter how hard people try to prevent them.
3.
 - a. In the long run people get the respect they deserve in this world
 - b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries
4.
 - a. The idea that teachers are unfair to students is nonsense.
 - b. Most students don't realize the extent to which their grades are influenced by accidental happenings.
5.
 - a. Without the right breaks one cannot be an effective leader.
 - b. Capable people who fail to become leaders have not taken advantage of their opportunities.
6.
 - a. No matter how hard you try some people just don't like you.
 - b. People who can't get others to like them don't understand how to get along with others.
7.
 - a. I have often found that what is going to happen will happen.
 - b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
8.
 - a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
 - b. Many times exam questions tend to be so unrelated to course work that studying is really useless.
- 9.

- a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
 - b. Getting a good job depends mainly on being in the right place at the right time.
- 10.
- a. The average citizen can have an influence in government decisions.
 - b. This world is run by the few people in power, and there is not much the little guy can do about it.
- 11.
- a. When I make plans, I am almost certain that I can make them work.
 - b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
- 12.
- a. There are certain people who are just no good.
 - b. There is some good in everybody.
- 13.
- a. Most of the time I can't understand why politicians behave the way they do.
 - b. In the long run the people are responsible for bad government on a national as well as on a local level.
- 14.
- a. What happens to me is my own doing.
 - b. Sometimes I feel that I don't have enough control over the direction my life is taking.
- 15.
- a. People are lonely because they don't try to be friendly.
 - b. There's not much use in trying too hard to please people, if they like you, they like you.
- 16.
- a. Many times I feel that I have little influence over the things that happen to me.
 - b. It is impossible for me to believe that chance or luck plays an important role in my life.
- 17.
- a. Sometimes I can't understand how teachers arrive at the grades they give.
 - b. There is a direct connection between how hard I study and the grades I get.
- 18.
- a. With enough effort we can wipe out political corruption.
 - b. It is difficult for people to have much control over the things politicians do in office.

19.
 - a. In the long run the bad things that happen to us are balanced by the good ones.
 - b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
20.
 - a. It is hard to know whether or not a person really likes you.
 - b. How many friends you have depends upon how nice a person you are.
21.
 - a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
 - b. There really is no such thing as "luck."
22.
 - a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
 - b. By taking an active part in political and social affairs the people can control world events.
23.
 - a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
 - b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.
24.
 - a. In my case getting what I want has little or nothing to do with luck.
 - b. Many times we might just as well decide what to do by flipping a coin.

Beck Depression Inventory-II (BDI –II)

This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Select the number beside the statement you have picked. If several statements in the group apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness
 0. I do not feel sad.
 1. I feel sad much of the time.
 2. I am sad all the time.
 3. I am so sad or unhappy that I can't stand it.
2. Pessimism
 0. I am not discouraged about my future.
 1. I feel more discouraged about my future than I used to be.
 2. I do not expect things to work out for me.
 3. I feel my future is hopeless and will only get worse.
3. Past Failure
 0. I do not feel like a failure.
 1. I have failed more than I should have.
 2. As I look back, I See a lot of failures.
 3. I feel I am a total Failure as a person.
4. Loss of Pleasure
 0. I get as much pleasure as I ever did from the things I enjoy.
 1. I don't enjoy things as much as I used to.
 2. I get very little pleasure from the things I used to enjoy.
 3. I can't get any pleasure from the things I used to enjoy.
5. Guilty Feelings
 0. I don't feel particularly guilty.
 1. I feel guilty over many things I have done or should have done.
 2. I feel quite guilty most of the time.
 3. I feel guilty all of the time.
6. Punishment Feelings
 0. I don't feel I am being punished.
 1. I feel I may be punished.
 2. I expect to be punished.
 3. I feel I am being punished.
7. Self-Dislike
 0. I feel the same about myself as ever.
 1. I have lost confidence in myself.
 2. I am disappointed in myself.
 3. I dislike myself.
8. Self-Criticalness
 0. I don't criticize or blame myself more than usual.
 1. I am more critical of myself than I used to be.

2. I criticize myself for all of my faults.
3. I blame myself for everything bad that happens
9. Suicidal thoughts or wishes
 0. I don't have any thoughts of killing myself
 1. I have thoughts of Killing myself, but I would not carry them out.
 2. I would like to kill myself
 3. I would kill myself if I had the chance.
10. Crying
 0. I don't cry anymore than I used to.
 1. I cry more than I used to.
 2. I cry over every little thing.
 3. I feel like crying, but I can't.
11. Agitation
 0. I am no more restless or wound up than usual.
 1. I feel more restless or wound up than usual.
 2. I am so restless or agitated that it's hard to stay still.
 3. I am so restless or agitated that I have to keep moving or doing something
12. Loss of Interest
 0. I have not lost interest in other people or activities.
 1. I am less interested in other people or things than before.
 2. I have lost most of my interest in other people or things.
 3. It's hard to get interested in anything.
13. Indecisiveness
 0. I make decisions about as well as ever
 1. I find it more difficult to make decisions than usual.
 2. I have much greater difficulty in making decisions than I used to.
 3. I have trouble making any decisions.
14. Worthlessness
 0. I do not feel I am worthless
 1. I don't consider myself as worthwhile and useful as I used to.
 2. I feel more worthless as compared to other people.
 3. I feel utterly worthless.
15. Loss of Energy
 0. I have as much energy as ever.
 1. I have less energy than I used to have.
 2. I don't have enough energy to do very much.
 3. I don't have enough energy to do anything.
16. Changes in Sleeping Pattern
 0. I have not experienced any change in my sleeping pattern.
 1. I sleep somewhat more/less than usual.
 2. I sleep A LOT more/less than usual.
 3. I sleep most of the day / I wake up 1-2 hours early and can't get back to sleep.
17. Irritability
 0. I am no more irritable than usual.
 1. I am more irritable than usual.
 2. I am much more irritable than usual.

3. I am irritable all the time.
18. Changes in appetite
0. I have not experienced any change in my appetite.
 1. My appetite is somewhat less/greater than usual.
 2. My appetite is MUCH less/greater than usual.
 3. I have no appetite at all / I crave food all the time.
19. Concentration Difficulty
0. I can concentrate as well as ever.
 1. I can't concentrate as well as usual.
 2. It's hard to keep my mind on anything for very long.
 3. I find I can't concentrate on anything
20. Tiredness or Fatigue
0. I am no more tired or fatigued than usual
 1. I get more tired or fatigued more easily than usual
 2. I am too tired or fatigued to do a lot of the things I am used to
 3. I am too tired or fatigued to do most of the things I used to do
21. Loss of interest in sex
0. I have not noticed any recent change in my interest in sex
 1. I am less interested in sex than I used to be
 2. I am much less interested in sex now
 3. I have lost interest in sex completely

Experimental group instructions:

Thank you for helping us with our study. For the duration of this month, please keep a writing utensil and a pad of paper or journal next to your bed, please go set this up right now. When you wake up in the morning, please write down as much of your dream(s) as you can. Do not worry about legibility or explanation, we will not ask you to turn it in, just write as much of the scene(s) in as much detail you can recall as soon as you wake up. No matter how little you remember, every little bit each morning helps. Please do not attempt to learn anything about Lucid or Control dreams for the duration of this experiment. We appreciate your continued input in the next 4 weekly surveys. If by any chance discussing your mood or emotional state has troubled you, or if you feel the need for any counseling or therapy, please do not hesitate to contact your nearest help line: Cornell's Counseling and Psychological Services (CAPS) - 1-607-255-5155, <http://www.gannett.cornell.edu/services/counseling/caps/> Cornell's Empathy, Assistance, & Referral Service (EARS) - 255-EARS (255-3277), <http://ears.dos.cornell.edu/> Thank you again for your assistance!

Control Group Instructions:

Thank you for helping us with our study. Please continue your normal routine and answer the next 4 weekly surveys. Please do not attempt to learn anything about Lucid or Control dreams for the duration of this experiment. If by any chance discussing your mood or emotional state has troubled you, or if you feel the need for any counseling or therapy, please do not hesitate to contact your nearest help line: Cornell's Counseling and Psychological Services (CAPS) - 1-607-255-5155, <http://www.gannett.cornell.edu/services/counseling/caps/> Cornell's Empathy, Assistance, & Referral Service (EARS) - 255-EARS (255-3277), <http://ears.dos.cornell.edu/> Thank you again for your assistance!

Table 1. Characteristic of Study Group (N=175*)

Characteristic	Experimental Group No.(%)	Control Group No.(%)
Gender		
Male	11(12.8)	14(15.7)
Female	75(87.2)	75(84.3)
Race/Ethnicity		
Black	6(7.0)	8(9.0)
Hispanic	3(3.5)	4(4.5)
Asian	17(19.8)	20(22.5)
Other/Biracial	8(9.3)	9(10.1)
White	52(60.5)	48(53.9)
Health		
Prescription Medication	19(22.1)	17(19.1)
Sleep Medication	1(1.2)	3(3.4)
Mental Health Medication	8(9.3)	4(4.5)
Counseling/therapy	5(5.8)	6(6.7)
None	50(58.1)	62(69.7)
Meditation Frequency		
Never	65(75.6)	75(84.3)
Infrequently	17(19.8)	11(12.4)
Frequently	4(4.7)	3(3.4)
Alcohol opinion - Alcohol is best consumed:		
No opinion	3(3.5)	5(5.6)
Not at all	15(17.4)	15(16.9)
Once a Month	11(12.8)	10(11.2)
Socially on weekends (1-3)	45(52.3)	46(51.7)
4+ a weekend night or more	12(14.0)	13(14.6)
Other Drug Opinions –		
No Opinion	15(17.4)	6(6.7)
One should never use drugs	43(50.0)	51(57.3)
Marijuana Socially	25(29.1)	30(33.7)
Marijuana Daily	3(3.5)	0(0.0)
Harder Drugs socially	0(0.0)	2(2.2)
Age		
18-25	85(98.8)	88(100.0)
26-34	1(1.2)	0(0.0)
Spirituality		
Very Spiritual	12(14.3)	10(11.4)
Somewhat	38(45.2)	44(50.0)
Not at all Spiritual	34(40.5)	34(38.6)

*The sum of subgroup numbers may not be equal to the total 174 because of missing data.

Table 1. Characteristic of Study Group ($N=175^*$)

Characteristic	Experimental Group No.(%)	Control Group No.(%)
Average Sleep Weekends (hrs)		
6	4(4.7)	6(6.7)
7	7(8.1)	11(12.4)
8	27(31.4)	30(33.7)
9	29(33.7)	29(32.6)
10 \leq	19(22.1)	13(14.6)
Average Sleep Weekday (hrs)		
≤ 5	9(10.4)	10(11.2)
6	18(20.9)	19(21.3)
7	27(31.4)	35(39.3)
8	27(31.4)	22(24.7)
9 \leq	5(5.8)	3(3.4)
Sleep Schedule Consistency		
Very Consistent	13(15.1)	15(16.9)
Somewhat Consistent	49(57.0)	47(52.8)
Somewhat Inconsistent	14(16.3)	19(21.3)
Very Inconsistent	10(11.6)	8(9.0)
Sleeper Type		
Light Sleeper	16(18.8)	15(16.9)
Normal	49(57.6)	56(62.9)
Heavy Sleeper	20(23.5)	18(20.2)

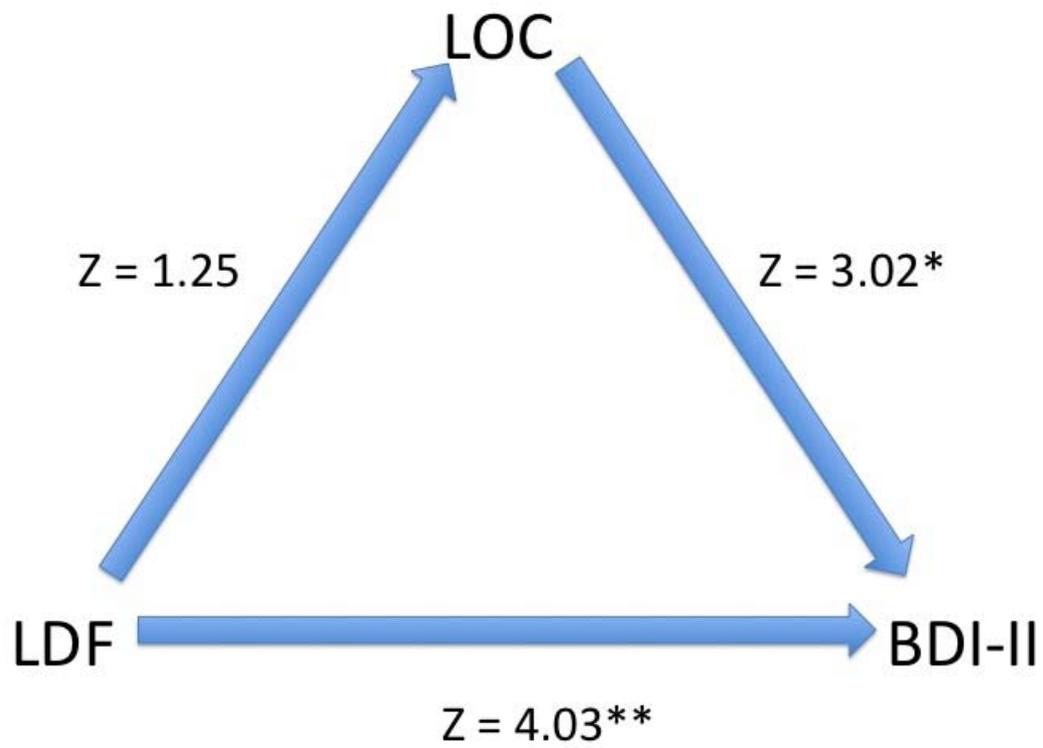
*The sum of subgroup numbers may not be equal to the total 174 because of missing data.

Table 2. Means and standard deviations of variables of interest by time and group.

Variable	Controls			Experimental			GLMM Sig. Vs. Group
	Time 1 M(SD)	Time 3 M(SD)	Time 5 M(SD)	Time 1 M(SD)	Time 3 M(SD)	Time 5 M(SD)	
LDF	2(1)	2(1)	2(1)	2(1)	2(1)	2(1)	Z= -1.34
LOC	0.54(0.16)	0.57(0.20)	0.60(0.21)	0.52(0.17)	0.53(0.21)	0.56(0.24)	Z= 1.06
BDI-II	10.44(8.73)	10.70(10.35)	8.53(8.60)	10.15(7.59)	8.36(8.02)	8.06(8.04)	Z= 0.77

Controlled for mental health medication, sleep medication, counseling/therapy, meditation frequency, average weekend sleep, spirituality, and ethnicity.

Figure 1. Mediation Model



* $p < 0.05$, ** $p < 0.001$.