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I, Henrietta Elms, hereby submit this original work as part of the requirements for the degree of Doctor of Education in Counselor Education.

It is entitled:
Effects of the Deep Meditative Relaxation Technique (DMRT) On Nocturnal Self-Awakening Sleep/Wake Quality Among University Students

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Effects of the Deep Meditative Relaxation Technique (DMRT)

On Nocturnal Self-Awakening Sleep/Wake Quality

Among University Students

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by

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Abstract

This study investigates effects of the Deep Meditative Relaxation Technique (DMRT) on self-awakening sleep/wake quality among university students. DMRT is a psycho-physiological, self-control intervention that operates on the theory that if psycho-physiological mind/body systems are unified to produce a desired effect with cue-directives projected in a body-scan just before sleep, the memory-trace of the cues and the behavior-response of the meanings of the cues are formulated, consolidated, and engraved into short- and long-term memory, and learning occurs the next day or within 48 hours. DMRT consists of Cue-Mentation and Sleep. The DMRT is hypothesized to (1) increase the frequency of waking before alarm time, (2) decrease difficulty waking from sleep, and (3) decrease difficulty falling asleep. Students were the target population because of the student-lifestyle: A common set of behaviors that include staying up very late into the night while studying, watching television, playing video games, surfing the web, or writing research papers. Such sleep deprivation may lead to more serious sleep disorders: sleep-onset insomnia or delayed sleep phase syndrome. Recruitment included both genders (2 males, 6 females), age 18 to 53 years. Both normal sleepers and those with minor sleep difficulties qualified to participate. Experimental phase ran three weeks, DMRT training was one hour, and follow-up evaluations within five weeks. DMRT was assessed with content analysis, the within-group repeated-measures ANOVA design, and a time-series design with parametric, univariate, and multivariate statistics at the alpha .05, one-tailed level. Findings indicated that the DMRT’s cues to “rest,” “relax,” and “sleep” effected change in six hours and 57 minutes with a sleep-onset-latency less than 15 minutes. Findings indicated that the DMRT’s cue to “wake 5-minutes before the alarm” was also successful, and this self-awakening produced a distinct waking-alertness that extended into the first six hours of the waking-life. Five-week follow-up evaluations indicated (1) students continued to use the DMRT; (2) they believe DMRT controls sleep; and (3) self-efficacy continued to increase. Implications of the study indicated DMRT is a therapeutic tool for ecological counselors and counselors alike. Future research suggests DMRT therapy for sleep deprivation, insomnia, and delayed sleep phase type sleep disorders.
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Dedications

This book is dedicated to my Father, my Mother, and my Big Sister: Ralph, Charlotte, and Shirley, respectively. The three of you began this journey with me, but are now deceased. However, it was your support and encouragement that helped me to endure when you were alive that proved to be an everlasting stimulus in mind, body, and spirit in the completion of this book. You were my first educators, role models, and protectors. For your love and support, I will forever be indebted and will carry your spirit for eternity. Thank you for being my Biggest Fans.

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Author’s Note

Visions are representations of our daily waking-life.
If you see an idea in a vision, believe it.
If you believe it, you can achieve it.

Henrietta S. Elms
1980
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CHAPTER ONE

Purpose/Aim of the Study

Sleep is a behavior experienced by mankind and animals alike. Sleep is an unconscious state when the physical skeleton is immobilized; yet, normal bodily functions are still operating, but perhaps, at a slower rate (Akerstedt et al., 2002). In spite of this unconscious state of being, the brain is very active with thoughts, visions, and/or dreams represented in the sleep-onset, rapid-eye-movement (REM), and non-rapid-eye movement (NREM) activities (Akerstedt et al., 2002; Aserinsky & Kleitman, 1953; Dement & Kleitman, 1957).

Sleep deprivation studies determined that insufficient sleep affects a person’s physical, mental, and social health (Ferrara & Gennaro, 2001; Pilcher, Ginter, & Sadowsky, 1997). Such negative effects include, for example, sleep inertia when one drives a car and may have an accident because of sleepiness (Kaplan, Itoi, & Dement, 2007).

Sleep deprivation not only leads to sleepiness, it also leads to awakening problems (Diagnostic and Statistical Manual of Mental Disorders [4th ed., Text Revision; DSM-IV-TR; American Psychiatric Association]. 2000; Ferrara & Gennaro, 2001; Okawa, Uchiyama, Ozaki, Shibui, & Ichikawa, 2002). Awakening problems manifest themselves when there is difficulty awakening from sleep at a preselected time to meet social or work obligations. Of course, even if we do meet obligations on time, our effectiveness may be depleted due to a lower level of alertness (Crabb, 2003; Mayers, Van Hooff, & Baldwin, 2003).

Students are especially prone to sleep deprivation problems because of the student lifestyle: a common set of behaviors that include staying up very late into the night while studying, watching television, playing video games, surfing the web, or writing research papers and projects (Brooks, Girgenti, & Mills, 2009; Okawa et al., 2002). Such a lifestyle oftentimes
includes both sleep difficulties and awakening problems (Brooks et al. 2009; DSM, 2000; Kayumov, Brown, Jindal, Buttoo, & Shapiro, 2001; Okawa et al., 2002).

Self-Awakening (SA) is the ability to wake from sleep at a predetermined time without external means (i.e., an alarm clock, telephone wake up calls, or awakening by another person in the household) (Bell, 1980; Elder, 1941; Lavie, Oksenberg, & Zomer, 1979; Matsuura Hayashi, & Hori, 2002a; Moorcroft & Breitenstein, 2000; Moorcroft, Kayser, & Griggs, 1997).

People naturally and spontaneously awake from sleep daily. However, specific schedule demands prompt individuals to depend on other means besides our natural ability to spontaneously awaken from sleep to meet various engagements: school schedules; work schedules; community activities; or other lifestyle activities that include entertainment, play, and social activities (DSM, 2000; Okawa et al., 2002). Although most people have the ability to wake at a desired time, independently of external means, technology has spared most of us of such self-regulation (Crabb, 2003; DSM, 2000).

Although everyone has the ability to self-awake, research has determined that to self-awake at a pre-set time is a “skill” (Bell, 1980; Crabb, 2003; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997). Just like any skill, self-awakening at a pre-set time may be learned (Bell, 1980; Crabb, 2003; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997); yet, it must be practiced to be successful on a consistent basis in order to be relied on (instead of alarms) to meet daily schedules (Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997; Zepelin, 1986).

In the few studies that investigated the Self-Awakening phenomenon, as a second thought, researchers inquired about the methods the “successful self-awakeners” used to awaken close to a pre-set hour (Lavie et al., 1979; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997). Participants reported the following pre-sleep methods: a regular schedule, subvocalizing
The Deep Meditative Relaxation Technique (DMRT) the time repeatedly, visualizing a clock with the target wake up time, force of habit, worry over scheduling requirements for the following day, rituals, or they just did not know (Lavie et al., 1979; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997).

The purpose of this study is to examine the effects of the Deep Meditative Relaxation Technique (DMRT) on nocturnal self-awakening sleep/wake quality among university students in a southern Midwestern State, in the USA. The DMRT is a non-pharmacological sleep/wake intervention used in the present study (1) to initiate the frequency of the ability to self-awake at a pre-set time, (2) to increase waking-alertness, and (3) to decrease the difficulty of falling asleep.

The aim of the study is not to ask students to change behaviors initiated by the student lifestyle. Instead, the aim is to offer students a tool to help their awakening at a pre-set time when such awakening is of the utmost importance.

**Background of the Problem**

The “student-lifestyle” is blamed for many of the sleep disturbances that college students suffer (Brooks et al., 2009; Okawa et al., 2002). Students are known to deprive themselves voluntarily of sleep during weekdays and try to compensate for missed sleep by sleeping long hours on the weekend, especially during and after exam weeks. Sleep deprivation is a serious problem for college students that will affect their intellect, grades, or general well-being (Brown, Soper, & Buboltz, 2001).

Lack (1986) discovered Australian college students’ most common sleep complaints were (a) difficulty falling asleep (18%), (b) early morning awakening (13.2%), (c) general sleep difficulties (12%), and (d) difficulty staying asleep (9%). Similarly, in a study of students attending a large United States rural university, Brown et al. (2001) found that sleep difficulties in college students that most often occurred "frequently" or "almost always" were (a) early
morning awakenings (25.5%), (b) general sleep difficulties (21.9%), (c) difficulty falling asleep (19.3%), (d) daytime napping (15.1%), and (e) difficulty staying asleep (10.9%).

Lack (1986) and Brown et al. (2001) found symptoms in students severe enough to meet criteria for a circadian rhythm sleep disorder called the delayed sleep phase syndrome (DSPS). The DSPS prevalence was 17% in Lack’s study and 11.5% in Brown’s study that was more than twice the estimated amount of this disorder in both countries’ general population.

Yet, college students very seldom seek medical advice for sleep disturbance (Akerstedt et al., 2002; American Sleep Disorders Association [ASDA], 1992; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). It is only when this free sleeping and waking behavior interferes with awakening the following morning to attend a scheduled appointment (e.g., a class, work, social event) that their failure to awaken at the desired time becomes a problem or presents some concern to the students.

Although students tend to ignore awakening problems and fail to consider their behavior a sleeping problem, the sleeping and awakening habits of students have recently been associated with a major sleep disorder: the “Circadian Rhythm Sleep Disorder” once labeled the “Sleep-Wake Schedule Disorder” in the Diagnostic and Statistical Manual of Mental Disorders (4th ed., Text Revision; DSM-IV-TR; American Psychiatric Association, 2000).

Humans, like most animals and plants, have biological rhythms, also known as circadian rhythms that are controlled by the biological clock and work on a daily time scale (American Academy of Sleep Medicine [AASM], 2008; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). Including sleep timing, these circadian rhythms affect biological functions such as body temperature, alertness, appetite, and hormone secretion (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).
Unlike other clocks, in the circadian clock, sleepiness does not continuously increase as time passed. In fact, a person's desire and ability to fall asleep are influenced by both the length of time since the person woke from an adequate sleep homeostasis (the body's ability to regulate its internal physiology to maintain stability in response to fluctuations in the outside environment) and by internal circadian rhythms. Consequently, the body is ready for sleep or wakefulness at different times of the day (AASM, 2008; DSM, 2000; Okawa et al., 2002).

According to Wozniak and Gorzelanczyk (2003), within a 24-hour day, we have a period of six to ten hours when we are very sleepy; and usually, it is the time when we normally sleep. In the remaining 14 to 18 hours, we are usually awake. Yet, only a portion of that awakening time is suitable for intellectual effort. The period of maximum alertness may last as little as two to six hours (Wozniak & Gorzelanczyk, 2003). Logically, it is best to sleep at the time of maximum sleepiness while activities that demand maximum focus or creativity should fall in the hours of maximum alertness.

Students tend to set their own body clocks to fit the lifestyle that provides them with what they believe they need to follow as students (DSM, 2000; Okawa et al., 2002). Students tend to study late at night; hence, they go to sleep late at night and wake late in the morning. Therefore, their body clocks are pre-set to awaken at a later time than their responsibility may require. Consequently, they are voluntarily setting their body clock, perhaps, without consciously knowing what the repercussions are until they try awakening at an earlier time than to what their body clock is now “pre-set” to sleep and to wake (Czeisler et al., 1981; DSM, 2000; Okawa et al., 2002).

Some individuals (i.e., students) who voluntarily delay sleep-onset to participate in social or work activities may complain of difficulty awakening (DSM, 2000). When presented with the
opportunity to sleep, these individuals fall asleep readily at earlier times; after a period of recovery sleep, they have no significant difficulty awakening in the morning. In such cases, the primary problem is sleep deprivation (DSM, 2000; Ferrara & Gennaro, 2001; Frances et al., 1995; Kayumov et al., 2001). Other students may display symptoms of more serious circadian rhythm sleep disorders (i.e., delayed sleep phase syndrome).

When individuals have to awaken the following morning at an earlier time than usual, they may spend the better part of the night (a) drinking alcohol; (b) taking some sedative hypnotic; or (c) taking some sleep-inducing substance. While trying to reach a lethargic state or level of drowsiness in order to go to sleep, they are, frantically, hoping to awake the following morning when the alarm sounds (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

Unfortunately, this does not always work. Students may sleep through the alarms; and if they do wake up, they may feel drowsy and confused (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman, Czeisler, & Coleman, 1981). As a result of the very method or substances used to help induce sleep the previous night, individuals are seldom fully alert the following morning (DSM, 2000; Kayumov et al., 2001; Mayer et al., 2003).

**Statement of the Problem**

The purpose of this study is to examine the effects of the DMRT on nocturnal self-awakening sleep/wake quality among university students. In relationship to the student lifestyle, research has determined that the delayed sleep phase type, also known as delayed sleep phase syndrome (DSPS), is one of the sleep disorders most prevalent among college students (AASM, 2008; Brown et al., 2001; DSM, 2000; Lack, 1986; Okawa et al., 2002).

Research also determined that victims of sleep disorders similar to DSPS are recognized
The Deep Meditative Relaxation Technique (DMRT)

by difficulty awakening from sleep to meet social obligations because of the late morning
delayed sleep phases (Akerstedt et al., 2002; ASDA, 1992; DSM, 2000; Frances et al., 1995;
Kayumov et al., 2001; Weitzman et al., 1981). Research further indicates that victims of sleep
disorders similar to delayed sleep phases (DSP) develop into a syndrome that creates chronic
delayed sleep phase insomnia (difficulty falling asleep and difficulty awakening from sleep)
(Akerstedt et al., 2002; ASDA, 1992; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002;
Weitzman et al., 1981). Regardless of whether or not a diagnosed sleep disorder is present,
students’ sleep difficulties may pose a major problem in their daytime obligations.

**Significance of the Study**

The purpose of this investigation is to determine the effects of the Deep Meditative
Relaxation Technique (DMRT) on nocturnal self-awakening sleep/wake quality among
university students. The DMRT is the intervention proposed to treat awakening problems that
includes teaching the skill of self-awakening at a pre-set time.

From a review of the literature, the most prominent non-pharmacological methods
(e.g., chronotherapy, bright light therapy) presently used to treat awakening problems or delayed
sleep phase (DSP) symptoms focus on time-setting to change the person’s biological body clock
(Czeisler et al., 1981; DSM, 2000; Kayumov et al., 2001). The DMRT, a non-pharmacological
intervention, likewise, focuses on time-setting too; but, it has an immediate focus on the
awakening problem whether or not symptoms are associated with delayed sleep phases. The
success of the DMRT in initiating wakefulness at a pre-set time will truly add to the gap in the
body of scientific knowledge in the search for new methods that help students with minor
awakening problems (e.g., sleep deprivation, delayed sleep phase syndrome).

Once awakening problems begin, sleep-onset problems or Sleep-Onset Insomnia
The Deep Meditative Relaxation Technique (DMRT)

(difficulty falling asleep) may also develop over time (AASM, 2000; Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981). The success of the DMRT adds to the gap in knowledge in science because it offers aid to lessen the difficulty falling asleep that increases sleep-onset quality.

Concerning sleep treatments, the DMRT, significantly, offers an addition to our gap in knowledge of science because it further advances the **Sleep-Learning Memory-Trace-Cue Consolidation Theory (SLMTCT)** or sleep-dependent learning. In explaining sleep-dependent learning, SLMTCT consists of the evidence demonstrated in the literature that indicates perceptual tasks and motor skills practiced before sleep are (1) engraved into memory-traces; (2) consolidated into long-term memory during sleep; and (3) learning manifests the following day (Hennevin, Hars, Maho, & Block, 2000; Karni, Tanne, Rubenstein, Askenasy, & Sagi, 1994; Mednick, Nakayama, & Stickgold, 2003; Mednick, Pathak, Nakayama, & Stickgold, 2002; Stickgold, James, & Hobson, 2000a; Stickgold, Whidbee, Schirmer, Patel, & Hobson, 2000b).

According to SLMTCT, this memory consolidation process removes the need to continuously rehearse the task during daytime hours when not trying to sleep; yet, the skill of initiating sleep-onset or waking-alertness is achieved much faster, effortlessly, when repeated the following night or in any attempts to go to sleep the following day with the use of the DMRT. Realistically, the DMRT’s ability to initiate and produce this skill will truly add to the gap of knowledge in science because it improves sleep/wake quality.

Furthermore, SLMTCT supports the use of the DMRT because it recognizes facts: (1) We learn while awake and asleep (Mednick et al., 2002; Stickgold et al. 2000a); and (2) sleep is a **memory reinforcement system** that aids health and education: physically, mentally, and socially (Crabb, 2003; Kaida et al., 2003, 2005; Karni et al., 1994; Stickgold et al. 2000b). Consequently,
The Deep Meditative Relaxation Technique (DMRT)

DMRT will truly add to the gap in knowledge in science because it aids the increase and rapid reproduction of the memory-trace sense of the programmed task (i.e., to rest, relax, sleep, and wake before the alarm) with the powers of both the conscious and unconscious mind.

The DMRT offers several distinct advantages from other sleep strategies. First, it is postulated that the DMRT speeds up awareness and alertness from sleep to wakefulness, a major drawback of sleep medication and sedative hypnotics (e.g., melatonin, benzodiazepine) (Dagan, Yovel, Hallis, Eisenstein, & Raichik, 1998; Kayumov et al., 2001; Okawa et al., 2002). In comparison to sleep medications, the DMRT will truly add to the gap of knowledge in science because it is *time effective* in producing alertness-upon-awakening.

In addition, DMRT is postulated to be efficacious because it is *cost effective* as well as *time effective*. Once DMRT is learned, the Sleep-dependent Learning Memory-Trace Cue Consolidation Theory hypothesizes to finalize its effects after at least 48 hours (including sleep time) (Stickgold et al., 2000b); or the effects are finalized in a 90-minute nap (Mednick et al., 2003; NIH, 2003). Consequently, the DMRT will add to the gap in knowledge in science because it provides a key “skill” students may use for a lifetime without supervision by a therapist.

After reviewing the *Self-Awakening Phenomenon* in the literature, there were no scientifically systematic studies conducted on a specific technique postulated to initiate self-awakening at a pre-set time; neither did the literature contain the acceptable norm nor standardized criteria to identify *consistency success* in the phenomenon (Lavie et al., 1979; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997). Hence, the present study adds to the gap in knowledge in science because it poses the opportunity (1) to set criteria for standardized units of measurements in the Self-Awakening Phenomenon and (2) to set criteria that define *consistency success* in the Self-Awakening Phenomenon.
Research determined that awakening by an alarm tends (1) to increase blood pressure, (2) to increase heart rate (Kaida, Nakano, Nittono, Hayashi, & Hori, 2003; Kaida, Ogawa, Hayashi, & Hori, 2005), and (3) to negatively affect alertness and mood (Crabb, 2003; Matsuura, Hayashi, & Hori, 2002b). Hence, this constant day-in-day-out of awakening by an alarm clock, negatively, affects both physical and mental health that is eventually reflected in waking-life behavior in the form of (1) depression, (2) anxiety, and (3) stress (Crabb, 2003; Kaida et al., 2003, 2005; Matsuura, Hayashi, & Hori, 2002a, 2002b).

Kripke et al. (2008) say the lateness of delayed sleep phase (DSP) cases and their unusual hours may lead to social opprobrium and rejection that may be depressing. Also, Kayumov et al.’s (2001) findings suggest DSP is a cause rather than a consequence of depression. Moreover, research demonstrates that dependence on technology like alarm clocks reduces self-regulation that tends to reduce self-efficacy (Crabb, 2003). In a rippling effect, this self-efficacy issue is more than likely to affect academia for students.

If the delayed sleep phase individual is capable of consistently waking before the pre-set time, not only will the need of an alarm clock be eliminated, but also its anxiety producing tendency will be removed (Crabb, 2003; Kaida et al., 2005; Matsuura, et al., 2002a, 2002b). Moreover, for example, clients’ experience with the DMRT aided their ability to combat (1) anxiety disorder and (2) physical fatigue in work related activities. Thus, the DMRT will truly add to the gap in knowledge in science since previous sleep evidence demonstrated it initiates one’s capabilities that improved everyday-life both physically and mentally (Elms, 2007).

Importantly, the significance of this study rests in the fact that it proposes a new self-control, innovative sleep/wake technique conceptualized with the *sleep-dependent-learning* theory to combine both *waking* and *sleeping* elements to manifest behavior recognized during
sleep and in wakefulness (Hennevin et al., 2000; Karni et al., 1994; Maquet et al., 2000; Mednick et al., 2002, 2003; Stickgold et al., 2000a, 2000b). The DMRT boosts the age-old concept of the mind-over-matter-thinking form of self-control. Literally built into the DMRT design, with the aid of both conscious and unconscious processes programmed to perform a task in wakefulness through sleep with the “sleep-dependent learning” concept in the DMRT, the DMRT truly adds to the gap in knowledge in science that seeks sleep methods that produce the desired effect in the reproduction of the task (i.e., to rest, relax, sleep, and wake before alarm time) in wakefulness consistently, effortlessly.

**Research Question**

This study will explore the research question: While decreasing the difficulty of falling asleep in the process, is it possible for the Deep Meditative Relaxation Technique (DMRT) to initiate self-awakening at a pre-set time (without external means) and initiate waking-alertness; and what opinions are generated by its use? Consequently, the research hypotheses to test the effects of the DMRT on nocturnal self-awakening sleep/wake quality among university students include the following.

**Research Hypotheses**

Hypothesis 1: The DMRT will increase the frequency of the ability to wake before the alarm index.

Hypothesis 2: The DMRT will decrease the difficulty waking from sleep index.

Hypothesis 3: The DMRT will decrease the difficulty falling asleep index.

**Definitions of Key Terms**

**Self-Awakening Phenomenon (SAP).** Self-Awakening Phenomenon is the ability to self-awake at a pre-set time without external means (i.e., alarm, technology, or another person).
Deep Meditative Relaxation Technique (DMRT). The Deep Meditative Relaxation Technique is a self-control (self-regulating, self-generating) sleep/wake technique that affects behavior in sleep and wakefulness through two specific psycho-physiological systems: (1) Cue-Mentation and (2) Sleep (sleep onset, slow wave sleep, delta sleep, and rapid eye movement sleep).

Essentially, Cue-Mentation is the mental process of literally programming the mind by, specifically, Telling the Self what to do, just before sleep (e.g., to relax). The DMRT’s Cue-Mentation and Sleep processes are measured by (1) the Wake Before Alarm Index, (2) the Difficulty Waking From Sleep Index, and (3) the Difficulty Falling Asleep Index.

Wake Before Alarm Index (WBAI). Wake Before Alarm Index measures self-awakening at a pre-set time without an alarm or other external means. WBAI measures self-awakening quality. The WBAI is the number of times one wakes before the alarm time or the frequency of self-awakening within one week. Next, the WBAI’s absolute values are converted to WBAI’s performance levels measured on a linear graphic scale anchored by the Level-1 (Extremely High Consistent Self-Awakening [5 to 7 days]) to Level-6 (Non-Consistent Self-Awakening [0 days]).

Difficulty Waking From Sleep Index (DWFSI). Difficulty Waking From Sleep Index measures the difficulty upon-awakening from nocturnal sleep that extends for six hours. DWFSI measures sleep-offset quality. The DWFSI is the standardized index score that produces DWFSI’s absolute values derived from the averaging of the weekly scores of the participants’ sleepy and/or alertness behaviors upon-awakening for the first six hours.

DWFSI is measured on the Elms Sleep/Alertness Scale-II (ESAS-II) (a 7-point linear graphic scale anchored by 1 [Felt alert, energetic, motivated, and/or focused after the last
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awakening from sleep from first opening eyes that last 6 hours] to 7 [Nodded and/or dozed off to sleep within 1 to 6 hours after the last awakening from sleep]). The DWFSI’s absolute values are derived from the mean score of the 7 descriptors. Next, the DWFSI’s absolute values are converted to DWFSI’s three performance levels measured on a linear graphic scale anchored by Level 1 (Not Difficult Alert/Energetic [1 to 3]) to Level 3 (Very Difficult-Lethargic/Sleepy/Sluggish [7]).

**Difficulty Falling Asleep Index (DFASI).** Difficulty Falling Asleep Index rates how hard or easy it is to fall asleep in sleep-onset. Sleep-Onset is applied to the stress of falling asleep at the beginning of nocturnal sleep. Sleep-Onset quality is problematic if it takes more than 31 minutes to fall asleep (Bonnet & Arand, 2003; Lichstein, Durrence, Taylor, Bush, & Riedel, 2003). The DFASI is the standardized index score derived from the averaging of the weekly scores of the participants’ time-stress behavior of going to sleep.

It is measured by the Elms Sleep-Onset Stress Scale-II (ESOS-II) (a linear graphic 10-point scale anchored by 1 [Fell asleep within 1-15 minutes; if I awoke before expected Wakeup Time, each awakening was less than 5 minutes] to 10 [Fell asleep after 45 minutes]). The DFASI’s absolute value is the mean of the descriptors. Next, the DFASI’s absolute values are converted to DFASI’s performance levels measured on a linear graphic scale anchored by Level 1 (Not Difficult-Normal Stress [1 to 3]) to Level 4 (Severe Stress [10]).

**Self-Awakening Sleep/Wake Quality (SA-SWQ).** Self-Awakening Sleep/Wake Quality is an, unobserved, latent variable measured by a combination of three constructs: (1) sleep-onset quality and (2) sleep-offset quality in relationship to (3) self-awakening quality. It is the quality of sleep that refers to both (1) subjective measures of the individual’s perception of how restorative, undisturbed, and/or refreshing his or her sleep has been (e.g., sleep quality and sleep
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mood); and (2) to the objective measures of the sleep duration (e.g., sleep-onset latency, waking after sleep-onset time, sleep efficiency and/or total sleep time).

Sleep-onset quality refers to the ease or difficulty of falling asleep at the beginning of nocturnal sleep and the maintenance of sleep within a sleep period measured by the Difficulty Falling Asleep Index (DFASI). Sleep-offset quality refers to the perception of alertness upon awakening that extends for six hours after nocturnal sleep measured by the Difficulty Waking From Sleep Index (DWFSI). Both sleep-onset quality and sleep-offset quality are examined in terms of self-awakening quality measured by the Wake Before Alarm Index (WBAI).
CHAPTER TWO

LITERATURE REVIEW

Theoretical and Conceptual Orientation Underlining the Study

Introduction

Sleep deprivation among college students is real (DSM, 2000; Ferrara & Gennaro, 2001). The student lifestyle affects the sleeping habits of almost every student, and some willingly admit it with no intention of seeking medical advice to treat it (Brooks et al., 2009; Buboltz, Brown, & Soper, 2001). The student’s schedule demands he or she is prompt and alert for all engagements. As students plan their course work and schedule, quality sleep time becomes second nature in importance.

College students’ first year is the time when the change in autonomy and new responsibilities occur (Brown et al., 2001). The responsibility of a student lifestyle tends to cause a significant change in sleeping habits (Brooks et al., 2009; Okawa et al., 2002). For example, they begin to attend classes at different times of the day and night. Such erratic schedule will play havoc on the body clock’s 24-hour sleep-wake cycles and circadian rhythms (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981). The effect on the circadian rhythms may lead to Delayed Sleep Phase Insomnia (DSPI) (difficulty falling asleep, difficulty awaking from sleep) (DSM, 2000; Okawa et al., 2002).

In light of the aforementioned issues concerning awakening from sleep, the present study proposes (1) to teach students the ability to self-awake at a pre-set time; (2) to increase waking-alertness; and (3) to minimize the effects of the stress of sleepiness in the process. Method wise, the Deep Meditative Relaxation Technique (DMRT) is the intervention of choice to accomplish these tasks.
This study will examine the effects of the DMRT on nocturnal self-awakening sleep/wake quality in college students. Thus, specifically, the research question is stated as follows: While decreasing the difficulty of falling asleep in the process, is it possible for the DMRT to initiate self-awakening at a pre-set time (without external means) and initiate waking-alertness; and what opinions are generated by its use? Therefore, the literature review describes awakening problems and the theoretical/conceptual components of the DMRT’s intervention proposed to ameliorate minor awakening problems that mimic the student lifestyle.

Scientifically, a functional approach to introducing and investigating an innovative intervention is to examine the literature that guides the rationale and methods of the study (Cone & Foster, 2006). The theoretical base for the components involved in the design and execution of the DMRT are grounded in three theories: (1) Sleep Quality More Important Theory (SQMIT), (2) the Sleep-Learning Memory-Trace Cue Consolidation Theory (SLMTCT), and (3) the Self-Awakening Phenomenon (SAP). Yet, the conceptual orientation of the DMRT is credited to the Powers of the Unconscious Mind.

**Student-Lifestyle and Delayed Sleep Phase Syndrome (DSPS)**

There are several circadian rhythm sleep disorders (CRSD): the Delayed Sleep Phase Type, the Work-Shift Type, the Jet-Lag Type, and the Nonspecific Type (Advanced Sleep Phase, Non-24-hour sleep-wake cycle) (AASM, 2008; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). The specific circadian rhythm type that shares some characteristics with students’ sleeping and awakening habits is labeled the Delayed Sleep Phase Type (Alfredsson, Akerstedt, Mattsson, & Wilborg, 1983; ASDA, 1992; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

The Delayed Sleep Phase Type (DSPT), also called the Delayed Sleep Phase Syndrome
The Deep Meditative Relaxation Technique (DMRT) (DSPS), is associated with the circadian rhythm synchronization of the human biological clock that determines sleep and wakefulness in a 24-hour sleep-wake cycle. DSPT is marked by (1) difficulty falling asleep during the week, (2) problems awakening at a planned time, and (3) morning sleepiness that significantly impairs daily functioning (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981).

The DSPT affects the timing of sleep (Czeisler et al., 1981; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). DSPT is seen in people who are unable to sleep and awake at the times required for normal school, work, or social needs. Generally, people who have symptoms of DSPT are able to receive enough sleep if allowed to sleep and wake at the times dictated by their body clock; providing they do not have another sleep disorder, their sleep is of normal sleep quality (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2000; Okawa et al., 2002; Weitzman et al., 1981).

Hypothetically, individuals with DSPT have an abnormally diminished ability to phase-advance sleep-wake hours (i.e., to move sleep and wakefulness to earlier clock times) or cause an alteration in the usual alignment of sleep with other circadian rhythms. As a result, these individuals are locked-in to habitually late sleep hours and have great difficulty shifting these sleep hours forward to an earlier time (Czeisler et al., 1981; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). However, individuals will fall asleep and awaken at consistent, albeit delayed, times when left to their own schedule (e.g., on weekends or vacations) when the circadian phase of sleep is stable (AASM, 2008; ASDA, 1992; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

Students with sleep-wake pattern symptoms similar to DSPT complain of difficulty
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falling asleep at socially acceptable hours; but once sleep is initiated, it is normal (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). In fact, there is also a concomitant difficulty awakening from sleep at socially acceptable hours (e.g., multiple alarms are often unable to arouse the individual) (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981).

Individuals with symptoms of the delayed sleep phase disorder who need to awaken for social and occupational obligations in the morning (e.g., class, work) but experience difficulty in doing so are chronically sleep deprived (Bonnet & Arand, 1995; DSM, 2000; Ferrara & Gennaro, 2001; Okawa et al., 2002). Consequently, sleepiness may result during the desired wake period (e.g., class time) that is often observed when one sees a student nodding off to sleep in class. When waking earlier than the time indicated by the circadian timekeeping system, the individual may demonstrate sleep drunkenness (i.e., extreme difficulty awakening, confusion, and/or inappropriate behavior) (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981).

When tested at socially normal sleep times, research determined that individuals suffering with delayed sleep phase (DSP) have (1) prolonged sleep-onset latency; (2) reduced sleep efficiency (due mainly to difficulty falling asleep); (3) short sleep duration of individual’s normal sleep time; and (4) in some people, moderately short rapid eye movement (REM) sleep latency (Akerstedt et al., 2002; ASDA, 1992; Brown et al., 2001; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Weitzman et al., 1981). However, when DSPT individuals are studied at their preferred sleep time, sleep is normal (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

Following a change in schedule, it is important to differentiate a circadian rhythm sleep
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disorder (CRSD) from normal patterns of sleep and normal adjustments. Distinctions lie in the persistence of the disturbance and the presence and degree of social or occupational impairment (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002). Many adolescents and young adults maintain delayed sleep-wake schedules without distress or interference with school or work routine (DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

Because of their preference for either late or early sleep schedules, many individuals are characterized as either night owls or morning larks, respectively (DSM, 2000; Frances et al., 1995; Kayumov et al., 2001; Okawa et al., 2002). However, these tendencies in students do not warrant a diagnosis of DSP. A diagnosis of DSP will be made in these individuals only if they experience (1) persistent clinically significant distress (e.g., severe symptoms of depression, anxiety); (2) impairment from not being able to awaken when desired (e.g., failure to go to class on time, sleeping in class, or self-efficacy issues); or (3) difficulty changing their sleep-wake pattern (e.g., delayed sleep times [i.e., 1-6 a.m.] to normal times [i.e., 10 to 11 p.m.]) (Akerstedt et al., 2002; ASDA, 1992; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002).

However, DSP must be differentiated from volitional patterns of delayed sleep hours (DSM, 2000). Some individuals (i.e., students) who voluntarily delay sleep-onset to participate in social or work activities may complain of difficulty awakening (DSM, 2000). When presented with the opportunity to sleep, these individuals fall asleep readily at earlier times; but after a period of recovery sleep, they have no significant difficulty awakening in the morning. In such cases, the primary problem is sleep deprivation (DSM, 2000; Ferrara & Gennaro, 2001; Frances et al., 1995; Kayumov et al., 2001).

The Sleep Quality More Important Theory (SQMIT)

Although there are differences among individuals in their need for sleep, the average
person needs 8.16 hours of sleep during a 24-hour day to prevent neurobehavioral defects from accumulating (Dinges, 2003). Karni et al. (1994) found that four to six hours of sleep is not enough, and the lack of sleep has severe effects on cognitive performance. Sleep less than seven hours has caused behavior problems in adolescence (Liu & Zhou, 1989). If one fails to go into REM sleep in the fourth quarter of an eight hour sleep period, memory fails to consolidate (Stickgold et al., 2000b).

According to Pilcher et al. (1997), a degree of variability in sleep habits, not often available in nonclinical and non-shift-work populations, is a result of the voluntarily irregular sleeping patterns in college students. College students provide a population in which variable sleep habits may be studied without the direct influence of more clinical concerns, such as sleep apnea or shift-work (Pilcher et al., 1997).

Pilcher et al. (1997) concede that students who sleep seven to eight hours are within normal ranges. Seven to eight hours of nocturnal sleep is positively associated with self-reported health status and longevity. According to Pilcher, extremely short nocturnal sleep duration (or total sleep time) has been linked to cardiovascular disease and gastrointestinal disorders; hence, health risks in clinical populations are also linked to sleep. In addition, poor sleep quality has been linked to increased health complaints in individuals with (1) sleep disorders (e.g., sleep-onset insomnia); (2) clinical disorder (e.g., sleep and chronic illness); and (3) shift-work (e.g. delayed sleep phase syndrome, worker sleep quality and worker health) (DSM, 2000; Pilcher et al., 1997).

Pilcher et al. (1997) postulate that sleep quality is related to more than just sleep quantity. Sleep quality is also connected to general health, well-being, and sleepiness. Hence, Pilcher et al. (1997) conducted a study to determine the extent that quantity of sleep affects quality of sleep.
Second, the authors investigated whether the measures of health, well-being, and sleepiness were differentially related to either aspect of sleep (sleep quantity or sleep quality).

The average sleep time (6.68 hours to 7.06 hours) obtained in Pilcher et al.’s (1997) study is in accordance with the average (6 to 9 hours) sleep patterns seen in the general population (Ferrara & Gennaro, 2001; Horne, 1988; Murphy, Rogers, & Campbell, 2000; Pilcher et al., 1997). Students also spent a mean “time napping” of 27.27 minutes. The mean for self-ratings of daily sleep quality for study-one was 4.87 and study-two was 4.99 (on a rating scale of 1 = awful to 7 = great). In spite of the good sleep efficiency (92%) obtained by Pilcher et al. (1997), students had relatively late bedtimes and late rising time.

Pilcher (1997) and colleagues found that health and well-being measures were better related to sleep quality than sleep quantity. Poor sleep quality was significantly correlated with increased physical health complaints and increased feelings of tension, depression, anger, fatigue, and confusion. The researchers also found that sleep quantity measured by average “time-in-bed” or average “time asleep” was not significantly correlated with any measures of health or well-being.

Pilcher et al. (1997) concluded that the relationships between sleep quality and measures of health, well-being, and sleepiness are independent of any effect by sleep quantity (total sleep time or sleep efficiency). Pitcher et al.’s (1997) study demonstrated that the quality of sleep is more important than the quantity of sleep. Perhaps, this is why evidence shows (1) a 30- to 90-minute nap is just as powerful in refreshing the body as a full night of sleep (Kaida et al., 2005; National Institute of Health [NIH], 2002); and (2) if the nap is extended to 60 to 90 minutes, sleep memory consolidation is equivalent to a full night of sleep (Mednick et al., 2002, 2003; NIH, 2002).
According to Van Cauter (1997), sleep quality refers to both the self-assessment of how restorative and undisturbed his or her sleep has been (via a standardized questionnaire) and to a series of objective measures that may be derived by several means: (a) polygraphic recordings (in the laboratory or at home), (b) recordings of wrist activity movements (wrist actigraphy monitoring), or (c) head movements and eyelid movements (Nightcap monitoring). Van Cauter (1997) research suggests subjective and objective measures of sleep quality are not necessarily concordant.

The most commonly used objective measure of sleep quality is an index of sleep fragmentation that may be derived from all three types of recordings. However, the amount and depth of non-rapid-eye movement (nonREM) sleep, the amount of rapid-eye-movement (REM) sleep, and the temporal organization of nonREM and REM stages are clearly major components of the complex concept of sleep quality (Van Cauter, 1997).

Traditionally, sleep quality has been quantified as a composite score of sleep quantity: (a) total sleep time, (b) sleep efficiency, (c) length of time to fall asleep, (d) number of nocturnal awakening, (e) length of time of awakening after sleep onset, (f) a feeling of fatigue/restfulness upon-awakening in the morning, and (g) general satisfaction with sleep (Lavie et al., 1979; Matsuura et al., 2002b; Mayers et al., 2003; Moorcroft et al., 1997; Pilcher et al., 1997; Sanofi-Aventis, 2008).

To determine the quality of sleep, one must focus on the state of mind of a person that includes feelings of tension, depression, anger, fatigue, and/or confusion (Pilcher et al., 1997). In this study, the focus is on sleep and waking-life quality in relationship to self-awakening in the investigation of the DMRT.
The Deep Meditative Relaxation Technique (DMRT)

Sleep-Learning Memory-Trace Cue Consolidation Theory (SLMTCT)

According to Neimark (1998), our ability to learn appears to be dependent on rapid eye movement (REM) sleep. Karni et al.’s (1994) findings indicate that if someone is trained in a task and allowed a normal night's sleep, he or she will show improvement in the next day. If sleep is interrupted in each rapid eye movement (REM) cycle, he or she shows no improvement at all.

Also, Karni et al.’s (1994) findings indicate that if participants had less than six hours of sleep, they did not improve, and the lack of that amount of sleep has severe effects on cognitive performance. These findings indicate that people need a certain quantity of sleep in order to learn. According to Neimark (1998), the truth seems to be they need certain cycles of sleep. When awoken before the last REM cycle, the brain is unable to consolidate the memory of the task. However, Stickgold et al. (2000a) found that more than REM cycles were at stake in Sleep-learning: The amount of slow wave sleep (SWS) in the first two hours of the night is highly correlated with the amount of learning as well.

These studies suggest that there may be a two-step process of memory enhancement in this unconscious state (Karni et al., 1994; Neimark, 1998; Stickgold et al., 2000a). Neimark (1998) suggests as people cycle from REM to SWS, they are passing information back and between different parts of the brain, as if the brain is holding a conversation with itself and identifying exactly what it needs to know. For example, Neimark suggests that consciously changing a dream in any direction while awake may stop recurring nightmares.

According to Stickgold et al. (2000a), sleep deprivation hours after training will interfere with consolidation; that is, it suggests involvement of sleep in consolidation with REM sleep and deeper SWS serving distinct functions. Stickgold subsequently showed that improvement on the
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task only occurs when participants are tested following a night of sleep, and this overnight improvement is proportional to the amount of SWS in the first quarter of the night and of REM sleep in the last quarter. These two sleep parameters explain 80% of the inter-subject variance in improvement (Stickgold et al., 2000b). These results suggest that it is the occurrence of sleep, rather than the simple passage of time, that leads to consolidation and improvement on the task.

Stickgold et al.’s (2000b) findings indicate that performance following a single training session improves beyond the first 24 hours and continues to improve after a second night of sleep. This improvement is dependent on the first night of sleep, and subsequent sleep will not replace the first night requirement. Moreover, Stickgold et al.’s (2000b) findings suggest that sleep after training will be important in the consolidation, integration, and maintenance of memories.

Stickgold et al.’s (2000b) results raise the question of when learning actually occurs. Learning clearly begins with the active participation of the individual at the time of training. However, in the consolidation and integration associated with this skill, learning must involve multiple steps that continue over at least 48 hours. These steps begin with attentive awareness during task training and continue with unconscious processing during sleep.

Along with Stickgold, Scott, Rittenhouse, and Hobson’s (1999) previous findings of a linear relationship between improved performance and the amounts of subsequent early-night SWS and late-night REM sleep, Stickgold et al.’s (2000b) results suggest that overnight improvement on the visual discrimination task requires at least three temporally distinct steps: the first occurring during initial training and the other two occurring during subsequent early night SWS and late night REM sleep, respectively.
Stickgold et al. (2000b) posit that this separation of three sequential steps is of particular value to the study of memory consolidation; that is, it permits the temporal dissection of the stages of memory consolidation and integration required to transform an initial memory-trace into a form capable of supporting improved performance. Like a voice recorded on a magnetic tape, memory-trace formation and consolidation in sleep ensure that the “cues” suggested in the DMRT Cue-Mentation process are engraved in long-term memory and short-term memory.

Hennevin et al. (2000) researched the post-learning paradoxical sleep (PS) deprivation effects and the PS changes induced by learning in 1995. The researchers presented a set of electrophysiological and behavioral experiments showing that (1) processing of relevant information is possible during PS; (2) new associations are formed during PS; (3) previously learned information are reprocessed during PS; and (4) the effects of information processed during PS are transferred to the awaked state and expressed in behavior.

Collectively, Hennevin et al.’s (2000) results support the idea that dynamic processes occurring during post-learning paradoxical sleep will contribute to the effectiveness of memory processing and facilitate memory retrieval in wakefulness. As Hennevin et al.’s (2000) results indicate, memory recognition of cues practiced before sleep are consolidated in sleep and recalled in wakefulness.

Because it eliminates the fourth quarter REM memory consolidation period in an eight hour sleep period, earlier research claimed four to six hours of sleep is insufficient (Karni et al, 1994; Liu & Zhou, 1989; Stickgold et al., 2000a, 2000b). In contrast, Mednick et al.’s (2002) findings indicated that a nap with a 90-minute sleep-wake cycle is just as effective in memory consolidation as a full night’s sleep. Furthermore, Mednick et al. (2002) indicated a 60- to
90-minute early afternoon nap will improve perceptual skill learning as much as a full night's sleep. Basically, Mednick et al.’s (2002, 2003) findings indicate it is not the amount of sleep that counts, but perhaps, the quality of sleep is more important.

According to the National Institute of Health (NIH) (2002), evidence is mounting that sleep – even a nap – appears to enhance information processing and learning. It appears that slow wave sleep obtained in a 30- to 60-minute nap is, also, memory consolidation processing (Hennevin et al., 2000; Mednick et al., 2002, 2003). Although a high quality sleep (i.e., a sleep cycle extending more than six hours) is clearly best (Karni et al., 1994), nap sleeping does appear to provide a convenient method of preventing burnout and work overload (Bradbury, 2003; Mednick & Ehrman, 2006; NIH, 2002).

In the first decade of the new millennium, the literature indicates researchers’ interest in sleep-dependent learning and its benefits to training increased. The accumulative research evidence indicates that if one practices a task just before sleep, (1) the memory-trace of that task consolidates during sleep and (2) learning manifests the next day (Hennevin et al., 2000; Karni et al., 1994; Maier, 2001; Maquet et al., 2000; Mednick & Ehrman, 2006; Mednick et al., 2002, 2003; Neimark, 1998; Sadigh, 1999; Stickgold et al., 2000a, 2000b; Stickgold, 2003).

Specifically, Stickgold et al. (1999) found that before sleep, memories of perceptual tasks training were consolidated in sleep. Yet, Maquet et al. (2000) discovered that memories of perceptual and motor skills practiced before sleep is consolidated in sleep. In fact, Wagner, Gais, Haider, Verleger, and Born (2004) found that after sleep there is an increased insight or a sudden gain of explicit knowledge. In other words, recent research studies boost the age-old fact that learning takes place in sleep (Curtis, 1963; Muller, 1900, as cited in Stickgold et al., 2000a). In essence, these findings suggest that since one learns perceptual tasks and motor skills through the
consolidation processes during sleep (Karni et al., 1994; Maquet et al., 2000; Mednick et al.,
2002, 2003; Stickgold et al., 1999, 2000a, 2000b), then deliberately initiating ideas just before sleep will be consolidated and learned during sleep, too!

In this study, the concept of sleep-dependent-learning is used to enhance behavior self-control with the aid of sleep. It is possible that such a strategy permits a person to control behavior that, subconsciously, becomes automatic at the desired time requested through the sleep memory consolidation process. Likewise, because of humans’ ability to control anxiousness physically and control psychological effects mentally, through the sleep memory consolidation processes, sleep difficulty will be minimized if one (1) goes to sleep when desired; (2) wakes when desired; or (3) relaxes when desired.

The Sleep-Learning Memory-Trace Cue Consolidation Theory has already been examined in other studies by looking carefully at participants’ abilities not only to memorize perceptual or motor skill tasks but also to control behaviors (i.e., pressing a finger switch that was learned earlier while awake) (Hennevin et al., 2000; Karni et al., 1994; Maquet et al., 2000; Mednick et al., 2002; Moorcroft & Breitenstein, 2000; Stickgold et al., 2000b; Zepelin, 1986). In another example, Neimark (1998) postulated that you have the capability to change absolutely anything in a nightmare: rehearse that change before sleep and the nightmare will get better.

Similar, the DMRT consists of elements that include practicing cues just before sleep with cue directives (1) to control behavior to be performed before and during sleep and (2) to be accessed both in sleep and wakefulness. Including studies that concede self-awakening is possible (Bell, 1980; Lavie et al., 1979; Moorcroft et al., 1997; Zepelin, 1986), the above studies implementing the Sleep-Learning Memory-Trace Cue Consolidation Theory or “sleep-dependent learning” (Hennevin et al., 2000; Karni et al., 1994; Maquet et al., 2000; Mednick & Ehrman,
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2006; Mednick et al., 2002; Stickgold et al., 1999; 2000a, 2000b) reflect conceptualizations supporting the DMRT.

In summary, the above research studies suggest techniques involved in training a person to remember or learn to control one’s behavior in wakefulness will work better if followed by a period of sleep. The Sleep-Learning Memory-Trace Cue Consolidation Theory is consistent with the age-old adage, “What’s done in the dark will be brought to the light.” In other words, with the DMRT, what is requested before sleep (1) enters the darkness of sleep and (2) manifests itself in the light of wakefulness.

The Self-Awakening Phenomenon (SAP)

The ability to awake from sleep at a pre-set time is a self-regulatory mechanism that has existed in humans since the beginning of time. Before the era of technology and alarm clocks, mankind used light sources such as the sun, moon, and stars to tell the time of day as well as the time to sleep and to awake. Once the industrial revolution dominated the western world and people needed to awake at specific times to begin work shifts, for many people, the ability to self-awake at a predetermined time was forsaken in favor of dependency on alarms (Crabb, 2003; Ferrara & Gennaro, 2001).

Today, it is understood that the very tool used to awake mankind is perhaps the source of mental and physical deficits in the human condition that include a higher increased heart rate and/or higher increased blood pressure upon-awakening after hearing the alarm sound, more likely, than when one self-awakes (Kaida et al., 2003, 2005). Furthermore, the inability to awake at a pre-set time is associated with (1) sleep deprivation and sleep disorders (i.e., circadian rhythm disorders, delayed sleep phase syndrome, delayed sleep phase insomnia); (2)
psychological disorders (i.e., depression, anxiety, mood swings); and (3) medical disorders (AASM, 2008; DSM, 2000; Kayumov et al., 2001; Kripke et al., 2008; Matsuura et al., 2002a).

According to Elder (1941), “The accuracy of awakening at an assigned hour depends greatly on the degree of motivation, time of retiring, and temporal relation of assigned hour to usual awakening time” (p. 557). Several studies have tested the ability to self-awake at a predetermined time to determine if this phenomenon exists (Bell, 1980; Lavie et al., 1979; Moorcroft et al., 1997).

Using recordings in the sleep laboratory, Lavie et al. (1979) conducted a study (1) to find out if the self-awakening phenomenon really exists; (2) to determine if the accuracy of performance is sleep-stage dependent; and (3) to determine if the demand to wake up at preselected times has an effect on the infrastructure of sleep. Lavie et al. (1979) recruited seven college students (6 males, 1 female) age 21 to 30 years. The students were professed self-awakeners and were chosen for this skill.

In experiment one, the participants slept in the sleep laboratory for four nights (one adaptation night, one baseline night, two experimental nights). On each experimental night, target times (3:30 a.m. or 5:30 a.m.) were written on a piece of paper and given to the participant 20 minutes before lights out in a balanced crossover order. Participants were paid according to their accuracy that was divided into four categories: (1) plus/minus 10 minutes, (2) plus/minus 20 minutes, (3) plus/minus 30 minutes, or (4) plus/minus 40 minutes from target time.

In experiment two, the two participants with the greatest success slept an additional seven nights for testing in the sleep lab. Part-two target times were randomly selected between 1:00 and 6:00 a.m. Participants were paid only if they woke within plus/minus 20 minutes from the pre-set time (alarm time, target-time).
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In Lavie et al.’s (1979) experiment-one findings, (a) five participants woke plus/minus 10 minutes from target time; (b) three within plus/minus 20 minutes; (c) one within plus/minus 30 minutes; and (d) five were 40 minutes or more from target time. After 120 minutes sleep, two of the participants were waked by the experimenter. Thus, there were 12 out of 14 awakenings in two nights for 86% successful self-awakenings in experiment one. Significantly, all participants’ sleep-onset latency increased from baseline.

In contrast, in part two, the accuracy of self-awakening at a pre-set hour decreased. The two participants chosen for experiment-two results indicated (a) only one awakening for plus/minus 10, plus/minus 20, and plus/minus 40 minutes from target time; (b) three awakenings were plus/minus 30 minutes from target-time; and (c) eight awakenings were greater than 40 minutes from target time.

Lavie et al. (1979) concluded “There is a general support for the common belief that some individuals are able to awake from sleep at a predetermined time with significant accuracy; however, the accuracy between the two experiments suggests that motivation plays an important role in the awakening response” (p. 449). Lavie et al. (1979) contend that the two participants in experiment-two were “clearly not motivated to be successful in waking up accurately than in the first part and complained of lack of challenge and accumulated fatigue” (p. 449).

Lavie et al.’s (1979) findings indicate sleep-onset latency (time it takes to fall asleep, to dose from consciousness to unconsciousness) was increased from baseline throughout both experiments. The researchers postulate that the increase in sleep-onset latency exists because of participants’ preoccupation with the experimental task to wake at a pre-set time. Participants reported using various techniques to assure the accurate awakening, such as “sub vocal repetition of the target time before falling asleep” (Lavie et al., 1979, p. 449).
Lavie et al. (1979) noted little evidence in the literature to justify why the majority of the awakenings occurred during rapid eye movement (REM) sleep. However, the researchers postulate that during REM sleep participants are attentive to internal stimuli and may retrieve information from long-term memory. Furthermore, the preponderance of REM awakenings suggests that participants did not measure more accurately the passage of time in REM sleep; but knowing that they had to wake up at a preselected time, they found it easier to terminate sleep in the REM period.

As a result, Lavie et al. (1979) suggest “REM periods may be seen as ‘gating periods’ when sleep will easily terminate, and the accuracy or performance is dependent on the termination of sleep at the appropriate REM period” (p. 450). Furthermore, Lavie et al. (1979) suggested the relative accuracy in successful performance of self-awakening observed in experiment-one resulted from the temporal proximity of the target times to the expected wake up times of the second and fourth REM periods.

Bell (1980) also investigated the ability to self-awake at a pre-set time. Bell’s study methods include 38 healthy adult participants (20 males, 18 females) who did not use sleeping aids and volunteered for participation for three consecutive nights. Night one was adaptation night, and nights two and three were control and experiment nights.

All participants chose as “target time” for the experimental night (a) an unusual time for their awakening and (b) at least 45 minutes earlier than their normal time of awakening the following morning. During experimental nights, each participant recorded (1) a chosen target time (expected wakeup time); (2) an estimate of the confidence they had in their ability to awaken at the target time (by indicating on a 100-mm line labeled from [total confidence
certainty] to [not a hope in the world]); and (3) the method they had used to try to set themselves to awake at target-time.

Bell’s (1980) findings indicated target-time awakening errors ranged from zero to -85 minutes (pre-target-time) and +150 minutes (post-target-time). Within 15 minutes of target-time, participants (53%) recorded an awakening. On experimental night, data analysis included (a) correlations between control night data (including number of spontaneous awakenings); (b) wake after sleep-onset; (c) total sleep time; (d) sleep-onset latency; (e) a sleep disturbance index or subjective sleep quality; and (f) the accuracy of awakening close to target-time).

The only significant comparison between control and experimental nights was the establishment of a greater number of awakenings on the latter than on the former. In other words, the participants woke up more when they had set a preselected time to awake than on nights when a pre-set time was not attempted.

Bell (1980) postulates there is a “skill” involved in the successful performance of self-awakening that may consist of two separate components: (1) an ability to induce in oneself a greater potential for an awakening than normal on an experimental night and (2) the ability to use accurately the information gathered at these check points during the night. Bell insists “A lack of skill in either of the two components could produce failure to awake from undisturbed sleep at a preselected target-time, and a high degree of skill in both components will be necessary to succeed in the task of self-awakening at a pre-set time” (p. 507).

Zepelin (1986) conducted a study to gain insight into the reputed accuracy of some people’s time judgment during sleep by investigating the differences between sleep stages in the threshold for self-awakening. Zepelin proposed the threshold for self-awakening may vary with sleep stage as does the threshold for awakening to auditory stimuli. Zepelin (1986) contended
“The electroencephalographic (EEG) stages differ with respect to recall and execution of pre-sleep instructions (e.g., to press a micro switch in response to a signal) with superior performance during rapid eye movement (REM) sleep” (p. 254). Consequently, Zepelin (1986) hypothesized that the threshold for self-awakening is lowest during REM sleep, as Lavie et al. (1979) suggested.

Zepelin’s (1986) study method consists of 15 participants (7 men, 8 women) ages 15 to 32 years, whose responses on a sleep questionnaire indicated they rarely awoke at night. As a rare occurrence, results indicated that all participants slept for at least 5 hours without one awakening. Four of the participants described themselves as self-awakeners; the other 11 were simply “willing to try.”

Participants were paid a nightly fee with bonuses related to accuracy of self-awakening. Target time was 4 a.m. for five nights. Because of varied bedtimes, the assigned pre-awakening intervals ranged from 198 minutes to 266 minutes. While the assigned pre-awakening intervals ranged from 207 to 210 minutes, the remaining trials' target-time was 3 a.m. with bedtimes at or near 11:30 p.m.

Zepelin’s (1986) findings indicate that of the 11 self-awakenings, two were from delta sleep (Stages 3 and 4 combined), five were from Stage 2, and four were from rapid eye movement (REM) sleep. Two of the proclaimed self-awakeners were within 10 minutes of target time, and another was within 15 minutes.

In a second experiment, the most accurate self-awakeners were tested an additional night under the same conditions. One of the most accurate participants awoke 24.5 minutes early, and the other awoke 49.5 minutes early. On a third trial, with target-time one hour later and the pre-awakening interval equaled 270 minutes, the most accurate participant awoke 127 minutes early.
Zepelin’s (1986) findings indicate that if one takes into account self-awakening that occurred when participants were allowed more than one attempt per night to awake accurately, there were 20 self-awakenings in total: Eight self-awakenings were from REM plus three were from suspected REM transitions. By allowing repeated awakenings, there were six sleepers who managed to awake within 15 minutes of target-time. Zepelin’s (1986) findings agreed with Lavie et al.’s (1979) findings that suggested the threshold for self-awakening is lowest during REM sleep.

Zepelin (1986) speculates “In the absence of demonstrations that there are individuals who can awake accurately with some consistency at a variety of target times, there is no objective support for the belief in the time-telling ability during sleep” (p. 256). Zepelin further proclaimed that in the study of the ability to self-awake at a pre-set time “contemporary studies have yet to identify a single individual capable of consistent performance”; yet, he determined “with the opportunity for repeated awakenings in the same night, many self-awakenings at a pre-set time seem accurate” (p. 256).

Moreover, like Elder (1941) and Lavie et al (1979), Zepelin (1986) documents this notion: “Awakenings are likely to occur by virtue of temporal proximity between target-times and rapid eye movement (REM) periods” (p. 256). Similar to Lavie et al.’s (1979) theory that REM seems to provide “gating periods” when sleep will easily terminate and the accuracy of performance is dependent on the termination of sleep at the appropriate REM period, Zepelin (1986) postulates “The REM cyclical recurrence seems to provide an ‘interval-timing clock’ that is available to all who are sufficiently motivated to awake and whose sleep is not so deep as to prevent it” (p. 256). Zepelin (1986) believes REM probably facilitates both the recall of the intention to awake and the act of awakening itself.
Another study to investigate the existence of self-awakening at a predetermined time was conducted by Moorcroft et al. (1997). This study attempted (1) to verify more precisely the existence of the ability to wake without external means at a preselected time, (2) to determine to what extent self-awakening is utilized by adults, and (3) to ascertain some of its determining factors. The study was divided into two experiments: a survey study and an objective actigraph home monitoring study.

In Moorcroft et al.’s (1997) survey research, 269 randomly unselected adults (140 females, 129 males) ages 21 to 84 years from a Midwestern City in the USA participated by a phone interview. Based on their responses, respondents were categorized into one of four groups according to their self-reported typical method of awakening.

Moorcroft et al. (1997) found people who (1) never use an alarm or external source (23%), (2) use an alarm yet stated that they will awaken before the alarm goes off (29%), (3) use an alarm but said they sometimes awaken before the alarm goes off (24%), and (4) use an alarm and said they do not awaken before the alarm goes off (24%). Yet, over half of the 269 participants said they had experienced waking at least once before their alarm.

Moorcroft et al.’s (1997) survey results indicated that 26% of the respondents said they awake without or prior to an alarm by having a sense of some kind of an internal clock. This was sometimes coupled with the bedtime ritual of actively focusing on a specific time to awake. Common responses by the others included habit or daily routine (16%) and stress or nervousness about something anticipated the next day (4%). The remaining 54% consisted of various other responses including having no idea of how they were able to do this. Moreover, responses from some participants reflected their perceptions that they could also program themselves to awake from brief naps after a set time had elapsed.
However, sex and shift-work did not significantly influence the self-awakening ability. Moorcroft et al. (1997) found 76% of the people in this ($N = 269$) sample who were able, at least some of the time, to cognitively program themselves to awake without an alarm or to awake before the alarm. Moorcroft et al. also found that age was a factor in the ability to awake without an alarm; those never using an alarm were significantly older. Hence, age and consistency of nightly sleep duration are related to the ability to awake at a predetermined time without alarms.

Moorcroft et al.’s (1997) findings indicate that the average age of the group that consistently did not use an alarm was older than the average age of the other three groups. The authors postulate that people who are more consistent in their nightly sleep durations may be more confident in their ability to wake themselves and be more successful in doing so; therefore, they never use an alarm. On the other hand, consistency in the time of awakening from morning to morning does not appear to be necessary for success.

In part two of the experiment, Moorcroft et al.’s (1997) investigation consisted of 15 participants (9 females, 6 males) ages 19 to 62 from a Midwestern City in the USA. Participants volunteered from newspaper advertisement asking for people who were able to regularly awake at a predetermined time without an alarm or were able to always awake before the alarm. Some to be answered before falling asleep and the rest upon awaking, a sleep diary containing 14 questions was used to assess sleep-wake patterns.

Including the time of the final awakening of the participant, Moorcroft et al. (1997) used an actigraph monitor (movement-activated recordings) to record the sleep and wake periods. Participants wore an actigraph and completed morning and before sleep sections of the sleep diary for three consecutive nights. Data were downloaded from the actigraph monitor periodically so that wake up time was determined to the minute.
Moorcroft et al.’s (1997) results were analyzed by comparing the expected wakeup time, noted before sleep, with the actual awakening time indicated on the actigraph recording. The difference between these times was derived for each of the three mornings. A positive difference indicated that the participant had overslept while a negative difference indicated that the participant woke before the target-time (expected wakeup time).

There were 44 nights of usable data because the actigraph failed on one night. Moorcroft et al. (1997) found the overall average was 3.34 minutes (overslept by 3 minutes and 20 seconds) with a standard deviation of 13.37 minutes. The intended and actual waking times did not significantly differ from one another. Most participants were able to self-awake very close to the expected waking time even after a mean of 7.06 hours total sleep time.

Moorcroft et al.’s (1997) findings indicated all 15 participants successfully self-awaked on the three experimental nights. However, one participant’s data were discarded one night because of actigraph dysfunction. There were a total of 44 self-awakenings. Moorcroft et al.’s (1997) findings showed 28 of the 44 self-awakenings were within 15 minutes of target time and 35 were within 30 minutes. One-half of the 44 self-awakenings (52%) were within seven minutes of the target time (mean = 3 minutes, 27 seconds).

Because, five participants were within 10 minutes of target time each of the three consecutive nights, Moorcroft et al. (1997) considered these participants successful consistently. Likewise, five more participants were consistently successful in awakening 15 minutes before the expected awakening time two of the three nights; as a result, they are considered moderately successful consistently. Twelve of the 15 participants chose different waking times on at least one of the three experimental nights. Moorcroft et al. (1997) noted that the participants who were
more successful at awakening close to their target were primarily the ones who were not as consistent in their choice of target-times.

Moorcroft et al. (1997) found that screening for the self-awakening ability produced more positive results in comparison to studies that did not. The researchers also found that recent reports that did not produce positive results used mostly college students as participants. Moorcroft et al. (1997) concede “College students may not be the best participants for normative sleep research since they tend to be chronically sleep deprived and sleep phase delayed” (p. 44).

Moorcroft and Breitenstein (2000) noted the various reasons some self-awakeners cited for success: (1) “don’t know,” (2) habit, (3) visualization of a clock set to wake up time, (4) some other kind of pre-sleep ritual, or (5) stress caused by thoughts of the schedule for the next day. In spite of the belief that a consistent time of waking from day to day might facilitate this ability, the participants who widely varied their self-set time of awakening were actually more accurate (Moorcroft et al., 1997).

To conclude, Moorcroft et al. (1997) found that those participants who were more consistent in the amount of sleep (total sleep time) they obtained from one night to the next were more accurate in their self-awakening than those who were more variable in total sleep time per night. Yet, factors such as gender or working shift schedules had no effect on this self-awakening ability (Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997).

In a laboratory study using polysomnographic equipment, Matsuura et al. (2002a) investigated the effect of habitual self-awakening on nocturnal sleep with 13 participants who habitually self-awake in the mornings. Students participated in two experimental nights: a forced-awakening night and a self-awakening night. The experimenter forced the wake up at the participant’s usual awaking time. Analyses consist of a test on anxiety immediately before the
The Deep Meditative Relaxation Technique (DMRT) experimental night, polysomnograph during the night, and subjective ratings of sleep quality immediately after awaking. On self-awakening nights, participants succeeded self-awakening in eight of 19 self-awakenings (42.1%).

Except for the Stage-1 Sleep, Matsuura et al. (2002a) determined that there were no significant differences between the forced-awakening and self-awakening nights in participants’ (1) anxiety, (2) subjective rating of sleep, and (3) the sleep variables (i.e., total sleep time, sleep-onset latency, wake after sleep-onset, number of awakening, sleep efficiency). Matsuura et al.’s findings suggest habitual self-awakening has no negative effects on (1) nocturnal sleep, (2) mood after awakening, or (3) satisfaction in sleep.

In another study, Matsuura et al. (2002b) conducted a survey study to investigate the sleep-wake habits and the subjective rating of sleep in a group of college students. The respondents selected consisted of 643 university students (354 male, 289 female; mean age = 19.1 ± 1.7 years). Students were categorized into two groups: habitual self-awakeners (SA) and non-Self-Awakeners (nonSA).

The SA group was asked this question: “How do you usually wake up in the morning?” The SA group answered: “Never use an alarm” or “Use an alarm yet awaken before the alarm goes off.” The nonSA group answered the same question: “Use an alarm but sometimes awake before the alarm goes off” or “Use an alarm and do not awake before the alarm goes off.”

Of the 643 students selected, 66 were classified into the SA group (10.3%, mean age, 19.2 ± 1.2 years) and 577 into the nonSA group (89.7%, mean age, 19.1 ± 1.7 years). Matsuura et al. (2002b) determined that the SA group went to bed and awoke approximately 30 minutes earlier than the nonSA group on weekdays; yet, there were no differences in total sleep time. Also, the SA group woke up earlier than usual. The SA group’s subjective ratings of mood after
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awakening were significantly better than the nonSA group. Matsuura et al.’s (2002b) findings determined that self-awakening correlates with age; yet, some younger adults (10.3%) have a habit of self-awakening at a pre-set time, too.

According to Crabb (2003), “Self-awakening at a target-time without external aids involves a number of self-regulatory processes related to time-consciousness and arousal, and it is believed to be a skill that most people can acquire” (p. 344). Furthermore, Crabb postulates “Awakening at a predetermined time is a social skill; insofar as, it coordinates individuals’ sleep-wake cycles with the schedules of school, families, transportation, work, and other social systems” (p. 344). However, because of the alarm clock, no effort or skill is required to achieve the goal of self-awakening at a predetermined time.

Crabb (2003) hypothesized that waking with aids (e.g., alarm clock, a person in household) is negatively correlated with measures of self-regulation, and self-awakening without aids is positively correlated with self-regulation. Crabb also postulated that correlations between alarm clock use and measures of self-regulation are larger in magnitude than are correlations between being waked by another person in the household and self-regulation.

In his investigation, Crabb (2003) recruited 417 undergraduate students (231 females, 186 males) ages 18 to 42 years. Relevant to self-regulation in the context of self-awakening from sleep, Crabb used three measures: (a) the Basic American Language Morning (BALM) scale that determined the score of whether a person was a morning or evening type; (b) subjective independence for self-awakening; and (c) self-efficacy concerning self-awakening.

Subjective independence measured how willing participants were to awake without an alarm. Self-efficacy was measured with two parallel items about self-awakening on weekdays and weekends. Crabb (2003) defined self-efficacy: (1) It is a system of beliefs about one’s ability
to perform a task successfully, and (2) it regulates choice behaviors, amount of effort, and persistence in acquiring and practicing relevant skills.

Crabb’s (2003) survey research findings indicated that 64.3% of students used an alarm, 13.7% were waked by another person, and 8.2% reported they self-awaken every day. With respect to the view that most people are capable of self-awakening, 71% of the students reported that they self-awaken “sometimes.” In addition, Crabb’s (2003) findings indicated “Participants who used awakening aids had relative poorer self-regulatory skills than did those who self-awakened; and this relationship was more pronounced when alarm clocks were used than when participants were awakened by household members, confirming the assumption that technological devices substitute for personal effort and skill more reliably than do other people” (p. 347).

Kaida et al. (2005) postulate “When we awaken by means of external stimuli, such as an alarm clock or someone’s voice, our blood pressure and heart rate will increase and these changes might trigger a heart attack” (p. 179). Consequently, Kaida and colleagues hypothesized that self-awakening will be useful to help prevent the sudden increases in heart rate and blood pressure when waking up. As Kaida et al. (2005) point out, Bell’s (1980) study found approximately 53% of people did wake within 15 minutes before a given hour determined before sleep. Because it combats increased blood pressure or increased heart rate upon awakening by an alarm, self-awakening is a feasible and logical choice to teach people to use to awake.

Kaida et al. (2005) studied nine older individuals (7 males, 2 females) age 65 to 80 years (mean age 74.1). After two adaptation nights, the participant’s average bedtime before experimental day was approximately 10 p.m. (total sleep time was approximately 400 minutes [6.7 hours]).
In 2003, Kaida et al. determined that self-awakening affected heart rate, but not blood pressure in younger people (21.7 [SD = 1.25]) years old. However, Kaida et al. (2005) found “Self-awakening prevents acute increases in blood pressure and heart rate that occurred simultaneously with arousal in elderly people” (p. 183). Furthermore, Kaida et al. (2005) postulate self-awakening may also reduce the risk of coronary heart attack that might occur after awaking suddenly.

Summarizing, as seen in the review of the literature, the Self-Awakening Phenomenon (the ability to wake up at a predetermined time without external means) truly exists, and research has diligently tried to explain how and why self-awakening at a pre-set time works (Bell, 1980; Crabb, 2003; Lavie et al., 1979; Kaida et al., 2005; Moorcroft et al., 1997; Zepelin, 1986). According to Elder (1941), “The accuracy of waking at an assigned hour depends greatly on the degree of motivation, time of retiring, and temporal relation of assigned hour to usual waking time” (p. 557).

Some theorize that self-awakening at a pre-set time is successful for some because of the infrastructure of sleep that involves rapid eye movement (REM) and non-REM (NREM) sleep cycles (Elder, 1941; Lavie et al., 1979; Murphy et al., 2000). The success of the Self-Awakening Phenomenon has been theorized to work because the preferred time to wake up from nocturnal sleep is phase related to circadian rhythms and the REM-NREM cycles (Akerstedt et al., 2002).

Crabb (2003) affirms this supposition: “Self-awakening at a target time without external means involves a number of self-regulatory processes related to time-consciousness and arousals and is believed to be a skill that most people can acquire” (p. 344). Crabb (2003) postulates that the self-awakening phenomenon is a “social skill”; insofar as it coordinates individuals sleep-wake cycles with the schedules of school, work, and other social systems.
Those who used self-awakening had better self-regulatory skills than those who used alarm clocks to wake up (Crabb, 2003). Self-awakening decreases heart rate in young adults while self-awakening decreases heart rate and high blood pressure in adults over 60 (Kaida et al., 2003, 2005).

Research demonstrates that self-awakening is a skill capable of being acquired (Bell, 1980; Crabb, 2003; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997); however, no specific scientifically determined technique exists (Lavie et al., 1979; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997). In this study, the DMRT, a new strategy, is used to teach participants how to initiate the self-awakening skill as well as increase sleep/wake quality.

**The Powers of the Unconscious Mind**

The DMRT is a self-generated, self-regulated sleep/wake technique that focuses on both sleep-onset and sleep-offset difficulties. The DMRT is an intervention that the researcher developed to relieve issues concerning sleep. The initiation of the concept of the DMRT stems from personal distressful experiences encountered as a child when there was a need to wake up from sleep. There were nightmares or incidents when an extremity (e.g., an arm, wrist, leg, or foot) was in pain because of a circulation problem, or the limb was in distress. Screaming out to siblings or parents to be waked from sleep fell on deaf ears, because they too were asleep. Remarkably, through the *Powers of the Unconscious Mind*, a remedy to self-awake was revealed.

At the age of eight, I believe I had what is known today as an *outer-body experience*. Vividly, I saw this *entity* flying above my sleeping body lying in bed. While flying above the sleeping body in the bed, this outer-body-entity communicated directives to *will* the body to self-awake rather than depend on someone else.
While still in an unconscious state, the directives to will the body to move finally worked when my head slipped off the pillow causing movement resulting in wakefulness. In a split second and just before physical consciousness or wakefulness, the outer-body-entity and the physical body lying in bed reunited both mentally and physically. In other words, in a split second, the thinking unconscious mind reunited with the unconscious physical body before awaking to full mental and physical consciousness. After self-awakening, the distressed limb was moved from its painful position and peaceful sleep once again achieved.

Evidently, there are several levels of unconsciousness. Sigmund Freud (1856-1939), the founder of psychoanalysis, determined that there are three states of mind: conscious, subconscious, and the unconscious. The unconscious state of mind has been defined as sleep (Webster, 1984). Sleep is the unconscious state when mentally the outside world is blocked out; the physical body is in a paralyzed or in an immovable state; yet, bodily internal organs are conscious but functioning at a slower rate.

While in the unconscious state of mind called Sleep, I was able to awake to a conscious level of that unconscious state. In this conscious level of unconsciousness, directives of Telling the Self what to do to self-awake were provided, and the physical body responded accordingly. Apparently, just as we do in our conscious state of being, the unconscious mind possesses the ability to think, too! Remarkably, the events of “Telling-the-Self” to wake from sleep when a limb was in distress while asleep continued into adolescence.

The childhood and adolescent experiences with self-awakening within sleep initiated the idea to develop the DMRT in adulthood. Through deductive reasoning, the idea was conceivable to reverse the process learned in sleep that one wills the self to awake, also, may will the self to fall asleep while awake. Through experimentation, I learned how to put myself to sleep by
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_Telling the Self what to do, just before sleep._ By combining earlier experiences of willing the Self to self-awaken and adding the rationalizations and knowledge gained of willing the Self to go to sleep, the Deep Meditative Relaxation Technique (DMRT) was born.

In 2003, the DMRT was tested for its ability to aid insomnia or difficulties falling asleep at a half-way house located in the community. During mental health counseling internship, I taught clients the DMRT to help with their sleep difficulties and nightmares. The clients were directed to say _cues_ (e.g., rest, relax, sleep) in a body scan just before sleep.

Once clients realized the value of the sleep quality they experienced, they told their friends. Next, the clients asked the researcher to teach their friends the DMRT to aid their sleep difficulties, too. This cry for help because of sleep difficulties initiated the development of a group plan for the Deep Meditative Relaxation Technique. Once again, the results of the participants’ experiences in several DMRT Sleep-Groups demonstrated that the DMRT theory of _Telling the Self what to do just before sleep_ is a valid and reliable tool that helps those seeking aid for stressful problems related to sleep (Elms, 2007).

Remarkably, even when others learned and used the DMRT, they were personally able to go beyond the initial training to help solve personal dilemmas because they had learned a new method of self-control with the aid of sleep. Successfully, in a controlled environment, the DMRT was examined on its ability to teach self-control for those having sleep-onset difficulties in a halfway house in 2003 (Elms, 2007). The purpose of this study is to determine if it is possible for the DMRT to teach self-control through sleep that will aid self-awakening and waking-alertness while decreasing sleep-onset difficulties in the process with students, in an uncontrolled environment.
The Deep Meditative Relaxation Technique (DMRT)

**Literature Review Conclusion**

The Deep Meditative Relaxation Technique (DMRT), a new innovative sleep/wake technique, is proposed to initiate the ability to self-awakening at a pre-set time (without external means) while alleviating the negative effects of awakening problems. Whether one is sleep deprived or has awakening problems similar to delayed sleep phase syndrome, the DMRT is postulated to provide an aid to awakening problems.

Survey research indicates that self-awakening is rarely used in the general population or among college students (Crabb, 2003; Matsuura et al., 2002b; Moorcroft et al., 1997; Murphy et al, 2000). However, if students are able to use the self-awakening phenomenon to awake without the alarm clock or other external means on a consistent basis, the DMRT will be a valuable tool to manage students’ sleep problems.

The delayed sleep phase sleep/wake problems initiated by the student-lifestyle affect student health: physically, mentally, and socially (AASM, 2008; Brooks et al., 2009; Czeisler et al., 1981; DSM, 2000; Kayumov et al., 2001; Okawa et al., 2002; Pilcher et al., 1997). Previous interventions that focus strictly on resetting a student’s sleep phases (Czeisler et al., 1981; Okawa et al., 2002), or drugs or hormones to induce sleep (Dagan et al., 1998; Kayumov et al., 2001), or vitamins to wake one up during the day (Okawa et al., 2002) ignore other perceived consequences of awaking problems. However, sleepiness, alertness, and mood are some of the major issues associated with awaking problems that also include the depression, anxiety, and stress of (1) trying to go to sleep; (2) trying to wake up at a pre-set time; and/or (3) trying to make scheduled appointments (Crabb, 2003; Matsuura et al., 2002a; Pilcher et al., 1997).

In order to treat the aforementioned consequences of awaking problems, it is hypothesized that the DMRT works to ameliorate awaking problems because of its theoretical
The Deep Meditative Relaxation Technique (DMRT)

based conceptual elements grounded in several theories: (1) the Sleep Quality More Important Theory, (2) the Sleep-Learning Memory-Trace Cue Consolidation Theory, and (3) the Self-Awakening Phenomenon. Yet, the DMRT’s conceptual orientation was revealed through the Powers of the Unconscious Mind.

_Sleep Quality More Important Theory_ (SQMIT) is the theory that poses the concept that it is not the amount of sleep that counts, but the quality of sleep that is more important in relationship to sleepiness, health, and well-being (Murphy et al., 2000; Pilcher et al., 1997). Hence, one’s feelings or perceptions (i.e., sleep quality, sleep mood) about sleep are more important than the amount of sleep (i.e., total sleep time or sleep efficiency) in producing the desired energized effect the following day (Pilcher et al., 1997).

_Sleep-Learning Memory-Trace Cue Consolidation Theory_ (SLMTCT) is the theory that the memory of a task practiced just before sleep becomes _cue-behavior-responses_ transferred and engraved into memory-traces that are consolidated into short- and long-term memory in unconscious sleep processes (slow wave sleep, Sleep Stage-3, Sleep Stage-4, and rapid eye movement sleep). The memory-traces of the “cues” are recognized and recalled at a time desired both in sleep and in wakefulness. SLMTCT is “sleep-dependent learning” (Hennevin et al., 2000; Karni et al., 1994; Mednick & Ehrman, 2006; Mednick et al., 2002, 2003; NIH, 2002; Stickgold et al., 2000a, 2000b, 2003).

Scientifically documented, the _Self-Awakening Phenomenon_ (SAP) is the ability to self-awake at a pre-set time without external means (e.g., alarm clocks or another person in the household) (Bell, 1980; Crabb, 2003; Lavie et al., 1979; Moorcroft & Breitenstein, 2000; Moorcroft et al., 1997; Zepelin, 1986). Self-Awakening Phenomenon has practical applications
The Deep Meditative Relaxation Technique (DMRT) to help ameliorate awakening problems (Crabb, 2003; Kaida et al., 2003, 2005; Moorcroft & Breitenstein, 2000).

Aided by the Powers of the Unconscious Mind’s teachings to will the Self to self-awaken and the logic used to will the Self to go to sleep with cues practiced just before sleep, the DMRT was born. Later, DMRT was developed to assist with sleep-onset difficulties. The technique consists of Telling the Self what to do, just before sleep.

Based on sleep research, the theory behind the use of the DMRT as an intervention for awakening problems rests in three conclusions: (1) Sleep quality is more important than sleep quantity in relation to producing the desired energized effect (Pilcher et al., 1997); (2) practice just before sleep initiates learning the next day (Karni et al., 1994; Stickgold et al., 2000a; Stickgold et al., 2000b); and (3) awakening oneself will eliminate the negative effects of an awakening problem (i.e., anxiousness initiated by the alarm) (Crabb, 2003; Kaida et al., 2005).

The DMRT proposes to help students with or without awakening problems by teaching the skill of self-awakening at a pre-set time, consistently, without an alarm or external source. Systematically, this study will focus on examining the effects of the Deep Meditative Relaxation Technique, a non-pharmacological sleep/wake intervention, on nocturnal self-awakening sleep/wake quality among university students.
CHAPTER THREE

METHOD

DMRT Theoretical Model

Causality will be proven only through the correct research design (i.e., longitudinal studies or experiments) (Fraenkel & Wallen, 2003). This study approach consists of both research designs: (1) Longitudinal because it extends over time for three weeks (Bryman & Cramer, 1999); and (2) experimental because it consists of the manipulation of variables, other relevant variables are controlled, and the effect on one or more dependent variables is observed (Fraenkel & Wallen, 2003). Seen in Figure 1: DMRT Theoretical Model: Self-Awakening Sleep/Wake Quality, the model displays the path diagram of the direct causality, influence, or predictions of the Deep Meditative Relaxation Technique’s claims.

This is a study to investigate the effects of the Deep Meditative Relaxation Technique (DMRT) on nocturnal self-awakening among university students. It is postulated that by mastering the DMRT one gains self-control over his or her behavior in initiating awakening through sleep, a behavior that improves waking-life quality. As illustrated in Figure 1, the DMRT has a direct effect or causal relationship with the three indicator variables: (1) Wake before alarm index (WBAI), (2) Difficulty waking from sleep index (DWFSI), and (3) the Difficulty falling asleep index (DFASI).

Also, it is postulated that all three dependent variables are inter-correlated with each other. For example, if the increase in the frequency of the ability to Wake Before Alarm Index (WBAI) increases, the Difficulty Waking From Sleep Index (DWFSI) decreases, the Difficulty Falling Asleep Index (DFASI) decreases, and vice versa.
The Deep Meditative Relaxation Technique (DMRT)

DMRT Theoretical Model: Self-Awakening Sleep/Wake Quality

Path diagram:

DMRT = Intervention
Indicator variables: Wake Before-Alarm Index, Difficulty Waking From Sleep Index, & Difficulty Falling Asleep Index

e = error variance

The Deep Meditative Relaxation Technique (DMRT)

**Independent Variable**

The DMRT is the independent variable or treatment variable employed to examine the sleep/wake behaviors of students in this study. The DMRT is a psycho-physiological technique that consists of (1) **Cue-Mentation** (cues or directives to initiate a cue-behavior-response in a body scan) and (2) the **sleep memory consolidation process** through **Sleep** (sleep-onset, slow-wave-sleep, delta sleep, and rapid-eye-movement sleep).

The DMRT proposes to initiate the cue-behavior-response by pairing cues (e.g., to relax) to each body part in a body scan, and the experience of this cue-behavior-response is practiced before sleep. The success of achieving the cue-behavior-response initiates sleep-onset faster, and the cues program the mind for waking-alertness that is transferred into sleep for memory consolidation to be recalled upon cue when requested in wakefulness. Self-control is very important in this investigation, and the DMRT is a self-control technique. In essence, by measuring the effects of the DMRT, its ability to teach self-control over sleep/wake behavior is measured.

The DMRT’s effects on self-awakening sleep/wake quality are measured by three hypotheses. Hypothesis-1: the DMRT will increase the frequency of the ability to wake before the alarm index. Hypothesis-2: the DMRT will decrease the difficulty waking from sleep index. Hypothesis-3: the DMRT will decrease the difficulty falling asleep index.

**Dependent Variables**

Because of the nature of sleep, there are several types of sleep/wake dependent variables (DVs) involved in this study that are used to describe and measure self-awakening sleep/wake quality (both quantitatively and qualitatively): (1) sleep quality continuity variables (i.e., sleep-onset latency, waking after sleep-onset latency, number of wakes, sleep efficiency, total
The Deep Meditative Relaxation Technique (DMRT) 

sleep time); (2) waking quality variables (i.e., subjective sleep quality, sleep mood, difficulty awakening from sleep); and (3) self-awakening quality variables (i.e., wake-before-alarm index, wake before alarm cue index, difficulty waking before the alarm index) (Browman & Tepas, 1976; Coats et al., 1982; Johnson, 1993; Lichstein et al., 2003; Matsuura et al., 2002a, 2002b).

The effects of using the DMRT are measured by three DVs’ indices for hypotheses testing: (1) the Wake Before Alarm Index (WBAI), (2) the Difficulty Waking From Sleep Index (DWFSI), and (3) the Difficulty Falling Asleep Index (DFASI).

First, *Wake Before Alarm Index* (WBAI) measures self-awakening at a pre-set time without an alarm or other external means. WBAI measures self-awakening quality. The WBAI is the number of times one wakes before the alarm time or the frequency of self-awakening within one week. Next, the WBAI’s absolute values are converted to WBAI’s performance levels measured on a linear graphic scale anchored by Level-1 (*Extremely High Consistent Self-Awakening [5 to 7 days]*) to Level-6 (*Non-Consistent Self-Awakening [0 days]*)..

Second, the *Difficulty Waking From Sleep Index (DWFSI)* measures the difficulty upon awakening from nocturnal sleep that extends for six hours after the last awakening from nocturnal sleep. DWFSI measures sleep-offset quality. The DWFSI is the standardized index score that produces DWFSI’s absolute values derived from the averaging of the weekly scores of the participants’ sleepy and/or alertness behaviors upon-awakening for the first six hours.

DWFSI is measured on the Elms Sleep/Alertness Scale-II (ESAS-II) (a 7-point linear graphic scale anchored by 1 [*Felt alert, energetic, motivated, and/or focused after the last awakening from sleep from first opening eyes that last 6 hours*] to 7 [*Nodded and/or dozed off to sleep within 1 to 6 hours after the last awakening from sleep*]). The DWFSI’s absolute values are derived from the mean score of the 7 descriptors. Next, the DWFSI’s absolute values are
The Deep Meditative Relaxation Technique (DMRT) converted to DWFSI’s three performance levels measured on a linear graphic scale anchored by Level 1 (Not Difficult Alert/Energetic [1 to 3]) to Level 3 (Very Difficult-Lethargic/Sleepy/Sluggish [7]).

The Difficulty Falling Asleep Index (DFASI) rates how hard or easy it is to fall asleep in sleep-onset. Sleep-Onset is applied to the stress of falling asleep at the beginning of nocturnal sleep. Sleep-Onset quality is problematic if it takes more than 31 minutes to fall asleep (Bonnet & Arand, 2003; Lichstein, Durrence, Taylor, Bush, & Riedel, 2003). DFASI is the standardized index score derived from the averaging of the weekly scores of the participants’ time-stress behavior of going to sleep in sleep-onset.

This sleep-onset stress is measured by the Elms Sleep-Onset Stress Scale-II (ESOS-II) (a linear graphic 10-point scale anchored by 1 [Fell asleep within 1-15 minutes; if I awoke before expected Wakeup Time, each awakening was less than 5 minutes] to 10 [Fell asleep after 45 minutes]). The DFASI’s absolute value is the mean of the descriptors. Next, the DFASI’s absolute values are converted to DFASI’s performance levels measured on a linear graphic scale anchored by Level 1 (Not Difficult-Normal Stress [1 to 3]) to Level 4 (Severe Stress [10]).

Research Design

As illustrated in the DMRT Research Design (Table 1), the study is a longitudinal, one group, field experimental design that extends three weeks. The pretest-posttest, within-group, field experimental research design is employed when one group of participants is measured or observed at least twice. The DMRT will be assessed on nocturnal sleep with three condition levels of treatment (pre, post-1, and post-2). Hence, there are repeated-measures or correlated-sample design and a time-series design when the group acts as its own control.
The Deep Meditative Relaxation Technique (DMRT)

**Table 1**

**DMRT Research Design**

<table>
<thead>
<tr>
<th>Screening Phase</th>
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<th>Experimental Phase</th>
<th>Posttest Phase</th>
<th>Debriefing Phase</th>
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<td>Screen Testing</td>
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<td>Treatment Posttest</td>
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<td>DMRT S/W Cycles</td>
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<td>WBAI</td>
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<td>DWFSI</td>
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<td>DFASI</td>
<td>DFASI</td>
<td></td>
<td>EVF</td>
<td></td>
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</tr>
</tbody>
</table>

**Note:**
- SCNQ: DMRT Screening Questionnaire
- DMRT: Deep Meditative Relaxation Technique
- WBAI: Wake Before Alarm Index
- DWFSI: Difficulty Waking From Sleep Index
- DFASI: Difficulty Falling Asleep Index
- EVF: DMRT Evaluation Form
- FUF: DMRT Follow-Up Form
- S/W: Sleep/Wake Cycles
Participants

Number of Participants

Students of both genders between the age of 18 and 65 years were offered the opportunity to participate in this study. Convenience samples are often used by the social scientists; that is, “samples that are either chosen by the investigator or that choose themselves (e.g., volunteers)” (Bryman & Cramer, 1999, p. 104). Purposive sampling was also used in this study. In purposive sampling, researchers base their judgment in selecting individuals on previous knowledge of a population and the specific purpose of the research. Although convenience and purposive sampling strategies are employed in this study, statistical procedures were used to determine the effect size for clarifying the magnitude of the obtained relationships.

As Heppner et al. (1999) point out, sample size is important because as the number of participants increases, so does the probability that the sample is representative of the population. The number of subjects is involved with the concept of statistical power (1 – beta). Power is the probability of rejecting the null hypothesis when the alternative is true, or the likelihood of detecting an effect when the effect is truly present. The number of participants needed depends on (1) the particular statistical tests used; (2) the alpha level; (3) the directionality of the statistical tests; (4) the desired power (1-beta); and (5) the size of the effect (See Cohen, 1988; Kraemer & Thiemann, 1987; and Wampold & Drew, 1990 for detailed discussions).

In this study, a sample size interval (NI) was calculated with G*Power 3 (2001) Power Analysis Computer Software. The statistical indices required to determine the correct sample size are listed in Appendix I. Data analysis in this study indicated calculating mean differences with (1) repeated measures procedures, (2) t tests, (3) analysis of variance (ANOVA), and (4)
multivariate analyses of variance (MANOVA). The power level chosen is \((1 – \beta = .80)\). Power of .80 has become the accepted standard in social sciences (Heppner et al. 1999).

Across the four above specified statistical tests, the sample size interval was calculated from the medium and large effect size statistics: Delta \((d) (.5, .8)\) or the \(F\) ratio \((f) (.25, .40)\), at alpha \((\alpha) (.05)\), one-tailed level with power \((1 – \beta = .80)\), respectively. The NI for this study consists of minimum to maximum individuals needed to obtain a medium or large effect size, respectively. Illustrated in Appendix-I, calculations with G*Power 3 (2001), the minimum number of participants needed consists of 12 and the maximum number of participants consists of 33 to obtain a medium or large effect size with a power of .80 with the specified statistical tests. In this study, the sample size interval’s minimum/maximum values were \(NI (12 to 33)\).

As seen in the Results section, the sample size for this study consisted of eight individuals that were tested with various statistical tests that produced statistically significant results with small, medium, and large effect size statistics.

**Recruitment Methods**

A request for sleep research volunteers was announced through the DMRT Recruitment Flyer (Appendix II); advertisement for the study was opened to the entire university community. The University of Cincinnati’s Institutional Review Board (UC-IRB) and Campus Officials granted the permission to conduct this study on the University of Cincinnati’s West Campus.

The DMRT sleep study used purposive sampling to test the effects of the DMRT on nocturnal awakening with its main focus on university students. With the permission of University Officials, this study was advertised through various channels: Student Housing, the Counseling ListServ, posting campus DMRT Recruitment Flyers, and by-word-of-mouth.
The Counseling Programs and Psychology Departments were specifically targeted for recruitment because the DMRT will be an attractive strategy for use with professional treatment interventions for sleep/wake disorders. Potential participants responding to the advertisement of the study were required (1) to sign a consent form before acceptance in the study and (2) to complete the DMRT Screening Questionnaire (SCNQ) that was used to include/exclude the respondent.

**Participants’ Screening Criteria**

The DMRT Screening Questionnaire (SCNQ) is the instrument developed and used to screen potential participants for inclusion/exclusion in this study. Screening is a means of control used in the study to obtain a sample with less severe sleep difficulties. The researcher hoped to collect information on a relatively low-risk group of college students who may or may not be experiencing minor sleep difficulties or awakening problems from nocturnal sleep at a predetermined time. Furthermore, individuals did not meet criteria for this study if they were involved in any other concurrent pharmacological or non-pharmacological treatment for sleep and/or awakening difficulties during the course of the protocol.

Individuals were screened for the use of tranquilizers, antihistamines, antidepressants, or anticholinergics. These drugs interfere with sleep patterns (Johnson, 1993). Furthermore, individuals reporting “moderate” or “severe” symptoms related to depression, anxiety, and/or stress were excluded. Potential participants who report sleep disorders (i.e., narcolepsy, restless leg syndrome/periodic limb movement disorder, gastro-esophageal reflux, or sleep apnea) did not meet criteria for the study.

All individuals with normal to minor sleep difficulties of initiating sleep-onset or have insomnia as identified by the criteria set forth in the literature for “normal,” “mild,” or
The Deep Meditative Relaxation Technique (DMRT)

“moderate” sleep difficulty met criteria to participate in this study (Bonnet & Arand, 2003; Coats et al., 1982; Horne, 1988; Lichstein et al., 2003; Mayers et al., 2003).

**Right to Refuse or Withdraw**

Participation was strictly voluntary. Participation were refused or discontinued at any time without penalty or loss of benefits retroactive to the period of time of the involvement in the study. The investigator had the right to remove anyone from the study at any time. Withdrawals from the study were for reasons related solely to the participant (e.g., not following study-related directions from the investigator).

**Legal Rights**

Participants were advised that nothing in the *Informed Consent Form* waived any legal right they have; and it did not release the investigator, the sponsor, the institution, or its agents from liability for negligence.

**Recruitment Incentives**

By using the DMRT, a tool that promises to aid the difficulty of initiating sleep-onset and waking-alertness, participants will benefit from this study because they will have knowledge of ways to address sleeping “flaws.” Consequently, in the DMRT Flyer, they were offered a nonpharmalogical tool to “put them to sleep” and “to wake them up” at a pre-set time. Also, participants were paid five dollars for attending each meeting on campus for related expenses.

**Compensation**

This is a voluntary process. Volunteers were remunerated for their involvement. Before the experimental phase of the study, participants received the Deep Meditative Relaxation Technique’s training. Also, if requested on the screening questionnaire, a summary of the study were offered and provided to each participant in Meeting #3. Participants were requested to meet
The Deep Meditative Relaxation Technique (DMRT)

on campus three times. Therefore, the investigator provided five dollars for each meeting per participant plus a five dollar bonus for their participation for a total of $20.

**Informed Consent Process**

From advertisement of the study, once the potential participant announced his or her interest in the study by email, he or she was emailed the *DMRT Study Audiovisual Recording Release Form* (Appendix-III). The form contained (1) the announcement that the DMRT Study sessions would be audiovisual recorded, (2) the conditions of audiovisual recording of the sessions for research proposes, and (3) a *digital signature* method for the return of the form via email to the researcher.

In the first meeting, a *DMRT Informed Consent Form* (Appendix-IV) approved by the University of Cincinnati Institutional Review Board was provided to each participant for reading, to ask questions for understanding, and for their signature for participation in the study. In Meeting #1, all eight participants signed the consent to participate.

**Privacy Protection**

Participants were informed that the data from the study may be published and presented at conferences. Participants were informed that they would not be identified by name unless disclosure is required by law: mandatory reporting of child abuse, elder abuse, or immediate danger to self or others. The audiovisual recording release form provided a “digital signature” method for the potential participant to agree (or not agree) to be audiovisual taped.

The form also assured the potential participant that every effort would be made to ensure the concealment of his or her identity through editing audiovisual recordings: (1) Facial features would be camouflaged with special camera features; (2) voice enhancements would be used to camouflage voice recognition; or (3) caption (or written language scripts) would be used on the
videotape screen to eliminate voice recognition. All entrustment notes, audiotapes, videotapes, and transcripts were stored in a locked file cabinet as a researcher permanent record.

Confidentiality

Every effort was made to maintain confidentiality. With the exception of the supervising faculty, the investigator did not allow anyone (a) to read instruments completed by participants in the study; (b) to read interview/questionnaire/survey transcripts; (c) to listen to audiotapes of the study or group sessions; or (d) to watch videotapes of the study or group sessions.

Identifiable Data

All participants’ names and geographical identifying data on all data collection materials were coded for data entry. Beginning when first walking in the door in the first meeting, all participants’ names were replaced with numbers to facilitate audiovisual recording of the study sessions’ activities. Electronically, participants’ facial image, if accidentally captured on film, were camouflaged or disfigured to conceal identity with special camera features.

All research data and audiovisual recordings are kept under lock and key, and they will remain a part of the researcher’s permanent record for educational teaching aids, future references, and publication purposes with participants’ identity camouflaged, permanently.

Risks of the Study

Risks to participants were minimized:

1. because procedures were used that are consistent with sound research design that do not unnecessarily expose participants to risk;

2. procedures were performed on the participants in their homes, consistent with their customary nighttime routines; and
3. procedures involved the initiation of the *relaxation response* that is familiar for reducing stress in some manner to most people.

Risks to participants were reasonable in relation to anticipated benefits to participants and the importance of the knowledge that may reasonably be expected to result. Participants were asked to focus on sleeping and relaxing to help eliminate difficulty of initiating sleep-onset and wakefulness. However, if there were any problems, participants were instructed to contact the researcher via email: elmsh@mail.uc.edu.

**Direct Benefits of the Study**

With the DMRT, a tool that promises to aid the difficulty of initiating sleep-onset and waking-alertness, the participants benefitted from this study because they gained knowledge of ways to address personal sleeping problems.

**Indirect Benefits of the Study**

The Counseling Programs and the Psychology Departments were specifically targeted for recruitment because the DMRT would add to their repertoire of professional treatment interventions for counseling/therapy. Also, participants were able to share the DMRT with family members or friends to help ameliorate minor sleep difficulties or awakening problems.

**Research Ethics Training**

On December 1, 2009, the researcher successfully completed all basic researchers’ knowledge requirements on the Greater Cincinnati Academic and Regional Health Centers Core Curriculum Modules.

**Funding**

The researcher was responsible for all monetary expenses of the experiment.
Site Permission

The University of Cincinnati Institutional Review Board granted the permission to perform this study on UC’s campus.

Setting

The setting for conducting the study was the University of Cincinnati’s West Campus. The procedure itself was conducted privately by each participant in his or her sleep/wake environment. The researcher met with participants in several sessions to conduct study activities: introductions, consent form signing, screening activities, DMRT training, and debriefing.

Apparatus

Equipment wise, the study of the DMRT included computers and internet access to assist in collecting the data. The *PASW Statistics GradPack 18* (2009) was used for statistical analysis of the data through statistical methods that include multivariate and univariate analyses at the \((p < .05)\) alpha level. Microsoft Office (2007) Computer Software was used for data collection.

Instrumentation

There are several instruments that focused on screening and assessments of within-group variables used in this study: (1) the DMRT Screening Questionnaire (SCNQ), (2) the DMRT Sleep Dairy (DmrtSD), (3) the Self-Awakening Scale (SAWS), (4) the Self-Awakening Scale Index (SASI), (5) the Elms Sleep/Alertness Scale-II (ESAS-II), (6) the Elms Sleep-Onset Stress Scale-II (ESOS-II), and (6) the DMRT Evaluation Form/Follow-Up Form (EVF/FUF).

Table 2: Self-Awakening Sleep/Wake Pattern Measures illustrates the nine observed dependent variables (DVs) generated by the data collected from the experimental instruments used in this study. The DVs represent constructs of the theorized latent variable: self-awakening.
### Table-2

**Self-Awakening Sleep/Wake Pattern Measures**

<table>
<thead>
<tr>
<th>Sleep-Onset Quality</th>
<th>Sleep Quality</th>
<th>Self-Awakening Quality</th>
<th>Sleep-Offset Quality</th>
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<td>TST</td>
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Reliability Coefficient = Pearson’s r

**Pilot Study**

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DMRT Study:

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Note: **VAR**: Variable Minutes (m). **Self-Awakening (SA)**. Performance Levels: (1 to 6). All Scales are Continuous scales.

Interval Scales: Linear graphic line (1 to 10 points). Ratio Scales: Linear graphic line (0 to ± 60 min) or (0 to 7 points).

*ESOS-II*: Elms Sleep-Onset Stress Scale-II = Interval Scale = Variable: DFASI.

*ESAS-II*: Elms Sleep-Onset Stress Scale-II = Interval Scale = Variable: DWFISI.

*SAWS*: Self-Awakening Scale & Variables: (1) SASI = Ratio (2) WBAI = Ratio (3) WBACI = Ratio, DWBAI = Ratio

Reliability Coefficient Pearson r: Pilot Study Results.

Reliability Coefficient Pearson r: DMRT Study Results.
The Deep Meditative Relaxation Technique (DMRT)

sleep/wake quality. The quality of sleep is examined on four levels: (1) sleep-onset quality, sleep-quality, (3) self-awakening quality, and (4) sleep-offset quality.

Through pilot testing, 13 original variables were reduced to nine dependent variables that best addressed objectives of the study. (See Pilot Study for details, Appendix V.). Sleep-onset quality is described by the Difficulty Falling Asleep Index (DFASI). Sleep continuity DVs that describe sleep quality are (1) Wake After Sleep-Onset (WASO), (2) Number of Wakes (NOW), and (3) Total Sleep Time (TST). Self-awakening quality’s DVs are (1) Self-Awakening Scale Index (SASI), (2) Wake Before Alarm Index (WBAI), (3) Wake Before Alarm Cue Index (WBACI), and (4) Difficulty Waking Before Alarm Index (DWBAI). The dependent variable defining sleep-offset quality or waking-life quality for six hours after the last awakening is Difficulty Waking From Sleep Index (DWFSI).

In addition, the DMRT Evaluation Form (EVF) and/or Follow-Up Form (FUF) produced six posttest indexes: DMRT Continue Use Index (DCUI), DMRT Help Index (DHI), Wake Before Alarm Index-2 (WBAI-2), Practice Effect Index (PEI), Deep Relaxation Index (DRI), and Sleep-Control Index (SCI). The EVF/FUF, program evaluators, described some aspects or characteristics (i.e., abilities, opinions, attitudes, and/or knowledge) generated from DMRT use of what the sample thinks/feels.

Illustrated in Table 2, the absolute values of each of the nine DVs examined in this study were defined and measured with three to six performance levels. These performance levels were measured with an interval scale. By placing the indexes on performance levels, the individuals within the group were compared on the specified variable according to the meaning of the level.

In addition, the validity and reliability information for the DVs used in this study were assessed in the Pilot Study: DMRT Psychometrics (2009) (Appendix V). The nine DVs used in
this study do not represent all of the variables that are derived from this study. Variables that were collected but not used in this report are located and described in the *DMRT Sleep Diary Variables/Scales Manual* (DmrtSD-VS-Manual) located in Appendix VI. All DVs and their measures used in this study are described in the following.

**Measures**

**DMRT Screening Questionnaire.** *DMRT Screening Questionnaire* (SCNQ) is the screening instrument developed for this study by the researcher (Appendix-VII). The SCNQ consists of 14 items for demographic identification and a 48-item questionnaire pertaining to sleep/wake behavior, pertinent medical conditions, and needed equipment to perform the study.

The SCNQ records (a) the potential participants’ reasons for wanting to participate; (b) their feelings about their sleep behavior and if they think they have sleep difficulty; (c) a description of their sleep/wake behavior; (d) if they have used relaxation or meditation techniques and if they have a problem with learning such techniques; (e) if they are willing to spend the necessary time to complete the study; and (f) if they are habitual self-awakeners.

The SCNQ consists of the following self-rating scales: (1) Self-Awakening Index (SAI) rated on the SAI scale (1-4); (2) sleep-onset latency-0 (SOL-0) rated on the SOL scale (1-60); (3) subjective sleep quality-0 (SQual-0) rated on the SQual scale (1-10); (4) difficulty waking from sleep-0 (DWFS-0) rated on the Elms Sleep/Alertness Scale (1-10); and (5) difficulty falling asleep-0 (DFAS-0) rated on the Elms Sleep-Onset Stress Scale (1-10).

To help distinguish at what phase of the study the DVs were assessed, the variables were labeled as follow: (1) The self-rating scales used in the SCNQ are marked with a zero (e.g., WBAI-0); (2) the self-rating scales for the experimental variables are not marked (e.g., WBAI); (3) the self-rating scales used in the EVF/FUF are marked with the number two (e.g., WBAI-2).
Except the Self-Awakening Index (SAI), the aforementioned SCNQ variables and scales are described in (a) the SCNQ; (b) ESOS-II; (c) ESAS-II; and/or (d) Table-2. However, the SCNQ’s variable and scale for SAI are described in the following:

**Self-Awakening Index.** Self-Awakening Index (SAI) distinguishes between those who habitually self-awaken (SA) and the non-habitual self-awakeners (nonSA). Participants are asked, “How do you routinely awaken on weekdays [weekend]?” The raw score is rated on a four-point graphic scale anchored by 1 (*Never use an alarm or external source to awaken*) to 4 (*Use an alarm, but do not awake before the alarm*). The SAI scale’s format is developed from models indicated by Matsuura et al. (2002b) and Moorcroft et al. (1997).

**DMRT Sleep Diary.** A *Sleep Diary* is a standard validated instrument in the field used to record sleep/wake behavior. A sleep diary (or log) is a daily written record of an individual's sleep-wake patterns containing the following information: (1) time of retiring and arising, (2) expected wakeup time, (3) time in bed (sleep efficiency), (4) estimated total sleep time, (5) sleep-onset latency, (6) number of wakes, (7) duration of wakes after sleep-onset, (8) quality of sleep, (9) sleep mood, (10) sleep alertness upon awakening, (11) daytime naps, (12) use of medications or caffeine beverages, (13) nature of awakening activities, and (14) other data (Bell, 1980; Coates et al., 1982; Hawkins & Shaw, 1992; Mayers et al., 2003; Meltzer, Mindell, & Levandoski, 2007; Rosen, Lewin, Goldberg, & Woolfolk, 2000; Sleepnet, 2008; Wilson, Watson, & Currie, 1998).

Sleep diary data were used because (1) the study is conducted in the field or in the individuals’ natural setting (home and daily environment); (2) this measurement strategy is most frequently used in home monitoring of sleep/wake behavior; and (3) it represents the primary means of assessing clients and patients’ sleep/wake behavior in practice and research (Morin,
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Culbert, & Schwartz, 1994; Murtagh & Greenwood, 1995; Nowell et al., 1997). The DMRT Sleep Diary is developed from the format of the models indicated by Bell (1980), Lavie et al. (1979), Matsuura et al. (2002b), Mayers et al. (2003), Moorcroft et al. (1997), and Sanofi-Aventis (2008).

The DMRT Sleep Diary (DmrtSD) describes sleep/wake quality (Appendix VIII). The sleep diary contains the estimated times the participants performed the sleep or waking behavior. The DmrtSD’s time-of-behavior produced seven observed DVs used in the study: SASI, WBAI, WBACI, DWBAI, WASO, NOW, TST, that are described in Table-2. Formulas to calculate the absolute values of (1) the seven sleep diary variables, (2) DWFSI, and (3) DFASI used in this study are located in the Sleep/Wake Pattern Index Formulas Chart (Appendix IX).

Further validity and reliability information of the sleep/wake variables are located in (1) the Pilot Study: DMRT Psychometrics (Appendix V); (2) the DmrtSD-VS-Manual (Appendix VI); and/or (3) the Sleep Continuity Psychometric History Chart (1967-2003) (Appendix-X). The DVs describing (1) SASI, (2) WBAI, (3) WBACI, (4) DWBAI, (5) DWFSI, (6) DFASI, (7) WASO, (8) NOW, and (9) TST are briefly described in the following.

Self-Awakening Scale. Self-Awakening Scale (SAWS) assesses when the participant wakes when an alarm is used. The time of the behavior is reported in the DmrtSD. The SAWS uses a linear graphic scale ranging from a negative (-) 120 minutes (wake before alarm minutes [WBAM]) to a positive (+) 120 minutes (wake after alarm minutes [WALM]). The “Zero” point represents waking at the expected wakeup time (W_EWT) or alarm time. The scale’s format is developed from models indicated by Moorcroft et al. (1997) and Lavie et al. (1979). There are four variables measured on the SAWS: SASI, WBAI, WBACI, and DWBAI (Table-2).
**Self-Awakening Scale Index.** The Self-Awakening Scale Index (SASI) measures self-awakening at a pre-set time without an alarm or other external means. SASI is developed from the SAWS (a linear graphic scale ranging from -120 minutes to +120 minutes). However, SASI also consists of performance levels measured on a linear graphic scale anchored by Level 1 (-1 minute to -15 minutes) to Level 5 (0 to +120 minutes). The SASI is assessed with the time-of-the-behavior reported in the sleep diary. The daily SASI’s raw scores are assessed with the time-of-the-behavior with the WBAM, WALM, and W_EWT.

SASI’s daily raw scores are calculated in the following three steps: (1) The wake before alarm minutes (WBAM) equal (=) the wake before alarm time (WBAT) minus (-) the expected wakeup time (EWT) (target time) noted in negative (-) minutes: \( WBAM = WBAT - EWT \). (2) The wake after alarm minutes (WALM) equal the wake after alarm time (WALT) minus the expected wakeup time (EWT) noted in positive minutes: \( WALM = WALT - EWT \). And (3), the waking at expected wakeup time (W_EWT) is the chosen target time or alarm time reported by each participant.

The absolute value (ABSV) of the daily times is the index-value used in the initial data analysis. The SASI’s ABSV (SASI_{ABSV}) is calculated with the times’ raw scores collected daily and then averaged to produce the index’s absolute value. The mean \( (M) \) is commonly known as the arithmetic average and is computed by adding all the scores in the distribution and dividing by the number of scores (Gravetter & Wallnau, 2000).

This study consists of averaging times (T), and the average is termed Mean-Time \( (M_T) \). Also, it consists of averaging scores (X), and the mean is termed Mean-Score \( (M_X) \). In addition, the SASI_{ABSV} is calculated with sleep diary variables by using two methods: (1) the minute-time-
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calculation method and (2) the hour-minute-time-calculation method. The formulas are located in the Sleep/Wake Pattern Index Formulas Chart (Appendix IX).

The minute-time-calculation method uses the WBAM and the WALM to calculate the SASI\textsubscript{ABSV}. The SASI\textsubscript{ABSV} minute-time-calculation method uses four formulas: (1) $\sum f = N_{\text{Days}}$, (2) $M_{T1} = \sum T / N = \sum \text{WBAM} / 7_{\text{Days}}$, (3) $M_{T2} = \sum \text{WALM} / 7_{\text{Days}}$, and (4) $M_{TD} = (M_{T1} - M_{T2})$ or $M_{TD} = (M_{\text{WBAM}} - M_{\text{WALM}})$. Formula-1 indicates that the sum of ($\sum$) the frequency ($f$) of the index-minutes it took to produce the behavior equals the number ($N$) of days the behavior occurred. The number of days equals to seven in this case because we are mainly assessing the 7-day-week intervals in the pretest and experimental phases of the study.

Formula-2 calculates the arithmetic average or the Mean-Time ($M_T$) of the minutes of the SASI\textsubscript{ABSV}. Formula-2 indicates that Mean-Time-1 ($M_{T1}$) equals the sum of ($\sum$) WBAM’s times (T) divided by the number (N) of days. Formula-3 indicates Mean-Time-2 ($M_{T2}$) equals the sum of ($\sum$) WALM’s times (T) divided by the number (N) of days. Formula-4 indicates that the Mean-Time Difference ($M_{TD}$) equals the Mean-Time-1 ($M_{T1}$) of the WBAM minus Mean-Time-2 ($M_{T2}$) of the WALM. Thus, the SASI\textsubscript{ABSV} equals the Mean-Time Difference ($M_{TD}$) of WBAM minus WALM.

The hour-minute-time-calculation method uses the actual “hours and minutes” of the expected wakeup time (EWT) and final wakeup time (FWT) to calculate the SASI\textsubscript{ABSV}. The SASI\textsubscript{ABSV} hour-minute-time-calculation method uses four formulas: (1) $\sum f = N_{\text{Days}}$, (2) $M_{T1} = \sum T / N = \sum \text{EWT} / 7_{\text{Days}}$, (3) $M_{T2} = \sum \text{FWT} / 7_{\text{Days}}$, and (4) $M_{TD} = (M_{T1} - M_{T2})$ or $M_{TD} = (M_{\text{EWT}} - M_{\text{FWT}})$. Formula-1 indicates that the sum of ($\sum$) the frequency ($f$) of the time-of-the-behavior equals the number ($N$) of days the behavior occurred. The number of days equals to seven in this
The Deep Meditative Relaxation Technique (DMRT)

case because we are mainly assessing 7-day-week intervals in the pretest and experimental
phases of the study.

Formula-2 indicates that Mean-Time-1 \((M_{T1})\) equals the sum of \((\sum)\) the EWT’s times \((T)\)
divided by the number \((N)\) of days. Formula-3 indicates that the Mean-Time-2 \((M_{T2})\) equals the
sum of \((\sum)\) the FWT’s times \((T)\) divided by the number \((N)\) of days. Formula-4 indicates that
Mean-Time Difference \((M_{TD})\) equals Mean-Time-1 \((M_{T1})\) of EWT minus Mean-Time-2 \((M_{T2})\) of
the FWT. Therefore, the SASI\textsubscript{ABSV} equals the Mean-Time Difference \((M_{TD})\) of the EWT minus
FWT.

Both the minute-time-calculation (MTC) and hour-minute-time-calculation (HMTC)
methods produce the SASI\textsubscript{ABSV}. Internally controlled, the MTC and HMTC methods reveal a
hidden check and balance system in the design in calculating the SASI\textsubscript{ABSV}. The MTC method
calculates the Mean-Time and the HMTC method calculates the Mean-Time Difference to
produce the SASI\textsubscript{ABSV}.

Next, the SASI\textsubscript{ABSV} is assigned to levels to represent the meaning of the final index
number of the SASI’s value. The SASI’s performance levels of the behavior are measured on a
linear graphic scale consisting of five levels ranging from Level 1 \((Very \ Good \ Self-Awakening \ [-1\ \ to\ \ -15\ minutes])\) to Level 5 \((Did\ not\ wake\ before\ the\ alarm\ \ [\geq\ 0\ minutes])\).

SASI’s absolute values converted to levels (1 to 5) represent (1) the smaller numbers
(e.g., -1 to -15 minutes) produce the better performance by waking before the alarm time and (2)
the larger numbers (e.g., -46 to -60 minutes) represent more time used in waking before alarm
while Level 5 represents waking at the alarm or not waking before the alarm time. Thus, an
increase in the behavior represented by the SASI refers to the better performance of waking
before alarm and is indicated by the smaller-numbered levels (Table 2).
**Wake Before Alarm Index.** The *Wake Before Alarm Index* (WBAI) measures self-awakening at a pre-set time without an alarm or other external means. WBAI measures self-awakening quality. The WBAI is the number of times one wakes before the alarm time (WBAT) or the frequency of self-awakening within one week. Simply, while the SASI measures the success of self-awakening at a pre-set time in minutes, WBAI measures the *consistency success rate* of self-awakening.

WBAI’s absolute value (WBAI$_{ABSV}$) formula is $\sum f (WBAT) = N_{Days}$ (Appendix IX). The formula indicates WBAI$_{ABSV}$ is the sum of ($\sum$) the frequency ($f$) of WBAT equals to the number ($N$) of days the behavior occurred. In other words, the WBAI$_{ABSV}$ is the sum of the frequency that the WBAT occurred within a 7-day period. Thus, the number of days is the WBAI$_{ABSV}$.

Next, the WBAI’s absolute values are converted to WBAI’s performance levels measured on a linear graphic scale anchored by Level-1 (*Extremely High Consistent Self-Awakening [5 to 7 days]*) to Level-6 (*Non-Consistent Self-Awakening [0 days]*) (Table-2). Consequently, the smaller-numbered levels produce the better performance of waking before the alarm *consistency success rate*.

**Wake Before Alarm Cue Index.** *Wake Before Alarm Cue Index* (WBACI) is used as the cue-power-indicator of the participants’ ability to wake within 10 minutes of the target time, consistently. In other words, WBACI measures the *cue-consistency success rate* of the behavior at the 10-minute level. Research determined that the ability to self-awake at the 10-minute interval is rated *high consistency success* (Moorcroft et al., 1997).

WBACI measures self-awakening’s *cue-consistency success* with the wake before alarm cue minutes (WBACM). WBACM are the designated DMRT’s “precision point interval” because it contains the *cue-time* range to self-awake. WBACM are the minutes that range from a
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negative 1 minutes to a negative 10 minutes (-1 to -10) from the expected wakeup time (EWT).
Participants choose their own individual wake up time, but must say the “cue” (wake 5-minutes before alarm). The precision-point-interval (-1 to -10 minutes) contains the precision point of “negative 5-minutes” to wake before alarm time.

Although WBACI measures consistency-success, it also indicates it is measuring the power of the cue-command (wake 5-minutes before the alarm) stated before sleep, theorized to consolidate within sleep, and perhaps manifest itself in wakefulness within the precision-point interval (-1 to -10 minutes) before alarm. The WBACI is derived from the EWT reported in the sleep diary. The WBACM equal the EWT less than or equal to negative 10 minutes, but less than zero. The formula is EWT ≤ -10 < 0 minutes.

WBACI’s absolute value (WBACI_{ABSV}) formula is \( \sum f (EWT \leq -10 < 0 \text{ min}) = N_{Days} \). The formula indicates WBACI_{ABSV} is the sum of (\( \sum \)) the frequency (\( f \)) of EWT less than or equal to negative 10 minutes less than zero equals to the number (\( N \)) of days the behavior occurred. In other words, the WBACI_{ABSV} is the sum of the frequency that the WBACM (-1 min to -10 min) from EWT (= zero) occurred within a 7-day period. Thus, the number of days is the WBACI_{ABSV}. WBACI_{ABSV} is also defined by WBACI’s performance levels measured on a linear graphic scale ranging from Level-1 (Extremely High Cue-Consistent Self-Awakening [5 to 7]) to Level-6 (Non Cue-Consistent Self-Awakening [0]) (Table-2). Consequently, smaller-numbered levels produce the better performance of the cue-consistency-success rate.

Difficulty Waking Before Alarm Index. Difficulty Waking Before Alarm Index (DWBAI) measures the individuals’ somnolence before leaving the bed. The DWBAI is calculated from the times (W_EWT, WALT) reported in the sleep diary, and it is reported by the participants’ responses on the ESAS-II’s Level-4 (Severe Sleepiness [points 8 to 10]). The wake
after alarm minutes (WALM) equal the wake after alarm time (WALT) minus the expected wakeup time (EWT) noted in positive minutes. The formula is WALM = WALT – EWT. Yet, the waking at expected wakeup time (W_EWT) is the time the participant sets the alarm.

DWBAI is developed from the SAWS (linear graphic scale ranging from -120 to +120 minutes). Since the W_EWT (= zero) and the WALM (= +1 to +120 minutes) represent the waking in the sleep period at alarm or returning to sleep and waking after alarm, both the W_EWT and the WALT were combined to refer to the frequency of these behaviors occurring per day to represent the DWBAI.

DWBAI’s absolute value (ABSV) (DWBAI_{ABSV}) is calculated with the following formula: \( \sum f (W_{EWT}) + \sum f (WALT) = N \). The formula indicates the DWBAI_{ABSV} is the sum of (\( \sum \)) the frequency (f) of waking at W_EWT’s times (T) plus the sum of (\( \sum \)) the frequency (f) of WALT’s times (T) equals the number (N) of times the behaviors occurred. The number (N) is the absolute value of the DWBAI.

The DWBAI’s absolute values are also assigned to performance levels using a linear graphic scale with four levels ranging from Level-1 (Low Difficulty Self-Awakening [0-3]) to Level-4 (Severe Difficulty Self-Awakening [10-14]). Thus, the smaller-numbered levels represent the preferred performance of the behavior of difficulty waking before the alarm (Table 2).

**Elms Sleep/Alertness Scale.** The *Elms Sleep/Alertness Scale* (ESAS) and *Elms Sleep/Alertness Scale-II* (ESAS-II) were used to calculate the Difficulty Waking From Sleep Index (DWFSI). DWFSI refers to the behavior describing the sleepy/alertness state attributed to the quality of sleep received the night before. DWFSI represents alertness upon-awakening from nocturnal sleep.
**Elms Sleep/Alertness Scale (ESAS).** *Elms Sleep/Alertness Scale* calculates the Difficulty Waking From Sleep Index (DWFSI) on a 10-point linear graphic scale ranging from 1 (*Not Difficult-Alert/ Energetic*) to 10 (*Severe Sleepiness*). The ESAS is only used to calculate the DWFSI in the DMRT Screening Questionnaire (Appendix VII), and the results are displayed with a zero (e.g., DWFSI-0).

**Elms Sleep/Alertness Scale-II (ESAS-II).** *Elms Sleep/Alertness Scale-II* is used to calculate the DWFSI in the study (Appendix XI). In ESAS-II, the DWFSI focuses on the difficulty upon-awakening from nocturnal sleep that extends into the first six hours after the last awakening. Because of the circadian rhythm, research has determined that at the seventh to eighth hour from awakening individuals will naturally get sleepy and want to take a nap at these times (Mednick & Ehrman, 2006; Mednick et al., 2003). Hence, for distinction, DWFSI only includes the first six hours after last awakening from nocturnal sleep.

The DWFSI is calculated with its absolute values that are converted to performance levels. The ESAS-II is a composite scale that consists of four performance levels with seven descriptors of the difficulty of awakening from sleep and three descriptors of difficulty waking before the alarm. The DWFSI’s seven descriptors range from 1 (*Felt alert, energetic, motivated, and/or focused after the last awakening from sleep from first opening eyes that last 6 hours*) to 7 (*Nodded and/or dozed off to sleep within 1 to 6 hours after the last awakening from sleep*). The DWFSI’s absolute values are derived from the Mean-Score of the first seven descriptors.

Yet, the Difficulty Waking Before Alarm Index (DWBAI) is measured with the last three descriptors (points 8, 9, 10) on the ESAS-II’s Level-4 (*Severe Sleepiness*). However, the DWBAI is used to assess sleep/alertness behavior of the difficulty waking before the alarm.
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sounds and/or sleeping pass the alarm. The ESAS-II's Level-4 describes the assessment of sleep behavior by the individual that confirms the calculation of the DWBAI by the sleep diary times.

The DWFSI’s absolute value ($\text{DWFSI}_{\text{ABSV}}$) is assessed in two steps with two formulas:

1. $\text{DWFSI} = \sum f = N$
2. $M_X = \frac{\sum X}{N} = \frac{\sum (\text{DWFSI})}{N_{\text{Days}}}$

Formula-1 indicates the sum of ($\sum$) the frequency ($f$) of the DWFSI’s daily scores ($X$) equals to the number ($N$) of days the behavior is recorded. The number ($N$) equals seven because of the 7-day-week interval of data collection in pretest and experimental phases of the study. Formula-2 indicates the sum of ($\sum$) the scores ($X$) is divided by the number ($N$) of days to equal the mean ($M$) of the scores ($X$). Thus, the $\text{DWFSI}_{\text{ABSV}}$ equals the Mean-Score ($M_X$) of the daily scores.

In the ESAS-II, DWFSI’s absolute values are converted to three performance levels to represent the meaning of the final index number. DWFSI’s performance levels of the behavior are measured on a linear graphic scale ranging from Level-1 (Not Difficult Alert/Energetic [1 to 3]) to Level-3 (Very Difficult-Lethargic/Sleepy/Sluggish [7]) (Table-2).

DWFSI’s absolute values converted to levels (1 to 3) represent (1) the smaller-numbered levels (e.g., Level 1) produce better performance and (2) the larger-numbered-levels (e.g., Level 3) present more difficulty in performing the behavior of waking from sleep. Thus, a decrease in the difficulty awaking from sleep is the better performance of the behavior represented by the smaller-numbered levels.

Participants were instructed to complete the ESAS-II on a daily basis after the first six hours after the last awakening from nocturnal sleep. The ESAS-II instrument contains the participant’s ID Code, study week number, date, and weekdays for each participant to record the difficulty awaking from sleep and the difficulty waking before the alarm on a daily basis in pretests and experimental phases.


**Elms Sleep-Onset Stress Scale.** The *Elms Sleep-Onset Stress Scale* (ESOS) and the *Elms Sleep-Onset Stress Scale-II* (ESOS-II) calculate the Difficulty Falling Asleep Index (DFASI). DFASI rates the stress of how hard or easy it is to fall asleep in the sleep-onset stage of sleep. Research has determined that it is normal to spend 30 minutes attempting to fall asleep (Bonnet & Arand, 2003; Sleep Continuity Psychometric History Chart [1967-2003] in Appendix-X). If one takes more than 31 minutes to fall asleep more than three times per week, the individual suffers from insufficient sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

**Elms Sleep-Onset Stress Scale (ESOS).** *Elms Sleep-Onset Stress Scale* was used in the DMRT Screening Questionnaire (Appendix VII). ESOS calculates DFASI on a 10-point scale ranging from 1 (*Not Difficult-Normal Stress*) to 10 (*Severe Stress*). DFASI is reported with a zero in the screening questionnaire (e.g., DFASI-0).

**Elms Sleep-Onset Stress Scale-II (ESOS-II).** The *Elms Sleep-Onset Stress Scale-II* was used to calculate the DFASI in the study (Appendix XII). The ESOS-II is a composite scale that consists of four levels with 10 descriptors of the difficulty of falling asleep behavior. The 10 descriptors are anchored by 1 (*Fell asleep within 1 to 15 minutes; if I awoke before expected Wakeup Time, each awakening was less than 5 minutes*) to 10 (*Fell asleep after 45 minutes*). The DFASI’s absolute values are derived from the Mean-Score of the 10 descriptors.

The DFASI’s absolute value (DFASI\textsubscript{ABSV}) is assessed in two steps with two formulas: (1) $DFASI = \sum f = N$ and (2) $M_X = \sum X / N = \sum (DFASI) / N_{Days}$. Formula-1 indicates the sum of the frequency ($f$) of the DFASI’s daily scores ($X$) equals to the number ($N$) of days the behavior occurred. The number ($N$) equals seven because of the 7-day-week interval of data collection in pretest and experimental phases of the study. Formula-2 indicates the sum of the daily scores
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(X) is divided by the number (N) of days to equal the mean (M) of the scores (X). Thus, the DFASIA equals the Mean-Score (Mₙ) of the daily scores.

In the ESOS-II, DFASIA’s absolute values are converted to four levels to represent the meaning of the final index-number. DFASIA’s performance levels of the behavior are measured on a linear graphic scale anchored by Level 1 (Not Difficult-Normal Stress [1 to 3]) to Level 4 (Severe Stress [10]) (Table 2). DFASIA’s levels (1 to 4) values represent (1) smaller-numbered levels (e.g., Level 1) produced the better performance and (2) the larger-numbered levels (e.g., Level 4) present more difficulty in performing the behavior.

Thus, a decrease in the difficulty falling asleep refers to the better performance of the behavior that is indicated by the smaller-numbered-levels. On the ESOS-II, participants record ID Code, study week number, date, and week days. The ESOS-II was used to record DFASIA on a daily basis in the study’s pretests and experimental phases.

**Wake After Sleep-Onset.** Wake After Sleep-Onset (WASO) is the length of time spent awake after going to sleep the first time after “lights out.” WASO is reported in the sleep diary nightly and averaged per 7-day week. WASO is obtained with the DmrtSD’s request: Estimate the time spent awake in a Sleep Period (in hours & minutes). In a sleep period, WASO represents the intra-waking time after sleep-onset to the final wakeup time (FWT). WASO is also used to determine the degree of sleep difficulty and the failure to maintain sleep throughout the night.

Research has determined that the time waking after sleep-onset greater than or equal to 31 minutes (WASO ≥ 31) more than three times per week is insufficient sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

WASO is assessed on a linear graphic scale anchored by one minute (*normal*) to 60 minutes (*severe*). These daily times (raw scores) are used to calculate the WASO index; that is,
daily times averaged per seven-day-week are the WASO’s absolute values. WASO absolute value (ABSV) (WASO$_{ABSV}$) is calculated with two formulas: (1) $\sum f = N$ and (2) $M_T = \frac{\sum T}{N} = \frac{\sum (WASO)}{7\text{Days}}$.

Formula-1 indicates that the sum of ($\sum$) the frequency ($f$) of waking after sleep-onset times reported daily equals the number ($N$) of days the behavior occurred in a 7-day-week interval. Formula 2 indicates that the sum of ($\sum$) the WASO’s times ($T$) divided by the number ($N$) of days the waking after sleep-onset behavior occurred equals Mean-Time ($M_T$). Thus, Formula-2 indicates that WASO$_{ABSV}$ equals the Mean-Time ($M_T$) of the WASO’s daily times ($T$) to produce the WASO index used in data analysis. WASO$_{ABSV}$ is also defined on four levels that range from Level-1 (*Normal WASO [0 to15 minutes]*) to Level-4 (*Severe WASO [46 to 60 min]*).

**Number of Wakes.** *Number of Wakes* (NOW) is the specific number of times one awakes in a nocturnal sleep period (entered bed time [EBT] to final wakeup time [FWT]). Participants are asked this question: “How many times did you wake up in a Sleep Period?” NOW is also used to determine the frequency degree of sleep difficulty of maintaining sleep. Research has determined that NOW less than or equal to 3 (NOW $\leq$ 3) in a nocturnal sleep period represents normal sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

NOW is assessed on a linear graphic scale anchored by 0 (*normal*) to 10 (*severe*). NOW’s absolute value (ABSV) (NOW$_{ABSV}$) is calculated with two formulas: (1) $\sum f = N$ and (2) $M_X = \frac{\sum X}{N} = \frac{\sum (NOW)}{7\text{days}}$. Formula-1 indicates the sum of ($\sum$) the frequency ($f$) of the behavior equals the number ($N$) of days the behavior occurred. Formula-2 indicates that the sum of ($\sum$) the scores ($X$) for the NOW divided by the number ($N$) of days equals the Mean-Score ($M_X$). Thus, the NOW$_{ABSV}$ equals the Mean-Score ($M_X$) of the NOW’s daily scores. NOW$_{ABSV}$ is the index for NOW.
Also, the NOW is defined on four clinical levels that range from Level-1 (Normal NOW [0 to 3]) to Level-4 (Severe NOW [10]). Clinically, the smaller-numbered levels (e.g., Level-1 [0 to 3 points]) are the preferred number of wakes.

**Total Sleep Time.** Total Sleep Time (TST) is sleep time (ST) measured by (enter bed time [EBT] minus final wakeup time [FWT]) minus total waking time (TWT) measured by (the sum of the length of waking after sleep-onset [WASO] plus sleep-onset latency [SOL]). The formula is TST = ST (EBT – FWT) – TWT (WASO + SOL) in minutes. TST is recorded in hours and minutes in the sleep diary. Also, TST’s daily times (T) are used to calculate daily sleep efficiency percentages.

The TST’s absolute value (ABSV) (TST_{ABSV}) is assessed by two formulas: (1) $\sum f = N$ and (2) $M_T = \sum T/N = \sum (TST)/7$Days. Formula-1 indicates the sum of ($\sum$) the frequency ($f$) of TST’s times reported in the sleep diary equals the number ($N$) of days the behavior occurred. Formula-2 indicates the sum of ($\sum$) TST’s times ($T$) divided by the number ($N$) of days equals the Mean-Time ($M_T$) of the total sleep times. Thus, the TST_{ABSV} or index equals the Mean-Time of the TST daily times.

**DMRT Evaluation Form/Follow-Up Form.** DMRT Evaluation Form (EVF) and/or DMRT Follow-Up Form (FUF) assess the participants’ evaluation of the DMRT’s overall effects on their sleep/wake behavior with the use of the DMRT (see Appendix XIII). In the EVF and FUF, one index was labeled with a number-2 (i.e., WBAI-2). The digit (2) is used to distinguish DVs from those located in screening questionnaire and experimental instruments.

**Wake Before Alarm Index-2 (WBAI-2).** Wake Before Alarm Index-2 (WBAI-2) was assessed with this question: “Can you habitually self-awake at a pre-set time (without alarm or
help) within 15 minutes before the alarm?” WBAI-2 is measured by WBAI-2’s linear graphic scale anchored by 0 (zero time per week) to 5 (5 times per week) (Table 3).

**DMRT Continue Use Index (DCUI).** Participants are asked if they will continue to use the DMRT with the **DMRT Continue Use Index (DCUI)** measured on the DCUI’s linear graphic scale anchored by 1 (definitely no) to 5 (definitely yes) (Table-3).

**DMRT Help Index (DHI).** Participants’ opinions are assessed with the question: “Did the DMRT help in the daily activities of your life?” The variable is labeled the **DMRT Help Index (DHI)** measured on the DHI’s linear graphic scale anchored by 1 (definitely no) to 5 (definitely yes) (Table-3).

**Deep Relaxation Index (DRI).** It is postulated that relaxation is one of the major elements in the DMRT that helps to produce the desired effects. Hence, relaxation is assessed in the evaluation of the DMRT in the EVF/FUF. The **Deep Relaxation Index (DRI)** was used to measure the participants’ rating of the effects the DMRT had on the ability to achieve relaxation. The DRI measures the relaxation effect with the DRI’s 6-point linear graphic scale anchored by 0 (no effect) to 5 (extremely high effect) (Table-3). DRI is used as the cue-power indicator that refers to the cue-command “relax” in the DMRT Cue-Mentation process. DRI indicates it is measuring the effects of the power of the cue “relax.”

**Practice Effect Index (PEI).** The EVF and FUF evaluate the feelings and opinions of the sample after their personal experiences with the DMRT. The EVF and FUF assess participants’ opinion with the request “Rate the effects more practice with the DMRT will have on the ability to consistently wake within 10 minutes before the alarm sounds.” The variable is labeled **Practice Effect Index (PEI)** measured on the PEI’s linear graphic scale anchored by 0 (no practice effect) to 5 (extremely high practice effect) (Table-3).
Table 3

**DMRT Program Evaluation Measures**

<table>
<thead>
<tr>
<th>VARIABLE NAME</th>
<th>DMRT Continue Use Index</th>
<th>DMRT Help Index</th>
<th>Wake Before Alarm Index-2</th>
<th>Practice Effect Index</th>
<th>Deep Relaxation Index</th>
<th>Sleep Control Index</th>
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<tr>
<td>VAR Abr.</td>
<td>DCUI</td>
<td>DHI</td>
<td>WBAI-2</td>
<td>PEI</td>
<td>DRI</td>
<td>SCI</td>
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<td>Scale Name</td>
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<td>PEI</td>
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</table>

**Note.**

VAR: Variable
Abr: Abbreviation
All scales are continuous
The Deep Meditative Relaxation Technique (DMRT)

Sleep-Control Index (SCI). The DMRT is theorized to be a technique that develops both self-control and sleep-control. Participants’ opinions about their ability to initiate sleep with the DMRT are assessed with the request “Rate the effects the DMRT has on initiating sleep.” The variable is labeled the Sleep-Control Index (SCI) measured on the SCI’s linear graphic scale anchored by 0 (no sleep-control effect) to 5 (extremely high sleep-control effect) (Table-3).

The WBAI-2, DCUI, DHI, PEI, DRI, and SCI’s absolute values are assessed by obtaining the Mean-Score ($M_X$) of each of the posttest scores ($X$) for all individuals or number ($N$) with the formulas: (1) $\sum f = N$ and (2) $M_X = \sum X/N$. Formula-1 indicates that the number ($N$) equals to the sum of ($\sum$) the frequency ($f$) of individuals included in the sample.

The formula-2 indicates the sum of ($\sum$) the posttest raw scores ($X$) is divided by the number ($N$) of individuals in the sample. Thus, the mean ($M$) score ($X$) of each one of the six posttest scores (WBAI, DCUI, DHI, PEI, DRI, and SCI) equals its Mean-Score ($M_X$). For example, DRI = $M_X = \sum X/N = \sum(DRI)/N$ equals the Mean-Score of DRI. The indexes are placed on performance levels (1 to 6) with the smaller-numbered levels (e.g., Level 1) representing the better performance of the behavior (Table 3). The EVF is sent via email after week three of the experimental phase, and FUF was administered one month after EVF.

Procedures

Recruitment Phase

Procedures for the participants in the present study are outlined in Figure 2: Procedure/Time Flow Chart. In the Recruitment Phase and with the permission of University Officials, the study was advertised through various channels: (1) Student Housing, (2) Counseling ListServ, (3) email, (4) campus posting of the DMRT Recruitment Flyers, and (5) by-word-of-mouth. Respondents had one week to announce their interest in the study.
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**Figure-2: Procedure/Time Flow Chart**

1. Advertisement
   DMRT Study
   2 Months.
   Respond Within 1-Week

2. Release Forms
   Emailed to Respondent.
   Form Returned:
   “Digital Signature”

3. Meeting Date
   Emailed to Potential Participants

4. Meeting #1
   Digital Signature
   Endorsed
   Purpose of DMRT Study

5. Meeting #1
   Instructions
   Rights/Risks
   Consent Forms Signed

6. Meeting #1
   Screening Tests
   1. DMRT Screening Questionnaire

7. Meeting #1
   DmrtSD, ESOS-II, & ESAS-II Explained & Practiced by Respondents.
   Excel Demonstrated.

8. Meeting #1
   Instructions:
   DmrtSD, ESOS-II, & ESAS-II Sent To Participants & Returned Daily & Weekly Via Email After Inclusion.

9. Adjourn
   Meeting #1
   Participants were Notified Via Email of Acceptance in the Study.

10. Instructions via Email
    Participants Chosen were Instructed to Collect Sleep-wake Cycles with Coded DmrtSD, ESOS-II, & ESAS-II for 7 Days & Nights & Returned Daily.

11. Pretest Data Collection
    1. 1-Week Sleep/wake Cycles.
    2. Emailed & Returned in 1-Week.

12. Pretest Evaluation
    1. DmrtSD
    2. ESOS-II
    3. ESAS-II

13. Instructions Emailed
    DMRT Group
    Meeting #2 Date.

14. Meeting #2: DMRT
    Training Day
    DMRT Group Practice

15. DMRT Training Script-Before Sleep
    1. Three Cycles of Deep Abdominal Breathing
    2. Say Cues to Body in a Scan from Toe to Head.
    3. Cue Words: “Rest,” “Relax,” “Sleep,”
       “Wake 5-minutes Before Alarm.”
    4. Practice DMRT Full Body Scan 2 Times before sleep.
       *Lie Down to Sleep with DMRT.
       *Repeat DMRT on Each Awakening.

16. Experimental Phase
    DMRT Group
    Collect Sleep/Wake Cycles & Practice DMRT Before Sleep for 2-Weeks.
    Email DmrtSD, ESOS-II, & ESAS-II Each Day.

17. Instructions Emailed
    DMRT Group
    Complete EVF.
    Return Immediately: Within 1-Week

18. Posttest Phase
    DMRT Group
    Prepare Data Analysis.
    Compare Pretest and Posttest Data

19. DMRT Group
    Date Sent for Meeting #3:
    Termination & Debriefing.

20. Meeting #3
    Follow-Up
    DMRT Group:
    Debriefing.
    Summary of Results.
    Dissertation Online.
    Release from Study.
    Study Termination.
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The DMRT Study Audiovisual Recording Release Form was emailed to the respondent to be returned signed with a digital signature (a self-designated four-digit fictitious number) (Appendix III). The release form informed the individual that the DMRT would be audiovisual recorded, and it provided the potential participant’s Permission “to be” or “not-to-be” audiovisual recorded during the study sessions. After the return of the release form with the signed “digital signature” to the researcher, a meeting date and location of the study were emailed to the respondent.

Both the respondent and the researcher signed the release form at meeting door-check-in and a copy provided to each. Also, at door-check-in, the potential participant received an Identity Code (ID) (a four-digit number) that replaced the name of the individual for dialogue purposes in each session to obscure identity during audio recording. Also, if accidentally videotaped, special camera features were used to camouflage facial recognition. All three study meeting sessions were audiovisual recorded.

In Meeting #1, a brief introduction, purpose, and procedures of the study were disclosed. All present were given an approved UC Institutional Review Board informed consent form of participant’s rights, risks, researcher and participant’s responsibilities, and confidentiality assurance by the researcher acknowledged (Appendix-IV). Potential participants acknowledged by signing that they would not be considered for inclusion in the study unless they met screening criteria. Individuals signed a consent form before providing data.

After signing the consent form in the meeting, potential participants completed the DMRT Screening Questionnaire (SCNQ). The SCNQ took approximately 20 minutes to complete. After SCNQ’s completion and collection, DMRT Sleep Diary (DmrtSD), Elms Sleep-
Onset Stress Scale-II (ESOS-II), and Elms Sleep/Alertness Scale-II (ESAS-II) were explained to all potential participants attending the meeting.

The individuals were instructed to expect their acceptance into the study once screening criteria were met, and notifications were emailed within one week. They were informed that (a) identity codes, (b) reminder instructions to complete the forms, (c) the DmrtSD, (d) ESOS-II, and (e) ESAS-II would be emailed. Potential participants were instructed to (1) collect sleep-wake cycles for two days, (2) return each day’s results, and (3) return completed two-day results by the third day via email.

After the two-day sleep-wake cycles were returned and screening criteria met, notices of those who passed screening requirements were notified and instructed to begin collecting sleep-wake cycles for one week beginning the following Sunday night.

Screening Phase

In the Screening Phase, responses to the SCNQ were evaluated. The SCNQ contains the demographic information that identifies the individuals, their on-campus or off-campus residence, their student qualifications, and the specific college or university attended. The SCNQ asked questions to determine if the person habitually wakes oneself without an alarm or external source at a pre-set time.

Also, the SCNQ has several variables that determined whether sleep/wake quality patterns of the individual were normal or consisted of sleep difficulties. Normal sleepers are those who sleep between six to nine hours per night (Ferrara & Gennaro, 2001; Horne, 1988; Murphy et al., 2000; Pilcher et al., 1997). Those who slept less than an average per week of “core sleep need time: 4.5 to 6 hours” (Horne, 1988) or those who slept more than a 10-hour average per week failed to meet criteria to participate in this study.
The study was restricted to “normal” and “mild” sleep difficulties for liability purposes. Individuals who have narcolepsy or sleep apnea were barred from participation to eliminate risks because of their physical disability. In addition, all individuals who indicated on the SCNQ that they have restless leg syndrome, periodic limb movement disorder, or gastro-esophageal reflux disorder did not meet criteria to participate in this study.

Individuals who indicated they have “normal” to “mild” depression, anxiety, or stress did not meet criteria to participate in this study. Individuals who indicated “moderate” or “severe” depression or anxiousness were not included because of the potential risks. Also, individuals who indicated they use psychoactive drugs for anxiety and/or depression did not meet criteria to participate.

Individuals who took sleeping pills or other substances to initiate sleep (i.e., alcohol or drugs) did not meet criteria for this study. Also, those who were physically incapable of performing the DMRT did not meet criteria for inclusion (i.e., suffer cramps or breathing problems that cause frequent awakenings).

Respondents with sleep difficulties identified as insomnia were allowed to participate in this study. Sleep difficulties were determined through several methods. Basic criteria identifying parameters for insomnia included the following: (1) sleep onset latency (SOL) greater than or equal to 31 minutes (SOL $\geq$ 31), (2) number of wakes (NOW) greater than three (NOW > 3), (3) waking after sleep-onset (WASO) greater than or equal 31 minutes (WASO $\geq$ 31), and/or (4) total sleep time (TST) less than or equal to five hours or greater than nine hours (TST $\leq$ 5 hrs or $> 9$) (Bonnet & Arand, 2003; Coats et al., 1982; Horne, 1988; Lichstein et al., 2003; Mayers et al., 2003; Sleep Continuity Psychometric History Chart, Appendix-X). Any one or combination of these criteria experienced more than three nights per week are needed to diagnosis insomnia.
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Individuals who did not meet criteria to participate were notified via email. Those individuals were thanked for their interest in the study and instructed to email the researcher if they had further questions. All individuals who met criteria were notified via email of their inclusion in the study with further instructions to follow in the baseline phase.

**Baseline Phase/Pretest Phase**

In the baseline phase of the study, identifying codes were assigned to each individual to preserve the identity of the individual. Participants were emailed the DMRT Sleep Diary (DmrtSD), the Elms Sleep/Alertness Scale-II (ESAS-II), and the Elms Sleep-Onset Stress Scale-II (ESOS-II) with the identifying codes and instructed to collect sleep/wake cycles for one week, beginning the following Sunday night. Participants were instructed to send daily results of the DmrtSD, the ESAS-II, and the ESOS-II. Participants submitted the completed sleep diary, the ESAS-II, and the ESOS-II at the end of the week via email to the researcher. They also had the opportunity to address questions about the instruments to the researcher via email.

In the DmrtSD, participants noted (1) the medicines and beverages consumed before sleep; (2) the expected wake up time set for the following morning; and (3) the enter bed time to actually go to sleep. After awaking the following morning, they filled out the second section of the sleep diary and completed the ESOS-II. However, for those who woke before the desired time or the expected wake up time, they were instructed to complete these items: “What time did you go to sleep?” and “What time did you awake?” If applicable, they recorded repeated sleep and awakening times on the sleep diary.

In the sleep diary, after individuals awakened from nocturnal sleep, they noted (1) their final wakeup time; (2) the time they left the bed; and (3) the specific time they awoke before their expected alarm wake up time. They also (a) noted the number of times they remembered
awakening throughout the night, (b) estimated the total time spent awake after “lights out” to go
to sleep in hours and minutes, (c) estimated the minutes it took to fall asleep after “lights out” to
go to sleep, (d) estimated their total sleep time in hours and minutes, (e) noted their satisfaction
with sleep quality, and (f) rated mood upon awakening. Also, participants recorded nap times.

Once participants completed the sleep diary upon awakening, they reported any difficulty
falling asleep in the ESOS-II. In the ESOS-II, participants responded to only one of the 10
descriptors of the difficulty falling asleep listed on the scale per day. The ESOS-II is a composite
scale ranging from 1 (Fell asleep within 1-15 minutes; if I awoke before Expected Wakeup Time,
each awakening was less than 5 minutes) to 10 (Fell asleep after 45 minutes). Participants were
instructed to complete the ESOS-II upon awakening from nocturnal sleep each morning.

In addition, participants were instructed to complete the ESAS-II after the sixth hour after
awakening or at the end of the day. The ESAS-II contains 10 descriptors that describe the stress
of one’s attempt to travel from an unconscious state of mind to a conscious state called waking
alertness. Participants were instructed to respond to two of 10 descriptors, if applicable, listed on
the scale per day. The scale is anchored by 1 (Felt alert, energetic, motivated, and/or focused
after the last awakening from sleep from first opening eyes that last 6 hours) to 10 (Slept through
the alarm or past the Expected Wakeup Time at least once). Results were returned to the
researcher via email.

**DMRT Training Phase**

The participants were notified of Meeting #2: DMRT Training Day. Participants
assembled for 60 minutes in the conference room in the Counseling suite at the university.
Participants were taught the *Deep Meditative Relaxation Technique* (DMRT) and instructed to
practice the procedure at least once, immediately, before entering the bed to sleep. Participants
were instructed to perform the DMRT until they fell asleep. They also were instructed to perform the DMRT if they awakened in a sleep period and began another sleep-onset stage to return to sleep. An example of the basic procedures of DMRT is displayed in the script in Figure-2 (15).

The DMRT process begins with DMRT Step 1: Deep Abdominal Breathing just before going to bed to sleep. Participants were instructed to sit in a chair, on a bed, or wherever they felt comfortable to initiate relaxation. Participants were directed to breathe in and out through their nostrils with mouth and eyes closed.

Participants began by expanding the abdomen as they inhaled. They continued to inhale until the mid-chest and upper-chest areas expanded like a balloon. They continued inhaling until the lungs were full. Then, as they exhaled, they were instructed to reverse the process so that they felt as if deflating from top to bottom. At the start of inhaling, slowly and smoothly through the nostrils, they were instructed to say the cue or directive (i.e., “relax,”) to oneself, silently. When the lungs were filled, they were instructed to pause and mentally say the cue (i.e., “relax”) and then begin exhaling. They were instructed to make each exhale at least five seconds or longer. This process was repeated three times before moving to the next step.

In the DMRT Step 2: Out-of-Bed Body Scan, participants were instructed to speak the cues (i.e., “rest,” “relax,” “sleep,” and “wake 5-minutes before the alarm” [at their chosen expected wakeup time]) while performing a body-scan (focus on body parts) from head to toe out-of-bed. Once participants had completed the Out-of-Bed Body Scan, they were instructed to immediately enter the bed to perform the DMRT Step 3: In-Bed Body Scan. The In-Bed Body Scan was performed until participants fell asleep.

Experimental Phase

In the Experimental Phase of the study, participants used the DMRT and collected data
regarding their sleep/wake cycles for two weeks with DMRT Sleep Diary, Elms Sleep/Alertness Scale-II, and Elms Sleep-Onset Stress Scale-II. Participants (1) completed each measure daily, (2) sent results to the researcher each day, and finally (3) sent a completed report each week.

Posttest Phase

After the two-week collection of the recorded sleep/wake cycles, the DMRT Evaluation Form (EVF) (See Appendix XIII) was emailed to the participants. The EVF consists of after treatment responses to the following statements: (1) Can you habitually self-awake at a pre-set time (without alarm or help) within 15 minutes before the alarm; (2) will you continue to use the DMRT; (3) did the DMRT help in your daily activities of your life; (4) rate the effects the DMRT has on the ability to achieve relaxation; (5) rate the effects more practice with the DMRT has on the ability to wake within 10 minutes consistently before the alarm sounds; and (6) rate the effects the DMRT has on initiating sleep. Participants were also asked to voice their opinions about their experience with the DMRT with two open-ended questions. Participants emailed the EVF to the researcher upon its completion but within one week after receiving it.

Termination Phase

Participants were notified of the announcement of the final meeting. In Meeting #3, participants were debriefed. The summary of the results of the study were provided to those who noted on the screening questionnaire the wish to receive it. The DMRT study’s participants were paid for their services. Participants were sent the FUF one month after the EVF.

Timeline

Advertisement for the experimental study progressed for two months. The total experimental study took approximately four weeks. There were seven phases: (1) screening, (2) baseline pretesting, (3) DMRT Training, (4) experimental phase, (5) posttesting evaluations,
The Deep Meditative Relaxation Technique (DMRT) (6) debriefing, and (7) DMRT follow-up evaluations. Total study was conducted in four months.

Data Analysis

The DMRT Sleep Diary (DmrtSD), Elms Sleep-Onset Stress Scale-II (ESOS-II), and the Elms Sleep/Alertness Scale-II’s (ESAS-II) daily estimates were averaged per week to produce a single index score, for that week. There were three sets of data analyses conducted: (1) preliminary analyses, (2) hypothesis testing analyses, and (3) supplemental analysis (to explore the data further, usually in search of explanations for the results of hypothesis-testing analyses) (Cone & Foster, 2006). Focus was primarily on hypothesis testing in considering Type I error. The alpha level was set at $\alpha = .05$ one-tailed significance level for conducting preliminary analyses and hypothesis testing.

Descriptive statistics, inferential statistics, and content analysis were employed to analyze the data. Descriptive statistics were employed to help determine if assumptions (e.g., normality and linearity) were met to determine if $t$ tests and analysis of variance (ANOVA) were the appropriate statistics to use with the generated data from the study.

Inferential statistics were employed to determine pretest and posttest mean differences of each dependent variable in hypothesis-testing. Means difference were evaluated with PASW GradPack 18 (2009) using the Within-Subjects Repeated-Measures procedures. Means difference were determined with the Within-Subjects Repeated-Measures ANOVA procedures when treatment times (pre, post-1, post-2) were evaluated in the test for the dependent variables to decrease Type I errors and increase the power of the test; rather than running multiple $t$ tests.

Trend analyses were employed to note the difference in the within-samples factors through Within-Subjects Repeated-Measures polynomial contrasts procedures and with content analyses. Means difference effect size necessary to determine a significance magnitude was
The Deep Meditative Relaxation Technique (DMRT) conducted with Within-Subjects Repeated-Measures statistical indices (i.e., correlation coefficient, partial eta, power (1 – beta), Polynomial contrast pairwise comparisons (i.e., partial eta, power (1 – beta), and Paired Samples T Tests pairwise comparisons (i.e., delta).

According to Heppner et al. (1999), social and behavior scientists settle for a medium effect size with a power (1 – beta = .80) to detect mean differences. In this study, a medium effects size, alpha .05, one-tailed level, with power (1 - beta = .80) was used with various statistical tests to determine the statistical significance of data results. The results of the dependent variables of interest in this study were reported as statistical significance levels, practical significance effects, level-index effect sizes, and content analysis.

**Threats/Controls/Limitations**

The purpose of the one-group pretest-posttest design is to test the effects of the Deep Meditative Relaxation Technique (the independent variable) by examining the significance of the differences between the observation of the pretest and the posttest scores. The one-group pretest-posttest design controls for most of the threats to internal validity discussed by Campbell and Stanley (1963). The unique strength of this design pertains to the use of the pretest that allows the researcher to perform various analyses that may be helpful in making valid inferences.

The pretest-posttest scores allow the researcher to examine the individual performance of specific participants. Kazdin (1980) suggests that in this way, researchers might examine participants who benefited the most versus those who benefited the least from the treatment intervention. In short, the pretest provides additional information for researchers, and perhaps some clues for future research directions.

By using the one-group pretest-posttest design, the effect of repeatedly administering a test to the treatment group is the same for all participants. In this experiment, the participants are
self-observers of their own behavior viewed and experienced overtime. Test responses represent nightly sleep/wake behavior that will naturally vary; therefore, the effect of repeated testing is not a threat to internal validity in this type of sleep experiment. *Practice effect* is not an issue.

By using a within-group repeated-measures design, one sample is used for each treatment, and the means are repeated for the same participants in each treatment. Hence, the repeated-measures design is more economical because fewer participants are needed: one sample for the entire study (Gravette & Wallnau, 2000).

When a study involves determining changes in response *across time*, a repeated-measures design is more appropriate (Gravetter & Wallnau, 2000). In repeated-measures designs, the researcher wishes to study the effects of practice on how well a person performs a task. Also, the present study is interested in participants learning the *skill* of self-awakening. Most studies of skill acquisition examine practice effects by using a repeated-measures design (Gravetter & Wallnau, 2000).

Gravetter and Wallnau (2000) contend the repeated-measures design eliminates *individual differences* (participant characteristics) because the same participants are used in every treatment. Repeated-measures design removes the individual differences from the data and, therefore, tends to reduce the sample variance. *Sample variance* is equivalent to noise and confusion in the data. Reducing sample variance makes it easier to see patterns in the data and increases the likelihood of finding significant results (Gravetter & Wallnau, 2000). Gravetter and Wallnau (2000) stated “Reducing the sample variance also reduces the standard error and produces a more precise and sensitive test for mean differences” (p. 354).

In addition, a time-series design is employed in this study. The time-series design involves repeated-measures or observations over a period of time before and after treatment. It is
really an elaboration of the one-group, pretest-posttest design.

Because something may happen between the last pretest and the first posttest, the major threats to internal validity that endanger use of the time-series design include history. Although there is no possibility of tests being changed during the study, instrumentation is not a threat because in the sleep diary only the time-of-the-behavior is recorded by the participant. In addition, since participants are only recording their sleep/wake behavior in relationship to time-of-behavior, there is no testing threat to internal validity due to practice effect.

The time-series design is a strong design in spite of the threats to internal validity. In most trend analysis studies, serious questions are raised concerning the validity of instrument interpretation with so many administrations. As Fraenkel and Wallen (2003) point out, an exception to this is the use of unobtrusive devices that may be used over many occasions because interpretations based on them should remain valid. Because it provides an indirect method to obtain necessary data by the participant documenting the time of a specific behavior that naturally occurs in a sleep period, the DMRT Sleep Diary is a partial unobtrusive device.

Power was increased with the use of parametric tests when appropriate. It was also increased (a) by using a within-sample design that requires only one group of participants to produce significant results; (b) by using reliable measures to decrease measurement error (i.e., measures are adopted from previous research and/or all experimental instrument measures were pilot tested before the study began); (c) by statistically controlling for extraneous variables (i.e., ANOVA F-ratio eliminates participant’s individual differences); (d) by increasing the strength of the treatment (i.e., by extending treatment to cover two weeks); and (e) by using a one-tailed test for all of the prediction variables (increases the waking before alarm time, decreases difficulty waking from sleep, and decreases difficulty falling asleep).
Internal/External Validity

The present study is an experimental field research design. An experimental field research design has moderately high internal and external validity: (1) It consists of experimental control through the manipulation of an independent variable, and (2) it is conducted in the participants’ home or natural real-life setting and livelihood (Heppner, Kivlighan, & Wampold, 1999).

*External validity* refers to the generalizability of a study’s results (Fraenkel & Wallen, 2003). Because this is a study conducted in a natural real-life setting where individuals normally sleep, the results may be generalizable to the public, in general, and students, in particular. Basically, since it possesses this particular characteristic of existence in a natural real-life setting, this study has high external validity (Fraenkel & Wallen, 2003; Heppner et al., 1999).

*Internal validity* refers to the confidence one will have in inferring a causal relationship among variables while simultaneously eliminating rival hypotheses (Heppner et al., 1999). Basically, internal validity in an experimental study focuses on whether or not the manipulation of the independent variable was responsible for the differences observed in the dependent variable. This study has internal validity because it is directly related to experimental control that is achieved through manipulation of the independent variable and determination of measurement times (Heppner et al., 1999).

Although an experimental field study attempts to examine causality in a naturally occurring setting, the researcher will never exercise the control in the field as in a laboratory. Heppner et al. (1999) contend an experimental field study will be at best only moderately high in internal validity. Yet, the study has high external validity because a sample of participants were taken directly from a population of interest (Heppner et al., 1999).
Cone and Foster (2006) contend that direct measures enhance external validity. The present study uses self-observations or self-monitoring techniques, also called ecological momentary assessment (Cone & Foster, 2006). Self-monitoring and self-observation are more direct than interviews, self-reports, and ratings by others: They require the participant (1) to observe and record the occurrence of the behavior of interest and (2) to do so at the time and place of its occurrence (Cone & Foster, 2006). To conclude, all the measures in this study contribute to high external validity because the results may be generalizable to the population of interest in this study: students in similar settings.
CHAPTER FOUR

RESULTS

Participants

The *Pilot Study: DMRT Psychometrics* was performed in 2009 to produce the validity and reliability evidence on the instruments and measures for this DMRT sleep study (Appendix V). There were five participants (1 male, 4 females) with a mean age of 46.20 years (SD = 11.75, range = 34–62 years) represented in the 2009 pilot study. In the present study, there were eight participants (2 males, 6 females) with a mean age of 26.13 years (SD = 12.029, range = 18 to 53). The *Sample Demographics Results* for the study are listed in Appendix XIV.

There were 16 potential participants, but screening reduced the number to 13 because of screening failures (e.g., non-familiarity with the Office2007 Excel program operating system). The remaining 13 potential participants collected data in the preliminary phase of which one failed to follow study related rules and was excluded from the study. There were 12 participants who began the experimental phase of the study. Three participants withdrew for various reasons (e.g., computer crash, approaching final exams, holiday seasonal job), and one was withdrawn because of habitual sleep-aids use. Five individuals responded to the flyer after closing the study.

Of the eight participants (6 undergraduates, 2 graduate) (3 African Americans, 1 Biracial, and 4 Whites), two lived on campus and six lived off-campus. Four of the students both worked and attended school. All eight participants (2 males, 6 females) completed all phases of the study. All eight students received their individual summation of their results in *Meeting #3: Debriefing*. Students’ active participation began in October 2011 and ended February 2012 for a total of four months. The DMRT Sleep Study was closed March 1, 2012. University of Cincinnati Institutional Review Board approved this study.
Findings

The results of this study were divided into two sections: Part-I and Part-II. Part-I consists of (1) the repeated-measures (RPM) analysis of variance (ANOVA) tests; (2) the Paired Sample T Test pairwise comparisons; and (3) the means difference on daily and weekly scores on nine dependent variables of the experimental results for the first three weeks of the study with a Sample ($N = 8$). Part-II consists of the RPM-ANOVA analyses of the evaluations by the eight participants in the EVF and FUF.

PART-I: DMRT Experimental Findings

The *Deep Meditative Relaxation Technique* (DMRT) was evaluated with the one-way within-subjects repeated-measures analysis of variance (RPM-ANOVA) on nine dependent variables. There were three predicted dependent variables (DV$s$) assessed: (1) Wake Before alarm Index (WBAI), (2) Difficulty Waking From Sleep Index (DWFSI), and (3) Difficulty Falling Asleep Index (DFASI). Along with the three predicted DV$s$, there were six DV$s$ assessed to (a) identify self-awakening problems in the sample; (b) support the predicted DV$s$; and (c) support the objectives projected in the study.

The Difficulty Waking Before Alarm Index (DWBAI) was used to identify if there were self-awakening problems experienced in the sleep period by this sample. Total Sleep Time (TST), Waking After Sleep-Onset time (WASO), and Number of Wakes (NOW) were assessed to support the results of the three predicted DV$s$ in relationship to DMRT procedures.

There was, also, a focus on two objectives of the study: (1) The Wake Before Alarm Cue Index (WBACI) was assessed to help determine DMRT *cue-consistency success* rate, and (2) the Self-Awakening Scale Index (SASI) scores were assessed to represent the establishment of a standardized self-awakening scale in examining the Self-Awakening Phenomenon. Each within-
The Deep Meditative Relaxation Technique (DMRT)

subjects factor was measured on three levels: (1) no-treatment in pretesting in week-one, (2) DMRT treatment in week two, and (3) DMRT treatment in week three. Descriptive statistics’ skewness and kurtosis illustrate that the test distribution is normal for all DVs (Tables 4, 5, 6).

All within-subjects repeated-measures ANOVA procedures and APA Style of reporting the results were adopted from Green et al. (2000). The ANOVA procedures were chosen to provide a more powerful test to avoid subjected experiment wise errors associated with running multiple paired sample \( t \) tests. The within-subjects ANOVA consists of both univariate and multivariate tests. The standard univariate ANOVA \( F \) test (labeled Sphericity Assumed) is not recommended when the within-subjects factor has more than two levels because of one of its assumptions, the sphericity assumption, is commonly violated, and the ANOVA \( F \) test yields inaccurate \( p \)-values to the extent that this assumption is violated (Green et al., 2000).

There are two multivariate assumptions underlying the one-way RPM-ANOVA: (1) The difference scores are multivariate normally distributed in the population and (2) independence of scores of each subject. To avoid the sphericity controversy, the multivariate test (e.g., Pillai’s Trace, Wilks’ Lambda, and so on) are used to analyze the ANOVA results because the Sphericity Assumption is not included in assumptions needed to use multivariate tests (Green et al., 2000). In this study, the Wilks’ Lambda (\( \Lambda \)) is the multivariate test used to evaluate the ANOVA hypothesis to determine if the population means are equal for all levels of the factor (Green et al., 2000). The Multivariate Normality Assumption was met and verified for each week’s data as illustrated in the One-Sample Kolmogorov-Smirnov Tests in Tables 7, 8, 9.

Follow-up comparisons were conducted with the polynomial contrasts procedure in the RPM-ANOVA for all nine DVs collected on three levels of each within-subjects factor. Polynomial contrasts were selected because they evaluate trend effects. Polynomial contrasts are
The Deep Meditative Relaxation Technique (DMRT)

### Table 4: Descriptive Statistics Week-1

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**Valid N 8**

*Note. Test distribution is Normal. Calculated from data.*

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**Valid N 8**

*Note. Test distribution is Normal. Calculated from data.*
### Table 6: Descriptive Statistics Week-3

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<td>wbaci-wk3</td>
<td>8</td>
<td>4</td>
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<td>4</td>
<td>1.75</td>
<td>.526</td>
<td>1.488</td>
<td>2.214</td>
<td>.752</td>
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<tr>
<td>dwbai-wk3</td>
<td>8</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>3.38</td>
<td>.800</td>
<td>2.264</td>
<td>.365</td>
<td>.752</td>
</tr>
<tr>
<td>waso-wk3</td>
<td>8</td>
<td>18</td>
<td>0</td>
<td>18</td>
<td>4.75</td>
<td>2.007</td>
<td>5.676</td>
<td>2.193</td>
<td>.752</td>
</tr>
<tr>
<td>now-wk3</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>2.75</td>
<td>.701</td>
<td>1.982</td>
<td>.459</td>
<td>.752</td>
</tr>
<tr>
<td>tst-wk3</td>
<td>8</td>
<td>244</td>
<td>306</td>
<td>550</td>
<td>433.25</td>
<td>27.517</td>
<td>77.831</td>
<td>6057.64</td>
<td>- .017</td>
</tr>
<tr>
<td>sasi-wk3</td>
<td>8</td>
<td>69</td>
<td>-58</td>
<td>11</td>
<td>-13.50</td>
<td>8.411</td>
<td>23.791</td>
<td>566.00</td>
<td>-1.150</td>
</tr>
<tr>
<td>Valid N</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Test distribution is Normal. Calculated from data.

### Table 7: Normality / Kolmogorov-Smirnov Test Week-1

#### One-Sample Kolmogorov-Smirnov Test

<table>
<thead>
<tr>
<th>WBAI-wk1</th>
<th>DWFSI-wk1</th>
<th>DFASI-wk1</th>
<th>WBACI-wk1</th>
<th>DBAI-wk1</th>
<th>WASO-wk1</th>
<th>NOW-wk1</th>
<th>TST-wk1</th>
<th>SASI-wk1</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Normal</td>
<td>Mean</td>
<td>1.38</td>
<td>4.25</td>
<td>2.88</td>
<td>.38</td>
<td>8.75</td>
<td>19.50</td>
<td>5.00</td>
</tr>
<tr>
<td>Most Extreme</td>
<td>Absolute</td>
<td>.223</td>
<td>.330</td>
<td>.300</td>
<td>.443</td>
<td>.191</td>
<td>.310</td>
<td>.255</td>
</tr>
<tr>
<td>Differences</td>
<td>Absolute</td>
<td>.223</td>
<td>.191</td>
<td>.300</td>
<td>.443</td>
<td>.191</td>
<td>.310</td>
<td>.255</td>
</tr>
<tr>
<td>Negative</td>
<td>Absolute</td>
<td>-.181</td>
<td>-.330</td>
<td>-.200</td>
<td>-.307</td>
<td>-.159</td>
<td>-.210</td>
<td>-.129</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td>.632</td>
<td>.935</td>
<td>.847</td>
<td>1.253</td>
<td>.539</td>
<td>.878</td>
<td>.720</td>
<td>.680</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.820</td>
<td>.347</td>
<td>.469</td>
<td>.087</td>
<td>.933</td>
<td>.424</td>
<td>.678</td>
<td>.744</td>
</tr>
</tbody>
</table>

Note. a. Test distribution is Normal.
b. Calculated from data.
The Deep Meditative Relaxation Technique (DMRT)

Table 8: Normality / Kolmogorov-Smirnov Test Week-2

<table>
<thead>
<tr>
<th>One-Sample Kolmogorov-Smirnov Test</th>
<th>wbai-wk2</th>
<th>dwfisi-wk2</th>
<th>dfasi-wk2</th>
<th>wbaci-wk2</th>
<th>dwbai-wk2</th>
<th>waso-wk2</th>
<th>now-wk2</th>
<th>tst-wk2</th>
<th>sasi-wk2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Normal</td>
<td>Mean</td>
<td>2.88</td>
<td>3.00</td>
<td>2.00</td>
<td>.63</td>
<td>6.00</td>
<td>7.75</td>
<td>3.88</td>
<td>426.0</td>
</tr>
<tr>
<td>Parameters&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Std. Dev.</td>
<td>2.532</td>
<td>1.512</td>
<td>1.414</td>
<td>.744</td>
<td>4.071</td>
<td>7.924</td>
<td>2.588</td>
<td>63.89</td>
</tr>
<tr>
<td>Most Extreme</td>
<td>Absolute</td>
<td>.172</td>
<td>.246</td>
<td>.260</td>
<td>.300</td>
<td>.188</td>
<td>.261</td>
<td>.169</td>
<td>.200</td>
</tr>
<tr>
<td>Differences</td>
<td>Positive</td>
<td>.146</td>
<td>.157</td>
<td>.260</td>
<td>.300</td>
<td>.188</td>
<td>.261</td>
<td>.141</td>
<td>.158</td>
</tr>
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<td></td>
<td>Negative</td>
<td>-.172</td>
<td>-.246</td>
<td>-.240</td>
<td>-.200</td>
<td>-.140</td>
<td>-.164</td>
<td>-.169</td>
<td>-.200</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td></td>
<td>.485</td>
<td>.695</td>
<td>.736</td>
<td>.847</td>
<td>.533</td>
<td>.737</td>
<td>.479</td>
<td>.566</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td></td>
<td>.973</td>
<td>.719</td>
<td>.651</td>
<td>.469</td>
<td>.939</td>
<td>.648</td>
<td>.976</td>
<td>.906</td>
</tr>
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</table>

Note. a. Test distribution is Normal.
b. Calculated from data.

Table 9: Normality / Kolmogorov-Smirnov Test Week-3

<table>
<thead>
<tr>
<th>One-Sample Kolmogorov-Smirnov Test</th>
<th>wbai-wk-3</th>
<th>dwfisi-wk-3</th>
<th>dfasi-wk-3</th>
<th>wbaci-wk-3</th>
<th>dwbai-wk-3</th>
<th>waso-wk-3</th>
<th>now-wk-3</th>
<th>tst-wk-3</th>
<th>sasi-wk-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Normal</td>
<td>Mean</td>
<td>4.50</td>
<td>2.75</td>
<td>1.75</td>
<td>1.75</td>
<td>3.38</td>
<td>4.75</td>
<td>2.75</td>
<td>433.25</td>
</tr>
<tr>
<td>Parameters&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Std. Dev.</td>
<td>1.773</td>
<td>1.165</td>
<td>1.165</td>
<td>1.488</td>
<td>2.264</td>
<td>5.676</td>
<td>1.982</td>
<td>77.831</td>
</tr>
<tr>
<td>Most Extreme</td>
<td>Absolute</td>
<td>.236</td>
<td>.335</td>
<td>.365</td>
<td>.193</td>
<td>.191</td>
<td>.357</td>
<td>.200</td>
<td>.167</td>
</tr>
<tr>
<td>Differences</td>
<td>Positive</td>
<td>.171</td>
<td>.183</td>
<td>.365</td>
<td>.193</td>
<td>.191</td>
<td>.357</td>
<td>.200</td>
<td>.167</td>
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<td>Negative</td>
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<td>-.335</td>
<td>-.260</td>
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<td>-.147</td>
<td>-.201</td>
<td>-.122</td>
<td>-.130</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td></td>
<td>.668</td>
<td>.947</td>
<td>1.033</td>
<td>.546</td>
<td>.540</td>
<td>1.011</td>
<td>.565</td>
<td>.473</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td></td>
<td>.764</td>
<td>.331</td>
<td>.236</td>
<td>.927</td>
<td>.933</td>
<td>.258</td>
<td>.907</td>
<td>.979</td>
</tr>
</tbody>
</table>

Note. a. Test distribution is Normal.
b. Calculated from data.
The Deep Meditative Relaxation Technique (DMRT)

more appropriate than pairwise comparisons when there are quantitative variables with time
measurement intervals that are equally spaced (e.g., weekly or monthly intervals) (Green et al.,
2000). In addition to ANOVA results for the nine DVs, the final index score was reported on its
indicated level shown in Table 10: DMRT Experimental Level-Indexes Effect Size Results.

Follow-up pairwise comparisons between time-levels were performed with the Paired
Sample T Tests with the Least Significance Difference (LSD) procedure (equivalent to no
adjustments). Behavior scientists are interested in the LSD in change of behavior. However,
these tests are performed to determine when the DMRT was effective between levels. In the
following, the above nine within-subjects factors with their DVs on three levels were used to
evaluate the DMRT based on the aforementioned procedures adopted from Green et al. (2000).

A one-way RPM-ANOVA was conducted with the within-subjects factor being the wake
before the alarm time and the dependent variable being the Wake Before Alarm Index (WBAI)
scores. The RPM-ANOVA results indicated a significant wake before the alarm time treatment
effect, Wilks’ Lambda $\Lambda = .191$, $F(2, 6) = 12.68$, $p = .003$, $\alpha = .05$, 1-tailed level, multivariate
partial ETA ($\eta^2$) = .81, power (1 – beta = .94). The effects size $\eta^2$ indicated the independent
variable accounts for 81% of the variance in the dependent variable. The observed power of .94
indicated the likelihood of finding a significant effect if one exists within the population, and
these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear effect with WBAI means
increasing over time, $F(1, 7) = 18.939$, $p = .001$, $\alpha = .05$, 1-tailed level, partial $\eta^2 = .73$, power
(1 – beta = .96). Higher-order polynomial contrasts (quadratic) were nonsignificant. By
inspecting WBAI’s three weekly means ($M$) and standard deviations ($SD$) ($M1 =1.38$, $SD = 1.51$;
Table 10: DMRT Experimental Level-Index Effect Size Results

<table>
<thead>
<tr>
<th>DVs</th>
<th>DFASI</th>
<th>WBAI</th>
<th>DWFSI</th>
<th>WBACI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>W1</td>
<td>W2</td>
<td>W3</td>
<td>W1</td>
</tr>
<tr>
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<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Levels</td>
<td>1.3</td>
<td>1.2</td>
<td>1.2</td>
<td>5</td>
</tr>
<tr>
<td>Delta</td>
<td>.46</td>
<td>.35</td>
<td>.69</td>
<td>-.52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DVs</th>
<th>WASO</th>
<th>SASI</th>
<th>DWBAI</th>
<th>NOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV Mean</td>
<td>20</td>
<td>8</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Levels</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Delta</td>
<td>.70</td>
<td>.53</td>
<td>.79</td>
<td>.84</td>
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</tbody>
</table>

Note. DVs = Dependent Variables. Min = minutes, Hrs = hours/minutes. W = Week. W1 = (pretest no-treatment), W2 = (treatment week-1), W3 = (treatment week-2). Delta illustrated calculations = W1 [W1 to W2], W2 [W2 to W3], W3 [W1 to W3]. Cohen's $d = \Delta$ ≥ .50 is important. Level-Index Meanings:

**DFASI** – Difficulty falling asleep index
- **Week-1** = L1.3 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 min).
- **Time-2 & 3** = L1.2 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min).

**WBAI** – Wake before alarm index
- **Week-1** = L5 (trivial consistent self-awakening [1 time per 7-day week])
- **Week-2** = L3 (medium consistent self-awakening [3 times per 7-day week])
- **Week-3** = L1 (extremely high consistent self-awakening [5 times per 7-day week])

**DWFSI** – Difficulty waking from sleep index
- **Week-1** = L2.4 (Desired to take a nap in the 5th or 6th hour after the last awakening from sleep)
- **Week-2 & 3** = L1.3 (Felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours)

**WBACI** – Wake before alarm cue index
- **Week-1** = L6 (Non-cue-consistent self-awakening [0])
- **Week-2** = L5 (Trivial-cue-consistent self-awakening [1])
- **Week-3** = L4 (Small cue-consistent self-awakening [2])

**WASO**—Wake after sleep-onset
- **Week-1** = L2 (Mild WASO [16 to 30 minutes])
- **Week-2 & 3** = L1 (normal WASO [1 to 15 minutes])

**SASI** – Self-awakening scale index
- **Week-1** = L5 (Did not wake before the alarm [≥ 0 min])
- **Week-2 & 3** = L1 (Very good self-awakening [-1 to -15 min])

**DWBAI** – Difficulty waking before alarm index
- **Week-1** = L3 (Moderate difficulty self-awakening [7-9])
- **Week-2** = L2.6 (Somewhat difficulty self-awakening [4-6])
- **Week-3** = L1 (Low difficulty self-awakening [0-3])

**NOW** – Number of Wakes
- **Week-1 & Week-2** = L2 (Mildly normal NOW [4 to 6])
- **Week-3** = L1 (Normal NOW [0 to 3])

**TST**—Total sleep time
- **Week-1** = L2 (Mildly normal TST [6 to 6.9 hrs])
- **Week-2 & 3** = L1 (Normal TST [7 to 8 hrs.])
The Deep Meditative Relaxation Technique (DMRT)

$M_2 = 2.88, SD = 2.532; M_3 = 4.50, SD = 1.773$), it is evident that the linear effect is due to the WBAI scores increasing over time (Tables 4, 5, 6).

It should be noted that there was little change in WBAI means from week-1 to week-2 and, therefore, the significant increasing trend effect was due to changes after week-1 when the DMRT was added to the participants’ sleep/wake behavior. Figure 3 displays the WBAI significant increasing trend effects. ANOVA results suggest that participants’ ability to wake before the alarm time significantly increased with the use of the DMRT. Therefore, the ANOVA results significantly confirmed Hypothesis 1: The DMRT will increase the frequency of the ability to wake before the alarm time.

The WBAI pretest score ($M_1 = 1.38, SD = 1.51$) is rounded off to 1 and applied to level-index on Level 5 (trivial consistent self-awakening [1-time per 7-day week]) (Table 2). Week-3 WBAI score ($M_3 = 4.50, SD = 1.773$) is rounded off to 5 and placed on Level 1 (extremely high consistent self-awakening [5 time per 7-day week]). The sample’s WBAI increased from Level 5 to Level 1 with the use of the DMRT, thereby, confirming Hypothesis 1: The DMRT will increase the frequency of the ability to wake before the alarm time. That is, the WBAI is placed on Level 1 (extremely high consistent self-awakening [5 times per 7-day week]) for this study.

As illustrated in Table 11: Level Difference/Psychometrics Results, follow up comparisons with the Paired Sample T Tests were performed on the WBAI three weekly scores to determine when the DMRT took effect. Table 11 indicated that WBAI week-1 to week-2 results produced a marginally significant treatment effect, $t(7) = -1.474, p = .092, \alpha = .05$, 1-tailed, $d = -.521$, power (1- beta = .38). Delta ($d$) effect size statistic measures the magnitude of the relationship of the difference between the means of two groups (conditions, times). Any delta .50 or larger is considered important (Green et al., 2000). Delta ($d$) indicated that the moderate
The Deep Meditative Relaxation Technique (DMRT)

*Figure 3: WBAI Trend Effects*
## Table 11: Level Differences/Psychometrics Results

### Paired Samples Test

| Dependent Variables | 95% Confidence Interval of the Difference | Effect Size | Power
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Lower</td>
</tr>
<tr>
<td>DFASI-w1-2</td>
<td>.875</td>
<td>1.885</td>
<td>-.701</td>
</tr>
<tr>
<td>dfasi-w2-3</td>
<td>.250</td>
<td>.707</td>
<td>-.341</td>
</tr>
<tr>
<td>DFASI-w1-3</td>
<td>1.125</td>
<td>1.642</td>
<td>-.248</td>
</tr>
<tr>
<td>WBAI-w1-2</td>
<td>-1.500</td>
<td>2.878</td>
<td>-3.906</td>
</tr>
<tr>
<td>wbai-w2-3</td>
<td>-1.625</td>
<td>1.768</td>
<td>-3.103</td>
</tr>
<tr>
<td>WBAI-w1-3</td>
<td>-3.125</td>
<td>2.031</td>
<td>-4.823</td>
</tr>
<tr>
<td>DWFSI-w1-2</td>
<td>1.250</td>
<td>1.282</td>
<td>.178</td>
</tr>
<tr>
<td>dwfsi-w2-3</td>
<td>.250</td>
<td>1.581</td>
<td>-1.072</td>
</tr>
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<td>DWFSI-w1-3</td>
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<td>1.069</td>
<td>.606</td>
</tr>
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<td>-.841</td>
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<td>wbaci-w2-3</td>
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<td>WBAC-w1-3</td>
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<td>DWBAI-w1-2</td>
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<td>3.662</td>
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</tr>
<tr>
<td>WASO-w1-2</td>
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<td>NOW-w1-2</td>
<td>1.125</td>
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</tr>
<tr>
<td>now-w2-3</td>
<td>1.125</td>
<td>1.959</td>
<td>-.513</td>
</tr>
<tr>
<td>NOW-w1-3</td>
<td>2.250</td>
<td>3.770</td>
<td>-.902</td>
</tr>
<tr>
<td>TST-w1-2</td>
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<td>-50.491</td>
</tr>
<tr>
<td>tst-w2-3</td>
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<td>-42.541</td>
</tr>
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<td>TST-w1-3</td>
<td>-19.250</td>
<td>66.017</td>
<td>-74.441</td>
</tr>
<tr>
<td>SASI-w1-2</td>
<td>24.625</td>
<td>29.340</td>
<td>.096</td>
</tr>
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<td>sasi-w2-3</td>
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<td>22.000</td>
<td>-11.017</td>
</tr>
<tr>
<td>SASI-w1-3</td>
<td>32.000</td>
<td>24.629</td>
<td>11.410</td>
</tr>
</tbody>
</table>

*Note. Results based on estimated marginal means. The mean difference is significant at the .05 level.*

*Calculated at the .05 two-tailed. **Calculated at .05 one-tailed. W = Week. \( \beta \) = Beta. Power = (1 – Beta).

Adjustment for multiple comparisons: Least Significant Differences (equivalent to no adjustments).

Cohen’s \( d \) = Delta Effect Size Statistic = \( d = \Delta = d \). Delta Effect Size > .50 or larger is important.
effect \( (d = -.52) \) of the DMRT’s influence on the participants was an important contributor to the participants’ increased waking before the alarm time in week-2.

Paired sample tests WBAI week-2 to week-3 results indicated there was a statistically significant increase in participants treatment for waking before the alarm time with the use of the DMRT, \( t (7) = -2.6, p = .018, \alpha = .05, 1\text{-tailed}, d = -.92, \) power \((1 - \beta = .76)\). These results indicated that the DMRT was highly effective in waking participants before the alarm in week-3 with a large effect size \( d = -.92 \) that indicated the magnitude of value of its importance in the changes produced. Also, WBAI week-1 to week-3 results indicated the overall differences represent a highly significant increase in participants’ ability to wake before the alarm time, \( t (7) = -4.352, p = .002, \alpha = .05, 1\text{-tailed}, d = -1.54, \) power \((1 - \beta = .99)\).

Table 12: Wake Before Alarm Index Daily Results indicates the exact time the DMRT caused a significant effect in the participants self-awakening behavior and the increase of the consistency rate of self-awakening within the sample for week-2 when they first received the DMRT intervention. As Table 13: DMRT Change-Effect-Time WBAI Results indicates, once 50% of the participants began to self-awaken on Thursday of week-2, they had reached the sample’s WBAI mean value of 1.38 units that was produced in week-1. All self-awakenings (SA) from this point forward would represent an increase in WBAI scores greater than week-1.

On Friday of Week-2, participants (75%) increased waking before the alarm by 2.125 units (Table 13). Therefore, it was Friday’s results that indicated a DMRT significant change-effect-time of 120 hours increase in waking before the time for the sample in week-2. However, the sample obtained an increase of .63 units within 48 hours (Table 13). Sample frequency of waking before alarm time increased from 1 person self-awakening in week-1 to 3 on Day-2 of week-2; that is, a 3:1 ratio increase is the effective change in waking before the alarm time
### Table 12: Wake Before Alarm Index Daily Results

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<tr>
<th>Week-2</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>W2 Mean</th>
<th>W1 Mean</th>
</tr>
</thead>
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<th>SUN</th>
<th>E.S.</th>
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<td>7:11</td>
<td>7:51</td>
<td>7:02</td>
<td>6:54</td>
<td>7:13 h</td>
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Note. W = Week. Inc. = Increase. E.S. = Effect Size ≥ .50 is important. L = Level. N = Sample. M = Mean. WBAI = Wake Before Alarm Index. TST = Total Sleep Time (hours/minutes = h). Day N = frequency per day.

DMRT Change-Effect-Time: Sample increased WBAI score by 1 after 6:57 hours/minutes with DMRT in W2.

DMRT Change-Effect-Time: Sample increased WBAI scores by 2 after 48 hours with DMRT in W2 (3:1 ratio).

DMRT Change-Effect-Time: Sample increased WBAI 2.12 units within 120 hours of using DMRT on Friday in W2.

Sample significantly increased WBAI scores by 3.12 units within 336 hours or two weeks of using DMRT.

- \( M2 − M1 = 2.88 − 1.38 = 1.50 \) units increasing difference.
- \( M3 − M2 = 4.5 − 2.88 = 1.62 \) units increasing difference.
- \( M3 − M1 = 4.5 − 1.38 = 3.12 \) units increasing difference.

WBAI = \( N \) (5) = 63% in W1. WBAI = \( N \) (6) = 75% in W2. WBAI = \( N \) (8) = 100% in W3.

WBAI – Level-Indexes:
- Week-1 = L5 (trivial consistent self-awakening [1 time per 7-day week])
- Week-2 = L3 (medium consistent self-awakening [3 times per 7-day week])
- Week-3 = L1 (extremely high consistent self-awakening [5 times per 7-day week])

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Table 13: DMRT Change-Effect Time WBAI Results

<table>
<thead>
<tr>
<th>WBAI Change-Effect-Time Week-2</th>
<th>Days</th>
<th>Daily Mean Increase</th>
<th>Week-2 Day Mean</th>
<th>Increase Change Effect Units</th>
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<tr>
<td>6:57 h Mon</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>48 h Tue</td>
<td>.25</td>
<td>.375</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>72 h Wed</td>
<td>.625</td>
<td>.25</td>
<td>0.875</td>
<td></td>
</tr>
<tr>
<td>96 h Thu</td>
<td>0.875</td>
<td>.50</td>
<td>1.375</td>
<td></td>
</tr>
<tr>
<td>120 h Fri</td>
<td>1.375</td>
<td>.75</td>
<td>2.125</td>
<td></td>
</tr>
<tr>
<td>144 h Sat</td>
<td>2.125</td>
<td>.375</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>168 h Sun</td>
<td>2.5</td>
<td>.375</td>
<td>2.875</td>
<td></td>
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</table>

<table>
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<th>WBAI Change-Effect-Time Week-3</th>
<th>Days</th>
<th>Daily Mean Increase</th>
<th>Week-3 Day Mean</th>
<th>Increase Change Effect Units</th>
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</thead>
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<td>.25</td>
<td>0.025</td>
<td>0.025</td>
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</tr>
<tr>
<td>48 h Tue</td>
<td>0.25</td>
<td>0.75</td>
<td>1</td>
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</tr>
<tr>
<td>72 h Wed</td>
<td>1</td>
<td>0.625</td>
<td>1.625</td>
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</tr>
<tr>
<td>96 h Thu</td>
<td>1.625</td>
<td>0.625</td>
<td>2.25</td>
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</tr>
<tr>
<td>120 h Fri</td>
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<td>144 h Sat</td>
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</table>

Note. W = Week. H = hours.
WBAI = Wake Before Alarm Index
SA = Self-Awakening
Total increase indicated for week-1 and week-2 means (2.88 – 1.38 = 1.50 units).
Total increase indicated for week-2 and week-3 means (4.50 – 2.88 = 1.62 units).
Total increase indicated for week-1 to week-3 means (4.50 – 1.38 units = 3.12 units).

Sample daily increases in WBAI scores obtained were greater than 1.38 units in W2.
Sample reached a WBAI score of 1.38 units on Thursday in W2.

Sample obtained significant change effect with 2.13 units increase on Friday in W2.
DMRT effected marginal significant change in Sample in W2 on Day 5 with 2.13 units within 120 hours.
Sample obtained an increase of .63 units within 48 hours.
Sample obtained an increase from 1 person self-awakening in W1 to 3 on Day-2 of W2 (3:1 ratio) increases.
DMRT Change-Effect-Time is 48 hours, Tuesday in week-2.
DMRT significant change-effect-time is 120 hours, Friday in week-2.
Change-Effect = Learning Effect.

Sample increasing scores continued for the remaining days of week-2 and week-3.
Sample increased in participants and WBAI scores on Day-2 in Week-3.
DMRT effected change in Sample on Day 2 with 1.00 unit increase in W3 within 48 hours.
The Deep Meditative Relaxation Technique (DMRT) (Table 12). Therefore, DMRT change-effect-time is 48 hours, Tuesday, Day-2 in week-2 when the frequency of waking before the alarm time increased and learning took place in the sample. After Monday in week-3, five to seven participants (63% to 88%) woke before the alarm time for the entire week-3 (Table 12).

Significantly, the sample increased their self-awakening abilities and became more consistent with it. From these findings, I conclude that the DMRT increased the frequency of the sample's ability to wake before the alarm time in this experiment; thereby, confirming Hypothesis 1: The DMRT will increase the frequency of the ability to wake before the alarm time; in addition, (1) the DMRT change-effect-time is 48 hours and (2) DMRT level-index is Level-1 (extremely high consistent self-awakening [5 times per 7-day week]).

The one-way RPM-ANOVA was conducted with the within-subjects factor being the difficulty waking from sleep and the dependent variable is the Difficulty Waking From Sleep Index (DWFSI) scores. The ANOVA results indicated a difficulty waking from sleep significant treatment effect, Wilks’ Lambda $\Lambda = .247$, $F (2, 6) = 9.132$, $p = .007$, $\alpha = .05$, 1-tailed level, multivariate partial $\eta^2 = .75$, power $(1 – beta = .84)$. The effects size $\eta^2$ indicated the independent variable accounts for 75% of the variance in the dependent variable. The observed power of .84 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear effect with DWFSI means decreasing over time, $F (1, 7) = 15.750$, $p = .002$, at $\alpha = .05$, 1-tailed level, partial $\eta^2 = .69$, power $(1 – beta = .92)$. Higher-order polynomial contrasts (quadratic) were nonsignificant. By inspecting DWFSI scores’ three weekly means ($M1 = 4.25$, $SD = 1.389$; $M2 = 3.00$, $SD = 1.512$;
The Deep Meditative Relaxation Technique (DMRT)

$M_3 = 2.75, SD = 1.165$, it is evident that the linear effect is due to the DWFSI scores decreasing over time (Tables 4, 5, 6).

Significantly, there were large changes in DWFSI means from week-1 to week-2 and, therefore, the significant trend effect was due to changes after week-1 when the DMRT was added to the participants’ sleep/wake behavior. Figure 4 displays the results of the significant decreasing trend effects. ANOVA’s DWFSI results suggest that participants’ difficulty waking from sleep significantly decreased with the use of the DMRT. Therefore, the ANOVA results confirmed Hypothesis 2: The DMRT will decrease the difficulty waking from sleep.

The DWFSI pretest score ($M_1=4.25, SD = 1.389$) is rounded off to a 4 and applied to Level 2.4 (Desired to take a nap in the 5th or 6th hour after the last awakening from nighttime sleep) (Table 10). Week-3 DWFSI score ($M_3 = 2.75, SD = 1.165$) is rounded off to 3 and placed on Level 1.3 (Felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours). The sample’s DWFSI decreased from a Level 2 (somewhat difficult/sleepy/sluggish [4]) behavior to a Level 1 (not difficult/alert and energetic [3]) behavior with the use of the DMRT, thereby, confirming Hypothesis 2: The DMRT will decrease the difficulty waking from sleep index. Therefore, the DWFSI is Level 1 (not difficult/alert and energetic [3]) for this study (Table 2)

Follow-up comparisons with the Paired Sample T Tests were performed on the DWFSI three weekly scores to determine when the DMRT took effect. Table 11 indicated that DWFSI week-1 to week-2 results produced a significant treatment effect, $t (7) = 2.758, p = .014, \alpha = .05, 1$-tailed, $d = .975$, power $(1 – \beta = .80)$. These results indicated that the DMRT had a large effect in decreasing the sample’s difficulty waking from sleep in the first week after receiving the technique with a delta magnitude effect size of .975.
Figure 4: DWFSI Trend Effects
The Deep Meditative Relaxation Technique (DMRT)

The Paired Sample T Tests overall results of DWFSI week-1 to week-3 indicated a highly significant decrease in difficulty waking from sleep treatment effect, $t(7) = 3.969$, $p = .003$, $\alpha = .05$, 1-tailed, $d = 1.40$, power ($1 - \beta = .97$). These results indicated that the DMRT had a strong large effect ($d = 1.403$) in decreasing the participants’ difficulty waking from sleep after receiving the DMRT.

_Table 14: Difficulty Waking From Sleep Daily Results_ represents the day the sample were significantly effective in waking from sleep by decreased DWFSI scores. The results indicated that two of the participants were highly effective in reducing their difficulty waking from sleep within 48 hours when their score dropped from a six to three, and these students did wake before the alarm in week-2. _Table 12: Wake Before Alarm Index Daily Results_ indicated that the three participants (#11, #12, and #13) (who really did not begin waking before the alarm in week-2 with the exception of #12 waking for an hour before the alarm one day) had the highest DWFSI scores compared to 5 (#14 to #18) who were waking before the alarm time in week-2 (Table 14).

Also, Table 14 illustrates findings that indicated within 6:57 (hrs/min) after performing the DMRT, participants began to decrease their difficulty waking from sleep represented by the Monday mean score (3.82), and their scores did not return to week-1 mean level ($M_1 = 4.25$, $SD = 1.389$) before the DMRT was used as indicated with a final DWFSI mean (3.00, $SD = 1.512$) in week-2. In addition, Table 15 illustrates how DWFSI mean (3.4) indicated that the group means received on Tuesday represented the significant decrease of 1.28 units within 48 hours after receiving the DMRT.

DMRT decreased DWFSI scores on Monday and Tuesday by 1.28 units ($0.43 + 0.85 = 1.28$ units) within 48 hours (Table 15). The DWFSI (1.28 units) decrease represents the significant change in waking from sleep behavior as indicated by the DWFSI means decrease from week-1.
### Table 14: Difficulty Waking From Sleep Daily Results

<table>
<thead>
<tr>
<th>Week-2</th>
<th>MON</th>
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<th>WED</th>
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<th>SUN</th>
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<td>3</td>
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<td>3</td>
<td>4.6</td>
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<td>4</td>
</tr>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>DWFSI 17</td>
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<td>6:55</td>
<td>7:31</td>
<td>7:11</td>
<td>7:51</td>
<td>7:02</td>
<td>6:64</td>
<td>7:13 h</td>
</tr>
</tbody>
</table>

**Note.**

W = Week. TST = Total Sleep Time (hours/minutes = h).

DWFSI = Difficulty Waking From Sleep.

Stu = Students. N = Number (Sample). W = Week. M = Mean.

W1 = (Pretest-No-treatment). W2 = (Treatment W1). W3 = (Treatment W2). L = Level.

M2 = W2 Day-1 Mean (M2d1). M2 = W2 Day-2 Mean (M2d2).

M2 = W2 Day-2 Mean (M2d5)

Sample began to decrease DWFSI within 6:57 hours of using the DMRT in Week-2:

- DWFSI (N = 8) = (M1 = 4.25) - (M2d1 = 3.82) = 0.43 difference, Monday.

Sample significantly decreased DWFSI within 48 hours of using the DMRT in Week-2:

- DWFSI (N = 8) = (M1 = 4.25) - (M2d2 = 3.4) = .85 difference, Tuesday.

- Mon & Tue results (.43 + .85 = 1.28 units) decreased DWFSI after 48 hrs. use of DMRT.

Sample continued to significantly decrease DWFSI after 120 hours of using the DMRT in Week-2:

- DWFSI (N = 8) = (M1 = 4.25) - (M2d5 = 2.71) = 1.54 difference, Friday.
Table 15: DMRT Change-Effect Time DWFSI Week-2 Results

<table>
<thead>
<tr>
<th>Hours</th>
<th>Days</th>
<th>Week-1 Mean</th>
<th>Week-2 Mean</th>
<th>Mean Difference Units</th>
<th>Day Decrease Units</th>
<th>Decrease Effect Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:57 h</td>
<td>Mon</td>
<td>4.25</td>
<td>3.82</td>
<td>0.43</td>
<td>0.43</td>
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</tr>
<tr>
<td>48 h</td>
<td>Tue</td>
<td>4.25</td>
<td>3.4</td>
<td>0.85</td>
<td>0.85</td>
<td>1.28 units</td>
</tr>
<tr>
<td>72 h</td>
<td>Wed</td>
<td>4.25</td>
<td>3.44</td>
<td>0.81</td>
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<tr>
<td>96 h</td>
<td>Thu</td>
<td>4.25</td>
<td>4.31</td>
<td>-0.06</td>
<td></td>
<td></td>
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<tr>
<td>120 h</td>
<td>Fri</td>
<td>4.25</td>
<td>2.71</td>
<td>1.54</td>
<td></td>
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<tr>
<td>144 h</td>
<td>Sat</td>
<td>4.25</td>
<td>3.53</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>168 h</td>
<td>Sun</td>
<td>4.25</td>
<td>2.7</td>
<td>1.55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note.
H = hours.
DWFSI = Difficulty Waking From Sleep Index.

Total decrease indicated for week-1 and week-2 means (4.25 - 3.00 = 1.25 units).
Total decrease indicated for week-2 and week-3 means (3.00 – 2.75 = 0.25 units).
Total decrease indicated for week-1 to week-3 means (4.25 – 2.75 = 1.50 units).

Sample daily decreases in DWFSI scores obtained were greater than 1.25 units.
Sample maintained a significant 1.54 unit decrease on Friday.
Sample maintained decreasing scores on Sunday with a 1.55 units decrease.
Sample DWFSI scores decrease of 1.55 units indicated week-2 was highly significant.

Sample reached a significant decreased DWFSI score of 1.28 units on Tuesday.
DMRT change-effect-time is 48 hours on Day 2, Tuesday in week-2.
Change Effect = learning effect.
to week-2 (DWFSI $M_1$ [4.25] minus $M_2$ [3.0] = 1.25 units) and verified by the DWFSI significantly decreased results in the ANOVA and Paired Sample T Test; that is, DMRT change-effect-time decreased DWFSI significantly within 48 hours (Table 15).

These findings, also, indicated that the participants’ performance was consistent with the idea of the cue to “wake 5-minutes before the alarm.” The findings indicated the cue to “wake” was also fulfilled by waking individuals mentally in sleep-offset. In addition, the second day-mean score (3.4) (Table 15) represents a DWFSI level-index change from Level-2 (somewhat difficulty [sleepy/sluggish]) to Level-1 (not difficult/alert and energetic) (Tables 2, 10). From these findings I conclude that the DWFSI significantly decreasing scores confirmed Hypothesis 2: The DMRT will decrease the difficulty waking from sleep. I conclude from the findings that the sample change-effect-time occurred on Day-2 on Tuesday, that is, 48 hours after using the DMRT intervention.

The one-way RPM-ANOVA was conducted with the within-subjects factor being the difficulty falling asleep and the dependent variable being the Difficulty Falling Asleep Index (DFASI) scores. The ANOVA results indicated a marginally significant difficulty falling asleep treatment effect, Wilks’ Lambda $\Lambda = .561$, $F(2, 6) = 2.349$, $p = .088$, at .05, 1-tailed level, multivariate partial $\eta^2 = .44$, power (1 – beta = .31). The effects size $\eta^2$ indicated the independent variable accounts for 44% of the variance in the dependent variable. The observed power of .31 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear effect with DFASI means decreasing over time, $F(1, 7) = 3.755$, $p = .047$, at .05, 1-tailed level, partial $\eta^2 = .35$, power (1 – beta = .39). Higher-order polynomial contrasts (quadratic) were nonsignificant.
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inspecting DFASI scores’ three weekly means ($M_1 = 2.88, SD = 2.232; M_2 = 2.00, SD = 1.414; M_3 = 1.75, SD = 1.165$), it is evident that the linear effect is due to the DFASI scores decreasing over time (Tables 4, 5, 6).

The larger change is seen in decreasing DFASI means from week-1 to week-2 and, therefore, the significant decreasing trend effect was due to changes after week-1 when the DMRT was used. Figure 5 displays the results of the decreasing DFASI trend effects. ANOVA trend effects results suggest participants’ difficulty falling asleep significantly decreased with the use of the DMRT. Therefore, the significant trend results confirmed Hypothesis 3: The DMRT will decrease the difficulty falling asleep index.

The DFASI pretest score ($M_1 = 2.88, SD = 2.232$) is rounded off to a 3 and applied to Level 1 on number 3 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 min) (Table 10). Week-3 DFASI score ($M_3 = 1.75, SD = 1.165$) is rounded off to 2 and placed on Level 1 on number 2 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min) (Table 10).

The sample’s difficulty falling asleep behavior decreased from number 3 to number 2 within Level 1 (not difficult falling asleep-normal stress) with the use of the DMRT (Table 2), thereby, confirming Hypothesis 3: The DMRT will decrease the difficulty falling asleep index. Therefore, the DFASI is Level 1.2 (not difficult falling asleep-normal stress [2]) (Table 2). Follow-up comparisons with the Paired Sample T Tests were performed on the DFASI weekly scores to determine when the DMRT took effect. As illustrated in Table 11, DFASI week-1 to week-2 and week-2 to week-3 results were nonsignificant. Yet, week-1 to week-3 produced a
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**Figure 5: DFASI Trend Effects**
significant treatment effect, \( t(7) = 1.938, p = .047, \alpha = .05, 1\)-tailed, \( d = .685 \), power \((1 - \beta = .54)\). These results indicated that the DMRT had a high moderate effect size delta \((.685)\) in decreasing the sample’s difficulty falling asleep in the overall results (Table 11).

*Table 16: Difficulty Falling Asleep Index Daily Results* illustrates the mean scores received by the sample per day. By means, sample’s significant change-effect-time is Friday when the daily means score decreased to 1.00 for a 1.88 unit decrease from week-1 mean (2.88 units). These findings indicated that the significant change-effect-time is Friday, that is 120 hours after the DMRT was used by the sample.

*Table 17: DMRT Change-Effect-Time DFASI Results* indicates the DMRT change-effect time in the sample’s sleep-onset behavior in week-2. The DMRT change-effect-time is 15 minutes on Day-1 on Monday in week-2 for the beginning of decreasing difficulty falling asleep index scores (Table 17). The results illustrated in Table 16 confirmed Hypothesis 3: The DMRT will decrease the difficulty falling asleep, the level-index is L1.2 \((1\ to\ 15\ min)\) (Table 10).

The one-way RPM-ANOVA was conducted with the within-subjects factor being wake after sleep-onset time and the dependent variable is the Wake After Sleep-Onset (WASO) scores. The ANOVA results indicated a marginally significant wake after sleep-onset treatment effect, Wilks’ Lambda \( \Lambda = .569, F (2, 6) = 2.271, p = .092, \) at \( \alpha = .05, 1\)-tailed level, multivariate partial \( \eta^2 = .43, \) power \((1 - \beta = .30)\). The effects size \( \eta^2 \) indicated the independent variable accounts for 43% of the variance in the dependent variable. The observed power of .30 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear trend effect with WASO means decreasing over time, \( F(1, 7) = 5.044, p = .030, \) at \( \alpha = .05, 1\)-tailed level, partial \( \eta^2 = .42, \)
### Table 16: Difficulty Falling Asleep Index Daily Results

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<th>Week-2</th>
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<th>WED</th>
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<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>W2 Mean</th>
<th>W1 Mean</th>
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<td>6</td>
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<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
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<th>W3 Mean</th>
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<td></td>
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<td>2.75</td>
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<td>L1.2</td>
<td>L1.2</td>
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<td>L1.2</td>
<td>L1.2</td>
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<td>L1.2</td>
</tr>
<tr>
<td>TST</td>
<td>7:08</td>
<td>6:55</td>
<td>7:13</td>
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<td>7:51</td>
<td>7:02</td>
<td>6:65</td>
<td>7:13 h</td>
<td></td>
</tr>
</tbody>
</table>

**Note.**

W = Week, Stu = Students (Sample), Level = L, H = hours/minutes.
TST = Total Sleep Time (hours/minutes = h).
DFASI = Difficulty Falling Asleep Index.

Total decrease indicated for week-1 and week-2 means (2.88 - 2.00 = .88 units).
Total decrease indicated for week-2 to week-3 means (2.00 – 1.75 = .25 units).
Total decrease indicated for week-1 to week-3 means (2.88 – 1.75 = 1.13 units).
Total decrease indicated for week-1 to week-2 Day-1 means (2.875 – 2.375 = .505 units).
DMRT change-effect-time is 6:57 hours/minutes on Day-1 in Week-2.
Change Effect = Learning Effect.

DFASI – Level-Index

- Week-1 = L1.3 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 min).
- Time-2 & 3 = L1.2 (Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min).
The Deep Meditative Relaxation Technique (DMRT)

Table 17: DMRT Change-Effect Time DFASI Week-2 Results

<table>
<thead>
<tr>
<th>Hours</th>
<th>Days</th>
<th>Week-1 Mean</th>
<th>Week-2 Day Means</th>
<th>Mean Difference Units</th>
<th>Day Decrease Units</th>
<th>Decrease Change Effect Units</th>
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<tbody>
<tr>
<td>15 m</td>
<td>Mon</td>
<td>2.88</td>
<td>2.375</td>
<td>0.505</td>
<td>.51</td>
<td>.51 units</td>
</tr>
<tr>
<td>48 h</td>
<td>Tue</td>
<td>2.88</td>
<td>2.75</td>
<td>0.13</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>72 h</td>
<td>Wed</td>
<td>2.88</td>
<td>2.75</td>
<td>0.13</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>96 h</td>
<td>Thu</td>
<td>2.88</td>
<td>2.125</td>
<td>0.755</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td>120 h</td>
<td>Fri</td>
<td>2.88</td>
<td>1</td>
<td>1.88</td>
<td>1.00</td>
<td>1.88 units</td>
</tr>
<tr>
<td>144 h</td>
<td>Sat</td>
<td>2.88</td>
<td>3.25</td>
<td>-0.37</td>
<td></td>
<td></td>
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<tr>
<td>168 h</td>
<td>Sun</td>
<td>2.88</td>
<td>1.875</td>
<td>1.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note.
M = minutes. H = hours.
DFASI = Difficulty Falling Asleep Index.

Total decrease indicated for week-1 and week-2 means (2.88 - 2.00 = .88 units).
Total decrease indicated for week-2 to week-3 means (2.00 – 1.75 = .25 units).
Total decrease indicated for week-1 to week-3 means (2.88 – 1.75 = 1.13 units).

Sample decreased DFASI .505 units in Day-1, Monday.
Sample daily decreases in DFASI scores obtained greater than .88 units on Day-4.
Sample maintained a greater than significant 1.00 unit decrease on Friday (1.88 units).
Sample regained decreasing scores on Sunday with a 1.01 units decrease.
Sample DFASI of 1.01 units on Sunday indicate marginal significant effect in W2.

DMRT significant change-effect-time is 120 hours, Day-5, on Friday in Week-2.
Sample decreased DFASI by .51 units on Day-1, Monday. Value ≥ .50 is important.
DMRT change-effect-time is 15 minutes, Day-1, on Monday in Week-2.
Change Effect = Learning Effect.
power (1 – beta = .49). Higher-order polynomial contrasts (quadratic) were nonsignificant. By inspecting WASO scores’ three weekly means (M1 =19.50, SD = 21.745; M2 = 7.75, SD = 7.924; M3 = 4.75, SD = 5.676), it is evident that the linear effect is due to the WASO scores decreasing over time (Tables 4, 5, 6).

A large change is seen in decreasing WASO means from week-1 to week-2 and, therefore, the decreasing significant trend was due to changes after week-1 when the DMRT was used. Figure 6 displays the results of the decreasing WASO significant trend effects. ANOVA results suggest that participants decreased their waking time within the sleep period. Therefore, ANOVA results of the WASO scores trend effects provided significant evidence that the DMRT reduced waking time after sleep-onset, thereby, returning the participants to sleep faster or eliminating awakening within the sleep period.

The WASO pretest score (M1=19.50, SD = 21.745) is rounded off to 20 minutes and applied to Level 2 (Mild WASO [16 to 30 minutes]) (Table 2). Week-3 WASO score (M3 = 4.75, SD = 5.676) is rounded off to 5 minutes and placed on Level 1 (Normal WASO [1 to 15 min]). The sample decreased the wake after sleep-onset time behavior from Level 2 (Mild WASO [20 min]) to Level 1 (Normal WASO [5 min]) with the use of the DMRT. Therefore, the WASO index is Level 1 (Normal WASO [5 minutes]) for this study (Table 10).

Table 18: Wake After Sleep-Onset Week-2 Results indicates the DMRT decreased waking after sleep-onset within six hours and 57 minutes after it was first used by the sample. Seven out of eight participants (88%) did not wake up within the sleep period. Thus, DMRT change-effect-time is 6:57 (hrs/min) in decreasing the WASO scores in week-2. The sample decreased waking after sleep-onset time from 20 minutes in week-1 to 8 minutes in Week-2.
The Deep Meditative Relaxation Technique (DMRT)

Figure 6: WASO Trend Effects
Table 18: Wake After Sleep-Onset Week-2 Results

<table>
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<tr>
<th>Stu</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>W2 Mean</th>
<th>W1 Mean</th>
<th>W3 Mean</th>
</tr>
</thead>
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<td>0:05</td>
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<td>0:02</td>
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<td>0:10</td>
<td>0:19</td>
<td>0:52</td>
<td>0:18</td>
</tr>
</tbody>
</table>

Day Mean: 0:08 0:09 0:13 0:15 0:00 0:05 0:04 7.75 m 19.50 m 4.75 m

Index-L: L1 L2 L1

TST = 6:57 7:12 7:13 6:14 6:26 7:37 8:03 7:06 h 6:54 h 7:13 h

Note.

W = Week. M = minutes. Day Mean = minutes. L = levels.
Wake After Sleep Onset (WASO).

TST = Total Sleep Time (hours/minutes = h)
Student #18 spent one hour and 5 minutes in waking after sleep-onset after using the DMRT in night one.

The remaining 7 participants (88%) did not spend anytime awake after sleep-onset after using the DMRT within 6 hours and 5 minutes in night one.

Sample decreased WASO time from 20 minutes in week-1 to 8 minutes in night one within 6 hours and 57 minutes of total sleep time for the sample after using the DMRT.

DMRT reduced Sample’s waking after sleep-onset from 20 minutes in Week-1 to 8 minutes in Week-2.
DMRT reduced Sample’s waking after sleep-onset from 20 minutes in Week-1 to 5 minutes in Week-3.
DMRT effected highly significant decreased change in WASO in Sample the first night within 6:57 h/m in Week-2.
DMRT change-effect-time decreasing WASO is 6:57 h/m in Day-1.
Change Effect = learning effect.

Level-Index Effect Size

WASO-Wake After Sleep-Onset Index

- Week-1 = L2 (Mild WASO [16 to 30 minutes])
- Week-2 & 3 = L1 (normal WASO [1 to 15 minutes])
The Deep Meditative Relaxation Technique (DMRT)

The RPM-ANOVA was conducted with the factor being number of wakes and the dependent variable is the Number of Wakes (NOW) scores. The results for the ANOVA indicated a number of wakes marginally significant treatment effect, Wilks’ Lambda $\Lambda = .656$, $F(2, 6) = 1.571$, $p = .070$, at $\alpha = .05$, 1-tailed level, multivariate partial $\eta^2 = .344$, power $(1 – \beta = .219)$. The effects size $\eta^2$ indicated the independent variable accounts for 34.4% of the variance in the dependent variable. The observed power of .22 indicated the likelihood of finding a significant effect when one exists in the population.

Follow-up polynomial contrasts indicated a marginally significant linear effect with NOW means decreasing over time, $F (1, 7) = 2.849$, $p = .067$, at $\alpha = .05$, 1-tailed level, partial $\eta^2 = .289$, power $(1 – \beta = .31)$. Higher-order contrasts (quadratic) were nonsignificant. By inspecting NOW scores’ three weekly means ($M_1 = 5.00$, $SD = 3.024$; $M_2 = 3.88$, $SD = 2.588$; $M_3 = 2.75$, $SD = 1.982$), it is evident that the linear effect is due to the NOW scores decreasing over time (Tables 4, 5, 6). A little change is seen in decreasing means from week-1 to week-2 and, therefore, the decreased trend was due to changes after week-1 when the DMRT was used. Figure 7 displays the results of the NOW decreased trend effects.

The NOW pretest score ($M_1 = 5.00$, $SD = 3.024$) is converted to 5 and applied to Level 2, and week-3 NOW score ($M_3 = 2.75$, $SD = 1.982$) is converted to 3 and placed on Level 1. The sample’s NOW increased from Level 2 (Mildly Normal NOW [4 to 6]) to Level 1 (Normal NOW [0 to 3]) with the use of the DMRT (Table 2). Therefore, the index Level results indicated that with the DMRT the sample decreased their Number of Wakes from 5 times per week to 3 times per week that represents Level 1 (Normal Number of Wakes [0-3]) in this study (Table 2).
The Deep Meditative Relaxation Technique (DMRT)

Figure 7: NOW Trend Effects
Table 19: Number of Wakes Daily Results indicates that only one student woke up for a total of three times on night one after using the DMRT. Seven of eight participants (88%) did not wake up in the sleep period on night one in week-2 after using the DMRT for 6:57 (hrs/min). The NOW decreasing findings indicated that the cue to “sleep” was highly effective within 6:57 (hrs/min) in the first night the participants used the DMRT in week-2.

Therefore, the DMRT change-effect-time is six hours and 57 minutes in decreasing the NOW for the sample in week-2. Also, NOW findings indicated that the participants decreased their number of wakes from week-1 level-index of L2.5 (Mildly Normal NOW [4 to 6]) to Level 1.3 (Normal NOW [0 to 3]) in week-3 (Table 2).

The RPM-ANOVA was conducted with the factor being total sleep time, and the dependent variable is the Total Sleep Time (TST) scores. The results for the ANOVA indicated a total sleep time nonsignificant treatment effect, Wilks’ Lambda $\Lambda = .908$, $F (2, 6) = .302$, $p = .75$, $\alpha = .05$, 1-tailed level, multivariate partial $\eta^2 = .092$, power ($1 – \beta = .08$). The effects size $\eta^2$ indicated the independent variable accounts for 9.2% of the variance in the dependent variable. The observed power of .08 indicated the likelihood of finding an effect.

Follow-up polynomial contrasts indicated a nonsignificant linear effect with TST means increasing over time, $F (1, 7) = .680$, $p = .22$, at $\alpha = .05$, 1-tailed level, partial $\eta^2 = .089$, power ($1 – \beta = .111$). Higher-order contrasts (quadratic) were nonsignificant. By inspecting TST scores’ three weekly means ($M_1 = 414$, $SD = 41.494$; $M_2 = 426$, $SD = 63.897$; $M_3 = 433.25$, $SD = 77.831$), it is evident that the linear effect is due to the TST’s scores increasing over time (Tables 4, 5, 6). A little change is seen in increasing means from week-1 to week-2 and, therefore, the increased trend was due to changes after week-1 when the DMRT was used.
Table 19: Number of Wakes Daily Results

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<th>Stu</th>
<th>MON</th>
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<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
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<th>Level-Index</th>
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<td></td>
<td></td>
<td></td>
<td>3.875</td>
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NOW = number of wakes. Day Mean = NOW per day.
Sample decreased NOW M1 to M2 = 1.12 units.
Sample decreased NOW M2 to M3 = 1.13 units.
Sample decreased NOW M1 to M3 = 2.25 units.
Sample (88%) significantly decreased NOW in 120 hours after using DMRT on Friday in W2.
Only one person (12.5%) awakened for a total of 3 times on night one after receiving the DMRT.
Sample (n = 7) or 88% did not wake after using the DMRT for 6:57 h/m on night one in W2.
Sample (N = 8) decrease from NOW (5) in W1 to NOW (3) in W2-Day1.
DMRT change-effect-time is 6:57 hours/minutes on Day-1, Monday in W2.
DMRT change-effect-time is 6:57 hours/minutes in significant decrease in NOW in Day-one.
Change Effect = Learning Effect.
Level-Index Effect Size
NOW—Number of Wakes Index
- Week-1 & W2 = L2 (Mildly Normal NOW [4 to 6])
- Week-3 = L1 (Normal NOW [0 to 3])
The Deep Meditative Relaxation Technique (DMRT)

*Figure 8* displays the results of the increased TST trend effects. ANOVA trend effect results suggested that participants increased the total sleep time by 19 minutes using the DMRT.

The TST pretest score ($M_1 = 414$ min, $SD = 41.494$) is converted to 6:54 (hrs/min) and applied to Level 2, and week-3 TST score ($M_3 = 433$ min, $SD = 77.831$) is converted to 7:13 (hrs/min) and placed on Level 1 (Table 2). The sample’s TST increased from Level 2 (*Mildly Normal TST [6 to 6.9 hrs]*) to Level 1 (*Normal TST [7 to 8 hrs]*) with the use of the DMRT. Therefore, the level-index results indicated that with the DMRT the sample increased their total sleep time by 19 minutes that represent Level 1 (*Normal total sleep time [7 to 8 hrs]*) in this study (Table 2). The final index score is Level 1 (*Normal TST [7.13 hrs]*) (Table 10).

*Table 20: Total Sleep Time Daily Results* indicated that the sample’s change-effect-time was the increased sleep time from week-1 6:54 (hr/min) to 6:57 (hrs/min) on Monday for a total of 3 minutes in Week-2. Also, TST scores indicated that the sample significantly increased total sleep time in week-2 Day-2 by 18 minutes (6:54 to 7:12 hrs/min). DMRT change-effect-time is 6:57 (hr/min) increased TST on Day-1, Monday, in week-2 immediately after using the DMRT.

A RPM-ANOVA was conducted with the factor being the difficulty waking before alarm and the dependent variable is the Difficulty Waking Before Alarm Index (DWBAI) scores. The RPM-ANOVA results indicated a difficulty waking before the alarm significant treatment effect, Wilks’ Lambda $\Lambda = .141$, $F (2, 6) = 18.219$, $p = .003$, at $\alpha = .05$, 1-tailed level, multivariate partial $\eta^2 = .859$, power (1 – beta = .986). The effects size $\eta^2$ indicated the independent variable accounts for 85.9% of the variance in the dependent variable. The observed power of .986 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.
The Deep Meditative Relaxation Technique (DMRT)

**Figure 8: TST Trend Effects**
The Deep Meditative Relaxation Technique (DMRT)

### Table 20: Total Sleep Time Daily Results

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<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>W2 Mean</th>
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<table>
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<th>W3 Mean</th>
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</thead>
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<td>L2</td>
</tr>
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</table>

Note. TST—Total sleep time. Day Mean = hours & minutes per day. W = Week. Stu = Student. H = hours/minutes

Sample increased Total Sleep Time by 12 minutes in week-2 after using the DMRT.
Sample increased Total Sleep Time by 7 minutes in week-3 after using the DMRT.
Sample increased Total Sleep Time by 19 minutes after using the DMRT between Week-1 & Week-3.

Sample increased Total Sleep Time by 18 minutes within 48 hours after using the DMRT in Week-2: (TST = [6:54 h/m to 7:12 h/m] = 18 minutes increase]).
DMRT significant change-effect-time is 48 hours increase of 18 minutes total sleep time.
Sample increased Total Sleep Time by 3 minutes within 6:57 h in Day-1, W2 compared to W1. (TST = [6:54 h/m to 6:57 h/m] = 3 minutes increase]).
DMRT change-effect-time is 6:57 hours/minutes increased TST, Day-1, Monday in Week-2.

Change Effect = Learning Effect.

TST—Level-Index Effect Size
- Week-1 = L2 (Mildly normal TST [6 to 6.9 hrs.]) = 6:54 hours/minutes
- Week-2 = L1 (TST [7 to 8 hrs.]) = 7:06 hours/minutes
- Week-3 = L1 (TST [7 to 8 hrs.]) = 7:13 hours/minutes
Follow-up polynomial contrasts indicated a significant linear effect with DWBAI means decreasing over time, \( F(1, 7) = 17.234, p = .004, \alpha = .05, \) 1-tailed level, partial \( \eta^2 = .711, \) power (1 – beta = .943). Higher-order contrasts (quadratic) were nonsignificant. By inspecting DWBAI scores’ three weekly means (\( M_1 = 8.75, SD = 3.059; M_2 = 6.00, SD = 4.071; M_3 = 3.38, SD = 2.264 \)), it is evident that the linear effect is due to the DWBAI’s scores decreasing over time (Tables 4, 5, and 6).

It should be noted that there was a little change in means from week-1 to week-2 and, therefore, the significant decreasing trend effect was due to changes after week-1 when the DMRT was added to the participants sleep/wake behavior. Figure 9 displays the results of the DWBAI significant decreased trend effects. ANOVA results suggest that participants’ difficulty waking before the alarm time significantly decreased with the use of the DMRT.

The DWBAI pretest score (\( M_1 = 8.75, SD = 3.059 \)) is rounded off to 9 and applied to Level 3 (moderate difficulty self-awakening [7 to 9]) (Table 2). Week-3 DWBAI score (\( M_3 = 3.38, SD = 2.264 \)) is rounded off to 3 and placed on Level 1 (low difficulty self-awakening [0 to 3]). The sample’s DWBAI decreased from Level 3 difficulty to Level 1’s difficulty waking before the alarm behavior with the use of the DMRT. Therefore, the DWBAI is Level 1 (low difficulty self-awakening [3]) (Table 2).

DMRT change-effect-time is 48 hours with the decrease of 1.88 units in DWBAI score on Tuesday, Day-2 in Week-2 (Tables 21, 22). DWBAI significant change-effect-time is 72 hours with a drop of 3 points (Table 22). These findings are corroborated by the SASI results that indicated the sample began waking before the alarm on Tuesday with a -17 units, and they were confirmed on Wednesday with a -4 units (Table 23).
The Deep Meditative Relaxation Technique (DMRT)

Figure 9: DWBAI Trend Effects

![Estimated Marginal Means of DWBAI Graph](image-url)
Table 21: Difficulty Waking Before Alarm Index Daily Week-2 Results

<table>
<thead>
<tr>
<th>Stu</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
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<th>W1 Mean</th>
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</tbody>
</table>

Day N 8 7 9 5 3 8 8

Day Mean 1.00 0.88 1.125 0.625 0.375 1.00 1.00 6.00 8.75 3.38

Level-Index

Note.
W = Week. M = Mean. L = level. Day N = Frequency per day. Day Mean = units per day.

Sample W1 to W2 DWBAI score decreased 2.75 units ($M_1 = 8.75 - M_2 = 6$).
Sample W2 to W3 DWBAI score decreased 2.62 units ($M_2 = 6.0 - M_3 = 3.38$).
Sample W1 to W3 DWBAI score decreased 5.37 units ($M_1 = 8.75 - M_3 = 3.38$).

DMRT change-effect-time is 48 hours, Day-2, Tuesday.

DMRT Level-Index = Effect Size
- Week-1 to Week-2 = L3.9 (Moderate Difficulty Self-Awakening [7 to 9]).
- Week-2 to Week-3 = L2.6 (Somewhat Difficulty Self-Awakening [4 to 6]).
- Week-1 to Week-3 = L1.3 (Low Difficulty Self-Awakening [0 to 3]).

Table 22: DMRT Change-Effect Time DWBAI Week-2 Results

<table>
<thead>
<tr>
<th>Hours</th>
<th>Days</th>
<th>Daily Mean Increase</th>
<th>Week-2 Day Mean</th>
<th>Decrease Change Effect Units</th>
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<tr>
<td>6:57 h Mon</td>
<td></td>
<td>1.00</td>
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</tr>
<tr>
<td>48 h Tue</td>
<td>1.00</td>
<td>0.88</td>
<td>1.88</td>
<td></td>
</tr>
<tr>
<td>72 h Wed</td>
<td>1.88</td>
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<td>3.005</td>
<td></td>
</tr>
<tr>
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<td>0.625</td>
<td>3.63</td>
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</tr>
<tr>
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<td>3.63</td>
<td>0.375</td>
<td>4.005</td>
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</tr>
<tr>
<td>144 h Sat</td>
<td>4.005</td>
<td>1.00</td>
<td>5.005</td>
<td></td>
</tr>
<tr>
<td>168 h Sun</td>
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<td>1.00</td>
<td>6.005</td>
<td></td>
</tr>
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</table>

Note. DWBAI = Difficulty Waking Before Alarm Index. H = hour.

DMRT change-effect-time is 48 hours, Day-2, Tuesday.

DMRT significant change-effect-time is 72 hours, Day-3, Wednesday.
The Deep Meditative Relaxation Technique (DMRT)

**Table 23: Self-Awakening Scale Index Daily Week-2 Results**

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<th></th>
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<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>Wk-2</th>
<th>Mean</th>
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<th>Mean</th>
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<td>-42</td>
<td>14</td>
<td>9</td>
<td>-6.13 m</td>
<td>18.50 m</td>
<td>-13.50 m</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note.**

M = Minutes. H = hours & minutes. N = Number (Sample) = 8. Level = L. Day Mean = minutes.

WBAI = Wake Before Alarm Index. Self-Awakening (SA).

WBACI = Wake Before Alarm Cue Index (-1 to -10 minutes). WBACI = Number per day.

TST = Total Sleep Time (hours/minutes = h). NOW = Number of Wakes

Self-Awakening Scale Index (SASI) = (-120 to +120 minutes). Negative m = WBAT. Positive m = WALT.

SASI = Mean = -6 minutes in Week-2.

Wake after alarm time (WALT) = [SASI = > 0 to +120 min] = 27% in W2.

Wake at Expected Wakeup Time (W_EWT) (alarm) = [SASI = 0] = 32% in W2.

Wake before alarm time (WBAT) = [SASI = < 0 to -120 min.] = 41% in W2.

WALT = N (3) = 37.5% in W2.

W_EWT = N (1) = 12.5% in W2.

WBAT = N (2) = 25% in W1. WBAT = N (4) = 50% in W2. WBAT = N (5) = 63% in W3.

Sample began “waking before the alarm” within 48 hours of using DMRT, SASI (N = 8) = -17, Tuesday.

DMRT change-effect-time is 48 hours significant increase in WBAI (SA).

DMRT change-effect-time in increased WBACI is 120 hours, on Friday (n = 5) in W2.

Sample began WBAI and WBACI in Week-2, SASI (N = 8) = -6.13 min.

Sample decreased NOW (5) from Week-1 to 3 in Day-1, W2 for 2 points difference.

DMRT change-effect-time is 6:57 hours/minutes Day-1, W2 decreased NOW.

Sample increased TST by 15 minutes in Week-2 on Day-2, within 48 hours.

DMRT significant increased TST change-effect-time is 48 hours.

Sample increased TST by 3 minutes in Week-2 on Day-1 (TST = 6:54 to 6:57 h/m = 3 min increase).

DMRT change-effect-time for increased TST is 6:57 hours/minutes, Day-1-W2.

Change Effect = learning effect.

**Level-Index Effect Size**

SASI – Self-awakening scale index

- **Week-1 = L5** (Did not wake before the alarm [≥ 0 min])
- **Week-2 & 3 = L1** (Very good self-awakening [-1 to -15 min])

NOW = Number of Wakes

- **Week-1 = L2.5** (Mild NOW [5])
- **Week-2 = L2.4** (Mild NOW [4])
- **Week-1 = L1.3** (Normal NOW [3])

TST – Total Sleep Time

- **Week-1 = L2** (Mild Normal TST [6 to 6.9 hrs.]).
- **Week-2 & 3 = L1** (Normal TST [7 to 8 hrs.]).
The Deep Meditative Relaxation Technique (DMRT)

Table 24 indicated that Sample \((n = 6)\) DWBAI was zero on Tuesday, Day-2 after using the DMRT in week-3. These findings indicated that the Sample’s DWBAI score remained in a decreasing mode as indicated by the means difference from week-2 to week-3 decrease of 2.62 units and week-1 to week-3 decrease of 5.37 units (Table 21). These results change the DWBAI level-index from L3.9 to L1.3 (Low difficulty waking before the alarm).

The one-way RPM-ANOVA was conducted with the within-subjects factor being the standardization of the self-awakening scale and the dependent variable is the Self-Awakening Scale Index (SASI) scores. The ANOVA results indicated a significant measurement of the waking treatment effect, Wilks’ Lambda \(\Lambda = .341, F (2, 6) = 5.801, p = .040\), at \(\alpha = .05\), 2-tailed level, multivariate partial \(\eta^2 = .66\), power \((1 – \beta = .65)\). The effect size \(\eta^2\) indicated the independent variable accounts for 66% of the variance in the dependent variable. The observed power of .65 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear effect with SASI means decreasing over time, \(F (1, 7) = 13.505, p = .008, \alpha = .05\), 2-tailed level, partial \(\eta^2 = .66\), power \((1 – \beta = .88)\). Higher-order polynomial contrasts (quadratic) were nonsignificant. By inspecting SASI scores’ three weekly means \((M1 = 18.50, SD = 23.489; M2 = -6.13, SD = 31.046; M3 = -13.50, SD = 23.791)\), it is evident that the linear effect is due to the SASI scores decreasing over time (Tables 4, 5, and 6).

A large change is seen in the decreasing SASI means from week-1 \((M1=18.50)\) to week-2 \((M2 = -6.13)\) and, therefore, the SASI significant decreasing trend was due to changes after week-1 when the DMRT was used. Figure 10 displays the results of the SASI decreasing significant trend effects. Week-1 and week-3 mean results suggest that the participants’ SASI
Table 24: Self-Awakening Consistency-Success Rate Week-3 Results

<table>
<thead>
<tr>
<th>Week-3</th>
<th>MON</th>
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<th>THU</th>
<th>FRI</th>
<th>SAT</th>
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</tr>
<tr>
<td>WBAT</td>
<td>6:15 AM</td>
<td>6:30 AM</td>
<td>6:49 AM</td>
<td>6:58 AM</td>
<td>6:50 AM</td>
<td>7:37 AM</td>
<td>8:00 AM</td>
<td>Stu #17</td>
</tr>
<tr>
<td>WBAM</td>
<td>0:45 m</td>
<td>0:30 m</td>
<td>0:11 m</td>
<td>0:02 m</td>
<td>0:10 m</td>
<td>0:23 m</td>
<td>0:00 m</td>
<td>-17 m</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>WBAI</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
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</tr>
<tr>
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<td>0</td>
<td>0</td>
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<td>0</td>
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</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>6:00 AM</td>
<td>6:20 AM</td>
<td>5:50 AM</td>
<td>9:30 AM</td>
<td>8:25 AM</td>
<td>Stu #18</td>
</tr>
<tr>
<td>WBAM</td>
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<td>2:00</td>
<td>0:00</td>
<td>0:40</td>
<td>1:10</td>
<td>0:30</td>
<td>0:35</td>
<td>-42 m</td>
</tr>
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<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>DWBAI</td>
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<td>0</td>
<td>0</td>
<td>3</td>
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<tr>
<td>WASO</td>
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<td>0:10</td>
<td>0:10</td>
<td>0:10</td>
<td>0:15</td>
<td>0:25</td>
</tr>
<tr>
<td>NOW</td>
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<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6/W</td>
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<tr>
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<td>5:10</td>
<td>7:15</td>
<td>7:00</td>
<td>5:40</td>
<td>7:40</td>
<td>7:55</td>
<td>6:35 h</td>
</tr>
</tbody>
</table>

\[ n = 6 \text{TST} \]

Figure 10: SASI Trend Effects
scores decreased from waking after the alarm time \((M_1=18.50, SD = 23.489)\) to waking before the alarm time \((M_3 = -13.50, SD = 23.791)\) (Tables 4, 6). Therefore, the mean results provided evidence that indicated the SASI significantly distinguishes and measures self-awakening behavior for (1) waking before the alarm time (-1 to -120 minutes); (2) waking at the alarm time (= zero); and (3) waking after the alarm time (+1 to +120 minutes).

The SASI pretest score \((M_1=18.50, SD = 23.489)\) is rounded off to +19 minutes and applied to Level 5, and week-3 SASI score \((M_3 = -13.50, SD = 23.791)\) is rounded off to -14 minutes and placed on Level 1 (Table 2). The sample’s SASI increased from Level 5 (Did not wake before the alarm \([\geq 0 \text{ min}]\)) to Level 1 (very good self-awakening \([-1 \text{ to } -15 \text{ min}]\)) before the alarm with the use of the DMRT (Table 2). The level-index results indicated that the sample was more accustomed to waking by the alarm (= zero) or after the alarm (1 to 120 min). Yet, DMRT treatment increased the ability to accomplish waking before the alarm (-1 to -120 min) that produced level-index results on Level 1 (very good self-awakening \([-1 \text{ to } -14 \text{ minutes}]\)) on the SASI scale. The SASI is Level 1.

*Table 23: Self-Awakening Scale Index Daily Week-2 Results* indicates the day the group began to wake before the alarm time after using the DMRT. Table 23 results indicated that two students did wake 10 minute before the alarm, and these results indicated the Wake Before Alarm Cue Index (-1 to -10 min) interval time was accomplished within six hours and 57 minutes of performing the DMRT. However, the group’s mean (-17) minutes indicated the DMRT change-effect-time is 48 hours when participants increased waking before the alarm time after receiving the DMRT on Day-2 in week-2. Week-2 Day-3 mean (-4) minutes results, also, indicated the group began to wake in the WBACI interval (-1 to -10 min) within 72 hours after performing the DMRT (Table 23).
SASI week-2 scores, also, indicated that the group began waking before the alarm on Tuesday and continued to wake before the alarm for the remainder of the week with the exception of the weekend days when the participants slept pass the alarm for 14 and 9 minutes on Saturday and Sunday, respectively (Table 23). In light of the fact that students seldom set an alarm on the weekend, their weekend results suggested that they did just that. The sample overall SASI mean score indicated the participants woke 6 minutes before the alarm in week-2 after receiving the DMRT(Table 23). This mean score of waking 6 minutes before the alarm indicated they woke in the WBACI interval, too, in week-2.

The one-way RPM-ANOVA was conducted with the within-subjects factor being waking before the alarm cue and the dependent variable is the Wake Before Alarm Cue Index (WBACI) scores. The ANOVA results indicated a wake before the alarm cue time significant treatment effect, Wilks’ Lambda $\Lambda = .269$, $F(2, 6) = 8.143$, $p = .010$, $\alpha = .05$, 1-tailed level, multivariate partial $\eta^2 = .73$, power ($1 – \beta = .79$). The effects size $\eta^2$ indicated the independent variable accounts for 73% of the variance in the dependent variable. The observed power of .79 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.

Follow-up polynomial contrasts indicated a significant linear trend effect with WBACI means increasing over time, $F(1, 7) = 13.444$, $p = .004$, at $\alpha = .05$, 1-tailed level, partial $\eta^2 = .66$, power ($1 – \beta = .88$). Higher-order polynomial contrasts (quadratic) were nonsignificant. By inspecting WBACI scores’ three weekly means ($M1 = .38, SD = .744; M2 = .63, SD = .744; M3 = 1.75, SD = 1.488$), it is evident that the linear effect is due to the WBACI scores increasing over time (Tables 4, 5, 6).
A little change is seen in increasing WBACI means from week-1 to week-2 and, therefore, the significant increasing trend was due to changes after week-1 when the DMRT was used. Figure 11 displays the results of the WBACI significant increasing trend effects. ANOVA results of WBACI scores suggest that participants were able to respond to the cue (wake five minutes before alarm) by waking within the WBACI (10-minutes interval [-1 to -10 min]) before the alarm with the use of the DMRT. Therefore, ANOVA results provide significant evidence that the cue “wake 5-minutes before alarm” had a powerful influence on the participants to wake as close to the alarm as possible as suggested by the DMRT cue theory.

The WBACI pretest score ($M_1 = .38, SD = .744$) is rounded off to 0 and applied to Level 6 (Table 2). Week-3 WBACI score ($M_3 = 1.75, SD = 1.488$) is rounded off to 2 and placed on Level 4. The sample’s WBACI increased from Level 6 (Non-Cue Consistent Self-Awakening [0]) to Level 4 (Small Cue-Consistent Self-Awakening [2]); that is, to wake before alarm “cue” (wake 5-minutes before alarm) represented the WBACI (-1 to -10 minutes) interval increase with the use of the DMRT.

The level-index results indicated that the sample was not accustomed to waking within 10 minutes before the alarm when WBACI indicated a pretest score with a zero effect. Yet, DMRT treatment increased the ability to accomplish waking within 10 minutes before the alarm that produced a small effect size for the Wake Before Alarm Cue Index (Table 2). Therefore, the WBACI is Level 4 (Small Cue-Consistent Self-Awakening [2]) for this study (Table 2).

Follow-up pairwise comparisons with the Paired Sample T Tests were performed on the WBACI weekly scores to determine when the DMRT took effect. Table 11 indicated that WBACI week-2 to week-3 results produced a significant treatment effect, $t (7) = -2.183$, $p = .033$, $a = .05$, 1-tailed, $d = -.77$, power (1- beta = .63); and week-1 to week-3 overall effects,
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Figure 11: WBACI Trend Effects
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t (7) = -3.667, \( p = .004 \), \( \alpha = .05 \), 1-tailed, \( d = -1.30 \), power (1- \( \beta = .95 \)). These results indicated that the participants began waking before the alarm cue time (-1 to -10 minutes) with a high moderate effect size delta (-.77) in week-2 to week-3 and in the overall results from week-1 to week-3 with a very large effect size delta (-1.30) (Table 11).

Table 24: Self-Awakening Consistency-Success Rate Week-3 Results represent six student’s performances in self-awakening consistency-success rate. Student #17 was chosen because the Wake Before Alarm Minutes (WBAM) are consistent for three days in a row, thereby, producing a “consistency success” rate for three nights. Student #17 was able to awaken within 11, 2, and 10 minutes before the alarm at varied enter-bed-times. According to Moorcroft et al. (1997), because Student #17 awakened two days in a row within 10 minutes before the alarm and the third within 15 minutes before the alarm, these results would classify Student #17 as a Self-Awakener with an effect size described as moderately consistently successful.

In this study, based on a 7-day week interval, the participant was classified on WBACI’s level-index effect size on Level 4 (small cue consistent self-awakening [2]) (Table 2). Yet, Student #17 self-awakened six days out of the 7-day-week. These results placed the student on a WBAI’s level-index effect size on Level-1 (extremely high consistent self-awakening [5 to 7 days/week]) (Table 2).

In contrast to earlier studies (Moorcroft et al., 1997; Zepelin, 1986), Student #17’s Number of Wakes is zero; that is, the student did not have to wake up periodically to check the time, in order, to successfully self-awaken close to the target time; yet the student awakened three nights within 15 minutes before the alarm time, and the total sleep time ranged from 4:05 to 6:43 hours/minutes on the nights she did wake within 15 minutes of the alarm, consistently (Table 24).
Table 24, contains Student #15’s performance in self-awakening “consistency success” rate who varied times entering the bed and the awakenings. This student enter-bed-time also demonstrates the delayed sleep phase symptoms, yet the student was able to obtain seven hours of sleep on an average for week-3. Student #15 was able to wake before the alarm (3, 10, 5, and 3 minutes) on four consecutive nights in week-3 with the use of the DMRT. All four times are within the WBACI interval (-1 to -10 minutes); that is, Student #15 responded to the exact wording of the cue to “wake 5-minutes before alarm” consistently. According to Moorcroft et al. (1997), Student #15 is a Self-Awakener with an effect size that classifies the student as successful consistently.

As a matter of fact, Student #15 awakened before the alarm 10 and 7 minutes two days in a row in week-2 after first receiving the DMRT (Table 23). As Student #15 findings indicated, after receiving the DMRT, Student #15 (a) self-awakened within 10 and 7 minutes before the alarm time for two days in week-2 (Table 23); (b) began waking within the alarm cue index when he did start waking in week-2 for two consecutive days (Table 23); (c) did not wake after the alarm in week-3; and (d) woke within 10 minutes before the alarm for 4 days, consecutively, in week-3 with the use of the DMRT (Table 24). In addition, Student #15 number of wakes only included waking one time on Monday and zero time the remainder of week-3 (Table 24).

Because the student awakened four days within 10 minutes before the alarm, Student #15’s WBACI level-index effect size results indicated a “cue-consistency” rate on Level 2 (large cue consistent self-awakening [4]) (Table 2). In addition, Student #15’s WBAI findings indicated waking before the alarm time for five days of the seven-day week. Therefore, Student #15’s WBAI level-index effect size is Level 1 (extremely high consistent self-awakening [5 to 7 days]) (Tables 2, 10).
While in the debriefing meeting with Student #15, I pointed out how his total sleep time had decreased by 56 minutes from week-1 to week-3. Student #15 said total sleep time decreased because he had a higher motivation to meet schedule and was busier in week-3 than week-1 and week-2. He admitted he took more naps to make up for the missed sleep when he awakened earlier to meet schedule; that is, the amount of sleep time was not the issue.

These results indicated that Student #15 was more interested in alertness and motivation in waking-life quality in sleep-offset, more so, than sleep quantity; thereby, confirming the Sleep-Quality More Important Theory proposed in this study. In other words, it was not the amount or quantity of sleep that was the drive behind the participant’s motivation, but the increased mental alertness and motivation from the increased ability to self-awaken (4 times within 10 minutes before alarm time in week-3) (Table 24) that aided meeting schedule successfully, consistently, for Student #15.

Table 24 consists of Student #11 “consistency success” rate that is based on a weekly schedule applying only to this study. Student #11 WBAT indicates the Delayed Sleep Phase Syndrome (DSPS) sleep disorder. This student was able to wake within the WBACI interval for 6, 4, and 6 minutes on three nonconsecutive days in week-3. The WBACI level-index is Level 3 (medium cue consistent self-awakening) (Table 2).

Student #11 did not wake before the alarm one time in week-2, nor did the student wake after the alarm time as Table 23 results indicated. Student #11 self-awakened five times before the alarm in the 7-day week-3. This student was able to wake before the alarm on four consecutive nights for a total of 5 in week-3 (Table 24). The WBAI’s level-index effect size is Level 1 (extremely high consistent self-awakening [5 to 7 days]) (Table 2). Also, the student’s
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Number of Wakes was 3 for the week; but on the four consecutive days that she woke before the alarm, her Number of Wakes was zero (Table 24).

In debriefing, Student #11 indicated that she felt she needed 9 hours of sleep to feel really rested in the past. Study results indicated that on some days she slept 10:27, 9:56, 8:53, and no less than 7:10 (hrs/min) in week-3 (Table 24). Week-3 TST’s average was 8:36 (hrs/min). These findings indicated that Student #11’s “sleep-need” was high. Because she only received 6:52 (hrs/min) total sleep time in week-1 (Table 20), these study findings indicated that there was severe sleep deprivation in the student’s life.

Because of apparent severe sleep deprivation aided by symptoms of DSPS and the “student-lifestyle,” once Student #11 began using the DMRT, DMRT’s first job was to remove the “sleep-need debt” (Horne, 1988) that had built up from the lack of sleep. Therefore, the DMRT rested, relaxed, and aided her going to sleep for eight days before she first began to self-awaken before the alarm on Tuesday in week-3 (Table 24).

Remarkably, once Student #11 began waking up before the alarm, the first two times were within six minutes before the alarm in the WBACI interval (-1 to -10 min) (Table 24). Moreover, Student #11 DWFSI scores decreased from a Level-2.5 (Desired to take a nap in the 3rd or 4th hour after the last awakening from nighttime sleep) to Level 1.3 (Felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours) (Tables 10, 14). Student #11’s WBACI index-level effect size is on Level 3 (medium cue consistent self-awakening) (Table 2). Yet, Student #11’s WBAI level-index is placed on Level 1 (extremely high cue-consistent self-awakening [5 to 7 days]) (Tables 2, 10).

Table 24 consists of the data for Student #16 whose WBAT indicated DSPS symptoms, too. In pretesting, the participant was completely alarm-dependent and woke by the alarm and
seldom after the alarm time. Student #16 also was able to self-awaken four times before the alarm in week-2 after receiving the DMRT. In Week-3, Student #16 self-awakened 2, 10, and 10 minutes before the alarm on Tuesday, Wednesday, and Saturday, respectively (Table 24).

The WBACI level-index effect size is Level 3 (medium cue-consistent self-awakening) in this study (Table 2). Student #16 woke before the alarm time 4 days of week-3 (Table 24). The WBAI level-index effect size is Level 4 (large consistent self-awakening) (Table 2). On the four days that Student #16 woke before the alarm time, the Number of Wakes was zero (Table 24). Also, total sleep time increased from 6:16 (hrs/min) in week-1 to 7:51 (hrs/min) in week-3 totaling 1:35 (hrs/min) increase in total sleep time (Table 20).

As illustrated by Table 25: WBACI Change-Effect Time Results, DMRT change-effect-time is 120 hours, Friday, Day-5 in Week-2. Sample was able to obtain a significant mean increase of WBACI scores of 1.12 units from week-2 to week-3. Total increase in WBACI scores was 1.37 units between week-1 and week-3 (Table 25). Noted in Table 24, of the six consistent Self-Awakeners (n = 6), 67% of the participants woke within 10 minutes before alarm. Therefore, DMRT change-effect-time for the habitual Self-Awakeners is 48 hours in week-3. However, DMRT significant change-effect-time is 96 hours, Thursday, Day-4 in week-3 for the sample (N = 8) increase in WBACI scores (Table 25).

**PART-II: DMRT EVF/FUF Evaluation Findings**

Part-II results provided the findings for that part of the research question that ask what are the opinions generated by the use of the DMRT. The DMRT study results consist of follow-up evaluations that focus on providing the participants a group-voice that further evaluates the DMRT. There were six dependent variables (DVs) used to evaluate the participants’ opinions, theories, or feelings about the DMRT: (1) DMRT Continue-Use Index (DCUI), (2) Wake Before
Table 25:

**DMRT Change-Effect Time WBACI Results**

<table>
<thead>
<tr>
<th>Hours</th>
<th>Days</th>
<th>Daily Mean Increase</th>
<th>Week-3 Day Mean</th>
<th>Increase change Effect Units</th>
</tr>
</thead>
<tbody>
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<td>7:08 h</td>
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<td>0.25</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>48 h</td>
<td>Tue</td>
<td>0.25</td>
<td>0.125</td>
<td>0.375</td>
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<td>72 h</td>
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<td>0.125</td>
<td>0.50</td>
</tr>
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<td>Fri</td>
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<td>0.125</td>
<td>0.625</td>
</tr>
<tr>
<td>144 h</td>
<td>Sat</td>
<td>0.625</td>
<td>0.625</td>
<td>0.625</td>
</tr>
<tr>
<td>168 h</td>
<td>Sun</td>
<td>0.625</td>
<td>0.625</td>
<td>0.625</td>
</tr>
</tbody>
</table>

Note. WBACI = Wake Before Alarm Cue Index. H = hours.
DMRT change-effect-time is 120 hours, Day-5, Friday in week-2.

<table>
<thead>
<tr>
<th>Hours</th>
<th>Days</th>
<th>Daily Mean Increase</th>
<th>Week-3 Day Mean</th>
<th>Increase change Effect Units</th>
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<tr>
<td>7:08 h</td>
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<td>0.875</td>
<td>1.25</td>
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<td>72 h</td>
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<td>168 h</td>
<td>Sun</td>
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</table>

Note. WBACI = Wake Before Alarm Cue Index. H = hour. M = Mean.
Sample increased WBACI scores week-1 to week-2 by .25 units (M2 = .63 – M1 = .38).
Sample increased WBACI scores week-2 to week-3 by 1.12 units (M3 = 1.75 – M2 = .63).
Sample increased WBACI scores week1 to week-3 by 1.37 units (M3 = 1.75 – M1 = .38).

DMRT significant change-effect-time is 96 hours, Day-4, Thursday in Week-3.
The six within-subjects factors produced scores two times to account for two levels of each factor. The DVs were the scores on the evaluation form (EVF) that represent Time-1 evaluations and the scores on the follow-up form (FUF) that represent Time-2 evaluations. The EVF scores were completed one week after the three experimental weeks of the study while FUF scores were provided one-month after the EVF. The means and standard deviations for the six DVs on the EVF and FUF are presented in Table 26.

The repeated-measures (RPM) analysis of variance (ANOVA) (RPM-ANOVA) was conducted on all six DVs. The ANOVA was chosen to provide the more powerful test in comparison to the Paired-Samples T Test. The standard univariate assumptions underlying the use of within-subjects repeated measures ANOVA were met: (1) Dependent variables are normally distributed; (2) independence of scores; and (3) sphericity or the homogeneity of variance of difference was maintained. Also, the normality assumption was met and verified with the One-Sample Kolmogorov-Smirnov Test (Tables 27, 28).

The most stringent assumption that must be met was the sphericity assumption. Since the EVF and FUF evaluations formed six DVs represent two time levels, the univariate tests labeled as the statistic for the Mauchly’s $W (=1.000)$ and the alternative univariate tests for Epsilon’s Greenhouse-Geisser ($=1.000$) verified that the sphericity assumption had been met for all six DVs. The differences in EVF and FUF DVs’ means were assessed to determine the trend effects of the results. Furthermore, the EVF and FUF’s DVs were reported on their indicated level as seen in Table 29. Therefore, the following results represent the DVs used to evaluate the
The Deep Meditative Relaxation Technique (DMRT)

Table 26: EVF-FUF Descriptive Statistics

<table>
<thead>
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<th>Dependent Variables</th>
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<th>Std. Deviation</th>
<th>Std. Error</th>
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</thead>
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<td>.313</td>
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<td>.886</td>
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</table>

Note:
EVF: Evaluation Form. FUF: Follow-Up Form.
### Table 27: Normality/Kolmogorov-Smirnov Test EVF Results

<table>
<thead>
<tr>
<th></th>
<th>DCUI_</th>
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<th>DHI_</th>
<th>PEI_</th>
<th>SCI_</th>
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**Note.** a. Test distribution is Normal. b. Calculated from data.

### Table 28: Normality/Kolmogorov-Smirnov Test FUF Results

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**Note.** a. Test distribution is Normal. b. Calculated from data.
### Table 29: DMRT EVF / FUF Level-Index Results

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<tr>
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</table>

*Note.* DVs = Dependent Variables. 
T1 = EVF = Evaluation Form scores. T2 = FUF = Follow-up Form scores. 
Means are rounded to one significant digit. 
Delta (Δ) effect size statistic = .2, .5, .8 or small, medium, and large, respectively. Δ ≥ .50 is important. 
Delta = T2 (T1 to T2 results).

#### Level-Index Meanings

**DCUI = DMRT Continue Use Index**
- Time-1 EVF = L3 (DMRT Continue Use-Maybe Yes)
- Time-2 FUF = L1 (DMRT Continue Use-Definitely Yes)

**WBAI-2 = Wake Before Alarm Index-2**
- Time-1 EVF = L4 (wake before the alarm 2 times per 7-day week)
- Time-2 FUF = L3 (wake before alarm 3 times per 7-day week)

**DRI = Deep Relaxation Index**
- Time-1 EVF = L3 (medium relaxation effect)
- Time-2 FUF = L2 (large deep relaxation effect)

**DHI = DMRT Help Index**
- Time-1 EVF = L3 (DMRT Help-Maybe Yes)
- Time-2 FUF = L3 (DMRT Help-Maybe Yes)

**PEI = Practice Effect Index**
- Time-1 EVF = L3 (DMRT has a medium practice effect)
- Time-2 FUF = L2 (DMRT has a large practice effect)

**SCI = Sleep-Control Index**
- Time-1 EVF = L3 (medium sleep-control effect)
- Time-2 FUF = L2 (large sleep-control effect)
participants’ opinions, theories, or feelings about the DMRT assessed on the EVF and FUF based on the aforementioned procedures.

A RPM-ANOVA was conducted with the within-subjects factor being participants’ opinions of whether they will continue to use the DMRT after the study was completed. The dependent variable is the DMRT Continue-Use Index (DCUI) scores on the evaluation form (EVF) (one-week after study completed) and the follow-up form (FUF) (one month after the EVF). The means and standard deviations for the EVF and FUF scores are presented in Table 26.

The results for the ANOVA indicated a DMRT continue use significant increasing time effect, Greenhouse-Geisser, $F(1, 7) = 5.923, p = .023, \alpha = .05$, 1-tailed level, univariate partial $\eta^2 = .46$, power $(1 – beta = .55)$. The effects size $\eta^2$ indicated the independent variable accounts for 46% of the variance in the dependent variable. The observed power of .55 indicated the likelihood of finding a significant effect when one exists in the population.

By inspecting DCUI-EVF mean-1 ($M_1 = 3.38$) and DCUI-FUF mean-2 ($M_2 = 4.75$), it is evident that there is a linear effect due to the WBAI scores increasing over time (Table 26). The results of the DCUI significant increasing trend effects are displayed in Figure 12. ANOVA results suggest that participants’ opinions to continue to use the DMRT significantly increased from week-one immediately after the study to week-five.

The DCUI-EVF time-1 score ($M_1 = 3.38, SD = 1.302$) is rounded off to 3 and applied to Level 3 (DMRT Continued Use-Maybe Yes), and DCUI-FUF time-2 (($M_2 = 4.75, SD = .707$) is rounded off to 5 and placed on Level 1 (DMRT Continue Use-Definitely Yes) that indicated the participants would definitely continue to use the DMRT after the study was completed. Therefore, the DCUI score results for this study indicated Level 1 (DMRT Continue Use Definitely Yes) (Tables 3, 29).
The Deep Meditative Relaxation Technique (DMRT)

**Figure 12: DCUI Trend Effect Results**
A RPM-ANOVA was conducted with the within-subjects factor being participants’ opinions on their ability to wake within 15 minutes before the alarm time (without help). The dependent variable was assessed with Wake Before Alarm Index-2 (WBAI-2) scores on the EVF and FUF. Means and standard deviations for the EVF and FUF scores are presented in Table 26.

The results for the ANOVA indicated a wake within 15 minutes before alarm marginally significant increasing time effect, Greenhouse-Geisser, $F(1, 7) = 3.316, p = .056$, at $\alpha = .05$, 1-tailed level, univariate partial $\eta^2 = .32$, power $(1 – \beta = .35)$. The effects size $\eta^2$ indicated the independent variable accounts for 32% of the variance in the dependent variable. The observed power of .35 indicated the likelihood of finding a significant effect when one exists in the population.

By inspecting WBAI-2-EVF mean-1 ($M_1 = 2.00$) and WBAI-2-FUF mean-2 ($M_2 = 2.75$), it is evident that there is a linear effect due to the WBAI-2 scores increasing over time (Table 26). The results of the WBAI-2 marginally significant increasing trend effects are displayed in Figure 13. ANOVA results of WBAI-2 suggest that as a group the participants did self-awaken at a pre-set time (without an alarm or help) within 15 minutes before the alarm. Therefore, the WBAI-2 scores trend results suggested participants woke within 15 minutes before the alarm, and this behavior increased significantly from the answers provided in the EVF to the FUF.

The WBAI-2-EVF time-1 score ($M_1 = 2.00, SD = 1.195$) is rounded off to 2 and applied to Level 4 (wake before the alarm 2 times per 7-day week), and WBAI-2-FUF time-2 ($M_2 = 2.75, SD = .886$) is rounded off to 3 and placed on Level 3 (wake before alarm 3 times per 7-day week) (Table 26). The sample’s WBAI-2 increased from Level 4 to Level 3 in their opinion of the ability to wake within 15 minutes before the alarm time with the use the DMRT. Therefore, the level-index is Level 3 (wake before alarm 3 times per 7-day week) (Tables 3, 29).
Figure 13: WBAI-2 Trend Effect Results
The RPM-ANOVA was conducted with the within-subjects factor being participants’ theories about the DMRT by rating the effects the DMRT had on one’s ability to achieve deep relaxation. The dependent variable is the Deep Relaxation Index (DRI) scores on the EVF and FUF. The results for the ANOVA indicated a nonsignificant rating on the deep relaxation time effect, Greenhouse-Geisser, $F(1, 7) = 1.750, p = .113$, at $\alpha = .05$, 1-tailed level, univariate partial $\eta^2 = .20$, power ($1 – beta = .21$). The effects size $\eta^2$ indicated the independent variable accounts for 20% of the variance in the dependent variable. The observed power of .21 indicated the likelihood of finding a significant effect when one exists in the population.

By inspecting DRI-EVF mean-1 ($M_1 = 3.38$) and DRI-FUF mean-2 ($M_2 = 3.88$), it is evident that there is a linear effect due to the DRI scores increasing over time (Table 26). The results of the DRI increasing trend effects are displayed in Figure 14. ANOVA trend effects results suggest that participants’ rating of the DMRT’s ability to achieve deep relaxation continued to increase from the first week’s opinions after the study to the fifth week in the FUF.

The DRI-EVF time-1 score ($M_1 = 3.38, SD = 1.061$) is rounded off to 3 and applied to Level 3 (*medium relaxation effect*), and DRI-2-FUF time-2 ($M_2 = 3.88, SD = .835$) is rounded off to 4 and placed on Level 2 (*large deep relaxation effect*) (Tables 3, 29). The sample’s DRI increased from Level 3 to Level 2 in their opinion about the DMRT’s initiation of a deep relaxation effect. Therefore, the DRI is Level 2 (*large deep relaxation effect*) (Tables 3, 29).

The RPM-ANOVA was conducted with the within-subjects factor being participants’ opinions on whether the DMRT helped in their daily activities of their lives. The dependent variable is the score on the DMRT Help Index (DHI) assessed on the EVF and the FUF. The results for the ANOVA indicated a nonsignificant DMRT daily life help time effect, Greenhouse-Geisser, $F(1, 7) = .636, p = .225$, at $\alpha = .05$, 1-tailed level, univariate partial
The Deep Meditative Relaxation Technique (DMRT)

Figure 14: DRI Trend Effect Results
The Deep Meditative Relaxation Technique (DMRT)

$\eta^2 = .08$, power $(1 – \beta = .10)$. The effects size $\eta^2$ indicated the independent variable accounts for 8% of the variance in the dependent variable. The observed power of .10 indicated the likelihood of finding a significant effect when one exists in the population.

By inspecting DHI-EVF mean-1 ($M_1 = 3.00$) and DHI-FUF mean-2 ($M_2 = 3.25$), it is evident that there is a linear effect due to the DHI scores increasing over time (Table 26). The increase in the DHI trend effect is displayed in Figure 15: DHI Trend Effect Results. ANOVA results suggest that sample’s opinions of whether the DMRT helped in their daily lives increased but produced nonsignificant results from the first evaluation to the second time evaluation in the FUF one month later.

The DHI-EVF time-1 score ($M_1 = 3.00, SD = .756$) is rounded off to 3 and applied to Level 3 (DMRT Help-Maybe Yes), DHI-2-FUF time-2 ($M_2 = 3.25, SD = .886$) is rounded off to 3 and placed on Level 3, also (Table 26). The sample’s DHI did not increase from Level 3 in their opinion about whether the DMRT helped in their daily lives. The DHI level-index is Level 3.

The RPM-ANOVA was conducted with the within-subjects factor consisting of the participants’ theories or feelings about the DMRT by rating the effects more practice with the DMRT will have on the ability to consistently wake within 10 minutes before the alarm sounds.

The dependent variable is the Practice Effect Index (PEI) scores assessed on the EVF and the FUF. The results for the ANOVA indicated a DMRT practice significant increasing time effect, Greenhouse-Geisser, $F(1, 7) = 5.505, p = .026$, at $\alpha = .05, 1$-tailed level, univariate partial $\eta^2 = .44$, power $(1 – \beta = .53)$. The effects size $\eta^2$ indicated the independent variable accounts for 44% of the variance in the dependent variable. The observed power of .53 indicated the likelihood of finding a significant effect when one exists in the population, and these results did not occur by chance.
Figure 15: DHI Trend Effect Results
By inspecting PEI-EVF mean-1 ($M_1 = 2.88$) and PEI-FUF mean-2 ($M_2 = 4.00$), it is evident that there is a significant linear effect due to the PEI scores increasing over time (Table 26). The significance increase in the PEI trend effect is displayed in Figure 16. ANOVA results of PEI suggest that participants believed and felt that more practice would increase the ability to wake within 10 minutes consistently before the alarm sounds.

The PEI-EVF time-1 score ($M_1 = 2.88$, $SD = 1.458$) is rounded off to 3 and applied to Level 3 (medium practice effect), and PEI-2-FUF time-2 ($M_2 = 4.00$, $SD = 1.069$) is rounded off to 4 and placed on Level 2 (large practice effect) (Table 26). The sample’s PEI increased from Level 3 to Level 2 in their opinion that the DMRT produced a large practice effect. Therefore, the PEI is Level 2 (DMRT has a large practice effect) for this study (Tables 3, 29).

The RPM-ANOVA was conducted with the within-subjects factor consisting of the participants rating the effects the DMRT has on initiating sleep. The dependent variable is the DMRT Sleep-Control Index (SCI) scores assessed on the EVF and the FUF. The results for the ANOVA indicated a DMRT sleep-control marginally significant increasing time effect, Greenhouse-Geisser, $F (1, 7) = 2.541, p = .078$, at $\alpha = .05$, 1-tailed level, univariate partial $\eta^2 = .27$, power (1 – beta = .28). The effects size $\eta^2$ indicated the independent variable accounts for 27% of the variance in the dependent variable. The observed power of .28 indicated the likelihood of finding a significant effect when one exists in the population.

By inspecting SCI-EVF means-1 ($M_1 = 3.13$) and SCI-FUF means-2 ($M_2 = 4.00$), it is evident that there is a marginally significant linear effect due to the SCI scores increasing over time (Table 26). The increase in the SCI trend effect is displayed in Figure 17. ANOVA marginally significant evidence of the SCI scores suggest participants increased their beliefs and feelings that the DMRT did affect sleep-control; especially, since it (1) initiates sleep faster;
The Deep Meditative Relaxation Technique (DMRT)

Figure 16: PEI Trend Effect Results
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Figure 17: SCI Trend Effect Results
(2) reduces waking after sleep-onset and/or eliminates waking after sleep-onset, often; (3) reduces the number of wakes in the sleep period; and (4) increases total sleep time when needed.

The SCI-EVF time-1 score ($M_1 = 3.13$, $SD = 1.458$) is rounded off to 3 and applied to Level 3 (medium sleep-control effect), and SCI-FUF time-2 ($M_2 = 4.00$, $SD = .926$) is rounded off to 4 and placed on Level 2 (large sleep-control effect) (Table 26). The sample’s SCI increased from Level 3 to Level 2. Therefore, the SCI is Level 2 (large sleep-control effect) for this study (Tables 3, 29).

From the findings indicated in the EVF and FUF, the sample ($N = 8$) increased their abilities, opinions, and beliefs about their sleep efficacy, self-regulation, and self-control. In other words, the DMRT therapy helped increase the participants’ self-efficacy.
CHAPTER FIVE

DISCUSSION

Summary of the Findings

This study investigated the effects of the Deep Meditative Relaxation Technique (DMRT) on nocturnal self-awakening sleep/wake quality among university students. DMRT is an innovative psycho-physiological sleep/wake intervention that operates on the theory that tasks practiced before sleep and sleep memory-consolidation processes initiate learning both in sleep and wakefulness the following day with learning increasing in 48 hours. The DMRT consists of Cue-Mentation and Sleep. The DMRT is used to initiate self-awakening at a pre-set time, to increase waking-alertness, and to decrease difficulty falling asleep. Students were the target population because of the “student-lifestyle,” a common set of behaviors that include staying up very late into the night while studying, watching television, playing video games, surfing the web, writing research papers, and etcetera.

This lifestyle oftentimes includes both sleep-onset difficulties and difficulties waking from sleep. Such sleep deprivation may lead to more serious sleep disorders like sleep-onset insomnia or delayed sleep phase syndrome. Recruitment included both genders, age 18 to 53 years, resulting in a sample of eight college students. Both normal sleepers and those with minor sleep difficulties qualified to participate based on a screening procedure. The study ran three weeks with a DMRT training day that followed pretest week, and follow-up evaluations one week and one month after the experimental phase. DMRT was assessed with (1) content analysis, (2) within-group repeated-measures ANOVA design, and (3) a time-series design. Results were assessed with parametric, nonparametric, univariate, and multivariate statistics at the alpha .05 one-tailed level.
The Deep Meditative Relaxation Technique (DMRT)

The DMRT Cue-Mentation cue-directives to “rest,” “relax,” and “sleep” memory-trace and behavior-response formations through sleep-dependent learning were demonstrated in the following sleep-onset/sleep quality linear trends effects with (a) repeated-measures ANOVA multivariate results (b) effect sizes and (c) univariate statistics. The sleep quality improvement demonstrated with the ANOVA and delta ($d$) results: (1) decreased difficulty falling asleep, ($F[1, 7] = 3.755, p = .047$, at .05, 1-tailed, multivariate partial ETA [$\eta^2$] = .35, power (.39), ($d = .69$); (2) decreased waking during the night after sleep-onset, ($F[1, 7] = 5.044, p = .030$, at $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .42$, power (.49), ($d = .79$); (3) decreased number of wakes, ($F[1, 7] = 2.849, p = .067$, $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .289$, power (.31), ($d = .60$); and (4) 19 minutes increased total sleep time, ($F[1, 7] = .680, p = .22$, $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .089$, power (.11), ($d = -.29$).

DMRT Cue-Mentation cue-directive to “wake 5-minutes before alarm” trend effect findings indicated successful improvement in self-awakening quality with the ANOVA and delta results: (1) Self-awakening ability (standardized score), ($F[1, 7] = 13.505, p = .008$, $\alpha = .05$, 2-tailed, multivariate partial $\eta^2 = .66$, power (.88), ($d = 1.3$); (2) increased wake before alarm index ($F[1, 7] = 18.939, p = .001$, $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .73$, power (.96), ($d = -1.54$); and (3) increased wake before alarm cue index, ($F[1, 7] = 13.444, p = .004$, $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .66$, power (.88), ($d = -1.3$).

The DMRT Cue-Mentation cue-directive to “wake 5- minutes before alarm” findings also indicated significant improvement in sleep-offset quality (wakefulness rated six hours after arising): (1) decreased difficulty waking before alarm, ($F[1, 7] = 17.234, p = .004$, $\alpha = .05$, 1-tailed, multivariate partial $\eta^2 = .711$, power (1 - beta = .943), ($d = 1.5$) and (2) decreased
The Deep Meditative Relaxation Technique (DMRT)

difficulty waking from sleep, \((F [1, 7] = 15.750, p = .002, \alpha = .05, 1\text{-tailed}, \text{multivariate partial } \eta^2 = .69, \text{power (.92), } (d = 1.4)).

The findings indicated that the DMRT change-effect-time (learning effect) for the sample for (1) the sleep quality variables (wake after sleep-onset, number of wakes, and total sleep time) were six hours and 57 minutes on Day-1 of receiving treatment, and (2) the change effect time for the sleep-onset quality variable (difficulty falling asleep) was 15 minutes after using the DMRT. Findings indicated the DMRT change-effect-time for sample on self-awakening variables (wake before alarm time, wake before the alarm cue) was 48 hours. Also, findings indicated that the DMRT change-effect-time for sample for sleep-offset quality (difficulty waking before alarm, difficulty waking from sleep) was 48 hours after receiving the treatment.

**Discussion of the Conclusions**

The DMRT sleep study is about various facets of sleep and awakening behavior among college students, and changes in these behaviors over time after learning a relaxation/self-cueing technique. In this study, the *Deep Meditative Relaxation Technique*, better known as the *DMRT*, a self-control psycho-physiological system, focuses on individuals’ (1) sleep-onset quality; (2) sleep quality; (3) sleep-offset quality; and (4) self-awakening quality. The DMRT consists of a combination of two psycho-physiological systems: Cue-Mentation and Sleep.

The Cue-Mentation system consists of four *cues* (directives): “rest,” “relax,” “sleep,” and “wake 5-minutes before the alarm.” The Cue-Mentation process consists of silently directing the cues to organs in a body-scan of the whole system, just before sleep. Previous literature has suggested that within the 90-Minute Sleep Cycles, the memory-traces of these cues and their initiated behavior-responses are transferred and learned in sleep (Hennevin et al., 2000; Karni et
The Deep Meditative Relaxation Technique (DMRT), al., 1994; Mednick et al., 2003; Mednick et al., 2002; Stickgold et al., 2000a; Stickgold et al., 2000b).

The DMRT Cue-Mentation process consists of three steps: *Step-1: Out-of-Bed Deep Abdominal Breathing*, *Step-2: Out-of-Bed Body Scan*, and *Step-3: In-Bed Body Scan*. In *Step-2: Out-of-Bed Body Scan*, students were directed to silently say to each body organ the four cues: *rest*, *relax*, *sleep*, and *wake 5-minutes before the alarm*; and in *Step-3: In-Bed Body Scan*, the student continued the repetition of these “cues” in sleep-onset, the stage of sleep that leads from the conscious to the subconscious to the unconscious mind (Sleep).

The key to the success of DMRT is the fact that the Cue-Mentation process is aided by the unconscious processes of Sleep when the “cues” are formulated into memory-traces that are stored in short-termed memory and long-termed memory. Hence, the cues to “rest,” “relax,” “sleep,” and “wake 5-minutes before alarm” along with the cue’s initiated behavior-responses were projected into Sleep and processed on all levels of the mind: conscious, subconscious, and unconscious. The idea is to focus on the individual, as a whole, who truly is the sum of its parts. Theoretically, within this Cue-Mentation process, the students literally told themselves what to do, just before sleep.

In debriefing, students said they actually felt specific organs relax as they silently spoke the cue “relax.” They also stated it took at least two nights before really beginning to rest and relax into the technique. In other words, they were no longer afraid or anxious, learning had taken place. Debriefing reports indicated that the first night centered on the memory of the order of the body-organs and applying their alarm times, especially if the expected wake up times varied. In Meeting#2, participants were directed to memorize the order of the body scan that started with the head in the out-of-bed step and began with the toes in the in-bed step.
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By beginning with the head in the out-of-bed body scan, the intended goal is to make sure participants, at least, put their minds into the DMRT before lying in the bed to go to sleep. Since falling asleep would be imminent, perhaps, before the entire body was scanned at least once before sleep, the DMRT begins out-of-bed first as a psychic built-in control system for experimental purposes. Similar to learning any new skill, the repetition or practice of the DMRT rendered the memory of the cues’ order and the order of the body-organs a mute issue because learning takes place in Sleep, too.

Based on the “sleep-dependent learning” theory, for study participants who practiced a motor skill or a peripheral skill just before sleep, learning took place the following day, and this learning is continued within 48 hours or with the second night’s sleep (Hennevin et al., 2000; Karni et al., 1994; Mednick et al., 2003; Mednick et al., 2002; Moorcroft et al., 1997; Stickgold et al., 2000a; Stickgold et al., 2000b). From the debriefing results alone, I conclude that in relationship to the cues to “rest” and “relax,” learning took place with the aid of Sleep within 48 hours with the use of the DMRT.

In a three-week seven-day interval, eight students participated in this experimental sleep study to test the effects of the DMRT on nocturnal self-awakening sleep/wake quality. The results consist of three prediction dependent variables: (1) Wake Before Alarm Index, (2) Difficulty Waking From Sleep Index, and (3) Difficulty Falling Asleep Index. Two study objective variables were assessed: (1) the Wake Before Alarm Cue Index that assessed the cue-consistency success rate and (2) the Self-Awakening Scale Index that standardizes a scale to be used in the examination of the Self-Awakening Phenomenon. Four support/sleep continuity variables were also used: (1) Difficulty Waking Before Alarm Index, (2) Waking After Sleep-Onset, (3) the Number of Wakes, and (4) Total Sleep Time.
Participants recorded the sleep and waking “times” of these scores for 21 nights of the experiment. ANOVA, Paired Sample T Tests, trend analyses, means difference analysis, and content analysis were used to examine the results. The research question is as follows: While decreasing the difficulty falling asleep in the process, is it possible for the Deep Meditative Relaxation Technique (DMRT) to initiate self-awakening at a pre-set time (without external means) and initiate waking-alertness; and what opinions are generated by its use? Also, there were three hypotheses (H): H1: the DMRT will increase the frequency of the ability to wake before alarm time; H2: the DMRT will decrease difficulty waking from sleep; and H3: the DMRT will decrease difficulty falling asleep.

Part-I and Part II Conclusions

The Difficulty Falling Asleep Index prediction dependent variable was assessed with the Elms Sleep-Onset Stress Scale-II (ESOS-II). The ESOS-II consists of four levels with three descriptors that identify (1) the approximate time of participants’ sleep-onset latency (estimated time it takes to fall asleep) and (2) the longest waking after sleep-onset latency (time awake after first going to sleep in the sleep period). Repeated-measures ANOVA results indicated a marginally significant decreasing difficulty falling asleep treatment effect, and a significant decreasing trend linear effect between week-1 to week-3 with an effect size partial $\eta^2$ (.35) and power (.39).

Noted above in the Results section, paired sample tests indicated that participants had nonsignificant Difficulty Falling Asleep Index results for both week-1 to week-2 and week-2 to week-3 of the experiment. Yet, the paired sample tests indicated there were a significant decreasing linear trend effect with a high moderate effect size delta (.69) that represented the improvement of participants’ sleep-onset quality between week-1 and week-3.
Because the students had little difficulty falling asleep, one would think the cue to “sleep” was not effective from the beginning of the use of the DMRT. One may argue that the students were going to sleep regardless of the intervention, especially (1) since it was their bed time; (2) five of the students possessed delayed sleep phase symptoms; and (3) three appeared normal but sleep deprived. However, results from the screening and week-1’s self-reports indicated they had difficulty waking from sleep and possessed poor self-awakening quality, too.

In fact, the difficulty falling asleep was one of the major problems that the Cue-Mentation process had to tackle. One must first obtain relaxing sleep in order for the unconscious processes to formulate the memory-traces of all the cues. In debriefing, students indicated they sensed a sleep difficulty issue. Yet, they did not know why because of the ease they experienced in falling asleep when some students (1) entered the bed after 12:00 AM each morning (delayed sleep phased); (2) entered the bed at 7:00 to 9:00 PM (advanced sleep phased); or (3) entered the bed between 10:00 PM to 12:00 AM (normal sleep phased) (Ferrara & Gennaro, 2001).

In debriefing, some participants indicated before using the DMRT, they had experienced intruding thoughts that interfered with going to sleep and extended their sleep-onset latency. These intruding thoughts consisted of, for example, thinking about school work, exams, projects, or phone calls from friends with a problem. These thoughts kept them awake when they wanted to sleep. Some of these students’ sleep diaries indicated taking more than 30 to 60 minutes to fall asleep. Because sleep-onset latency greater than 30 minutes approaches the severe categorical level, the findings indicated that these students’ sleep-onset quality was severely flawed.

For example, before using the DMRT, one student lay awake for more than one hour trying to fall asleep. In debriefing, the student explained that he did not look at TV or videos or was occupied with anything physical. He explained there were some nights he was too anxious to
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fall asleep because of scheduling worries the following day. Also, this particular student would awaken in the middle of the night; when he found it hard to return to sleep, he would stay up doing school work until he felt sleepy again in spite of the need to awaken early to meet schedule the following day.

The DMRT was designed to occupy the individual’s mind in sleep-onset to help control such intruding-thoughts that may keep one awake. Logically speaking, if one is busy with performing the Out-of-Bed and In-Bed DMRT steps as instructed, it is hard for outside thoughts to master one’s mind. Students who spoke of the intruding-thoughts problem explained how when some thoughts attempted to disturb the student, he or she continued the repetition of the “cues” while focusing on each body part that, in return, blocked-out other thoughts while performing the DMRT.

Remarkably, blocking out “intruding-thoughts” because one is actively performing the DMRT in the sleep-onset stage is one of the hidden effects of the DMRT that proved valuable to improving sleep-onset quality in this study. As a matter of fact, this hidden effect of the DMRT on the students’ sleep-onset behavior may account for the statistically significant decreasing linear effect results with the large moderate effect size delta (.69) and power (.54) in the paired sample tests for week-1 to week-3 or the repeated-measures polynomial contrasts partial $\eta^2$ (.35) and power (.39) for the Difficulty Falling Asleep Index scores.

I conclude from the difficulty falling asleep findings that the students’ practice with the DMRT revealed one of the hidden built-in psychic controllers developed in the design of the technique: to remove intruding-thoughts that increase sleep-onset latency. Furthermore, I conclude from the findings of this study that both the ANOVA and paired sample test results indicated an increase in sleep-onset quality, thereby, confirming Hypothesis 3: The DMRT will
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decrease the difficulty falling asleep. Also, the level-index result is Level 1.2 (*not difficult, normal stress [fell asleep within 1 to 15 minutes]*) for this sample.

As indicated above, the DMRT first two cues instructed participants to first rest and relax. The recognition of the effects of these cues was demonstrated first by playing an active role in initiating sleep. Each time the students repeated these cues, they (1) became more relaxed; (2) entered a trance-like state, perhaps, on a subconscious level; and (3) lost consciousness when entering sleep. With or without the DMRT, in order to go to sleep one must first rest and relax. Therefore, the sleep continuity variables must be assessed to determine the full effects of the DMRT on sleep quality, too.

Assessment of the difficulty falling asleep in the Elms Sleep-Onset Stress Scale-II (ESOS-II) also included assessing waking after sleep-onset too. In order to understand why the difficulty falling asleep index scores produced significant decreasing linear effects in the overall results, one may need to examine Wake After Sleep Onset scores closely. Participants are asked to note the “time spent awake” within the sleep period. Some students in this study spent anywhere between two minutes to two hours awake in a sleep period.

ANOVA study results indicated that the sample spent 20 minutes trying to return to sleep after waking up in the sleep period in week-1. The Wake After Sleep-Onset scale consists of four levels of time intervals. Normal waking after sleep times range from one to 15 minutes. Sample’s week-1 results were placed on Level-2 since waking time was between 16 to 30 minutes.

After receiving the DMRT in week-2, the sample Waking After Sleep-Onset scores indicated a significant decreasing treatment linear effect with a high moderate effect size delta (.70) and in week-2 and an overall high moderate effect size delta (.79) in week-1 to week-3 with a partial multivariate $\eta^2$ (.42) with power (.49) that indicated the importance of this decreasing
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effect. Hence, participants who had earlier experienced longer waking time in the sleep period (1) began to fall asleep quicker by only staying awake no more than five minutes in waking after sleep-onset or (2) began to completely eliminate waking within the sleep period by week-3 with the use of the DMRT.

Looking at the Wake After Sleep-Onset scores, it is understandable why overall Difficulty Falling Asleep Index scores were statistically significant from week-1 to week-3; that is, participants had no problem first falling asleep in sleep-onset. However, their ability to fall asleep after waking within the sleep period was flawed in week-1. By using the DMRT, it decreased difficulty Waking After Sleep-Onset scores that, in return, helped to decrease the Difficulty Falling Asleep Index in its overall effects from week-1 to week-3, too.

Waking After Sleep-Onset scores indicated that the DMRT was highly effective in decreasing this problem in the first week of receiving the DMRT. These findings were demonstrated by the participants sleeping all night without waking for five and six nights of week-3. These results indicated that difficulty falling asleep was no longer a problem. Also, the decrease of time spent awake in a sleep period caused the participants’ Total Sleep Time scores to increase.

The significant decreases in the Waking After Sleep-Onset scores were not the only factor affected by the DMRT. The sample’s Number of Wakes also decreased. Some students were waking in the sleep period two and three times per night. The sleep diary was designed to capture the number of times the participants awakened in a sleep period, as well as the amount of time spent awake in a sleep period.

There were three sets of “sleep and wake times” spaces provided in the sleep diary to note these waking and returning to sleep behaviors. Participants were instructed to complete the
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“sleep/wake times” when first leaving the bed the next morning. Yet, if students did awake in the
sleep period and found it hard to return to sleep, they were instructed to complete these responses
while awake at that waking time. By designing the sleep diary in respect to a “set of sleep/wake
times” when waking after sleep-onset, it demonstrated a sense of an internal-psychic-system
control in the design of the sleep diary so participants would be more accurate in reporting the
“time-of-the-behavior.”

The Number of Wake scores indicated marginally significant decreasing linear effects in
the ANOVA results with $\eta^2$ (.29) and power (.31), and the overall results from paired sample
tests for week-1 to week-3 indicated a moderate effect size delta (.60) that indicated the
importance of the effect. By decreasing the Number of Wakes in the sleep period and decreasing
waking after sleep-onset time, participants increased their total amount of time spent sleeping.

Total Sleep Time scores did not indicate significant statistical results in any of the
individual weeks with or without the DMRT. However, study results indicated that there was a
total sleep time increasing linear effect in the overall trend with a small delta effect size (-.289).
The sample increased the total sleep time by 12 minutes in week-2 and by seven minutes in
week-3 for a total of 19 minutes in the overall increased sleep between week-1 to week-3.

According to the literature review, Karni et al. (1994) found that four to six hours of sleep
is not enough, and the lack of sleep has severe effects on cognitive performance. Sleep less than
seven hours has caused behavior problems in adolescence (Liu & Zhou, 1989). If one fails to go
into REM sleep in the fourth quarter of an eight hour sleep period, memory fails to consolidate
(Stickgold et al., 2000b).

Students’ increase in Total Sleep Time scores did move the sample from a Total Sleep
Time level-index results that indicated Level-2 (mildly normal total sleep time) to a Level-1
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(normal total sleep time). Hence this sample increased in Total Sleep Time scores moved from Level-2 (6 hours and 54 minutes) to Level-1 (7 hours and 13 minutes). According to previous research findings, this was a very important increase in total sleep time in relation to improvement to cognitive performance for individuals, in general, and for students, in particular, academically (Karni et al., 1994; Liu & Zhou, 1989; Stickgold et al., 2000b).

In spite of the Total Sleep Time scores’ ANOVA or paired sample nonsignificant statistical results, this increase in total sleep time level-indexes from Level-2 to Level-1 is very important in noting the effects of the DMRT improvement in sleep quality. The sample began to sleep longer once the participants began (1) reducing the difficulty falling asleep; (2) decreasing the number of wakes; and (3) decreasing waking after sleep-onset time. By extending Total Sleep Time scores with the reduction of difficulties encountered in sleep-onset and practically eliminating waking after sleep-onset in the sleep period, participants experienced all the stages of sleep for an increased production of uninterrupted sleep cycles.

Participants decreased their waking after sleep-onset time from 20 minutes in week-1 to eight minutes in week-2 to five minutes in week-3 for a total reduction of 15 minutes in the study. In other words, participants begun to experience longer Stage-3 and Stage-4 delta sleep: the stages where learning takes place (Akerstedt et al., 2002; Dement & Kleitman, 1957). These longer uninterrupted sleep time periods are paramount to the theory behind the DMRT. In order for the Cue-Mentation process to be fulfilled, one must also sleep so these cues are transferred into sleep. During sleep, the memory-traces of these cues and their behavior-responses are formulated into short- and long-termed memories for instant recall in sleep and/or wakefulness.

Remarkably, the DMRT Cue-Mentation process tends to follow an orderly behavior response directed by the order the cues were introduced in the body scan. As indicated above, the
cues to “rest” and “relax” were the first ones that indicated learning had taken place when the participants stated they rested and relaxed into the technique by night two, or within 48 hours (including sleep) of practicing the cues. Also, the sample’s decreases in (1) Difficulty Falling Asleep Index, (2) Waking After Sleep-Onset scores, and (3) Number of Wakes scores allowed participants to increase their Total Sleep Time scores by week-2. Because of this decrease in the sleep-onset difficulties and increased sleeping time, these results indicated the cue to “sleep” was realized next.

Study findings indicated that before the DMRT increased the ability to self-awaken, it had to aid the removal of the sleep difficulties that may have existed. Reiterating the fact, one must first rest and relax in order to go to sleep. According to Horne (1988), a “sleep debt” is when individuals sleep less than an average per week of “core sleep-need time: 4.5 to 6 hours.” If one possessed a sleep-debt, the DMRT works to decrease this sleep-debt before it attempts to continue to fulfill the task to “wake.” In other words, the DMRT “puts you to sleep” before it “wakes you up” in the order that the “cues” dictate.

I conclude from the study findings that indicated (1) a decreased difficulty falling asleep, (2) a decreased waking after sleep-onset, (3) a decreased number of wakes, and (4) an increased total sleep time caused an increase in sleep-onset quality and sleep quality, thereby, confirming Hypothesis 3: The DMRT will decrease the difficulty falling asleep index. Furthermore, I conclude that all of the sleep-onset quality and sleep quality dependent variables occupy the Level-1 category on their individual level-indexes.

The Difficulty Waking Before Alarm Index was developed to identify if there were self-awakening problems. Only 8.2% in one student population (Crabb, 2003) and 10.3% in another student population (Matsuura et al., 2002b) self-awakened; therefore, the other 89% to
91% used the alarm or some other external means to wake up at a pre-set time. The Difficulty Waking Before Alarm Index’s measurements illustrated the difficulty of this behavior. An individual possesses difficulty waking before the alarm if he or she failed to wake before the alarm time; that is, (1) if the alarm wakes one up; (2) one sleeps through the alarm time (one to 120 minutes); or (3) if one returns to sleep after the alarm time (1 to 120 minutes) within the sleep period.

This study results indicated that week-1 to week-3 Difficulty Waking Before Alarm Index scores were highly significant in the ANOVA results with a multivariate partial $\eta^2 (0.85)$ and power (0.99). In addition, week-2 to week-3 and the overall results from week-1 to week-3 were highly significant in decreasing this behavior with very large effect size deltas (1.10) and (1.46), respectively. The level-index results indicated that the participants began the study in week-1 on a Level-3 that represented moderate difficulty self-awakening. However, the sample’s week-3 results increased the sample’s level-index to a Level-1 (low difficulty self-awakening).

The students in this study were truly Non-Self-Awakeners. The Difficulty Waking Before Alarm Index was designed to capture both “waking at the alarm” and “waking after the alarm” by adding the frequency of both together; that is, the score could range as high as 14 (wake at alarm and/or slept after alarm for 7 days) with the lower scores representing the least difficulty of this behavior. Not one student in this sample received a score less than five on the Difficulty Waking Before Alarm Index scale and some scores ranged as high as 13 on the scale in week-1.

However, with the use of the DMRT, the sample Difficulty Waking Before Alarm Index scores for week-3 ranged from a zero to seven with 75% of the scores ranging from zero to four. I concluded from these findings that the DMRT was instrumental in changing the participants of this study from alarm-dependent individuals to students who now possessed the ability to
The Deep Meditative Relaxation Technique (DMRT) frequently and consistently self-awaken before the alarm (without external means).

The Self-Awakening Scale (negative 120 minutes to plus 120 minutes) was developed to measure this Self-Awakening Phenomenon, the ability to self-awake at a pre-set time without external means, with scores ranging from values for (1) Waking Before Alarm Time (negative 1 to negative 120 minutes); (2) Waking at the Expected Wakeup time (alarm = zero); and (3) Waking After Alarm Time (one to 120 minutes). The Self-Awakening Scale Index (SASI) uses the same elements as the Self-Awakening Scale, but its raw score time-intervals are labeled according to five levels, with Level-1 representing waking before the alarm within a negative one to a negative 15 minutes while Level-5 represents waking at the alarm (= zero) or after the alarm time (1 to 120 minutes).

The Difficulty Waking Before Alarm Index scores indicated that participants had severe problems waking before the alarm, or simply, were alarm-dependent individuals. The SASI scores confirmed those results. SASI scores’ mean score of week-1 results indicated the sample awakened 18.5 minutes after the alarm time. Once participants begin using the DMRT in week-2, participants’ self-awakening ability increased with a moderate effect size delta (.54); that is, the sample began waking six minutes before the alarm time, immediately, in week-2.

The repeated-measures ANOVA results indicated a significant increasing treatment effect with the SASI, with a partial $\eta^2$ (.66) and power (.65). The overall SASI scores increasing trend linear effect was also statistically significant with a larger effect size delta (1.30) and power (.95) in week-1 to week-3. SASI scores level-indexes indicated that the sample increased from a Level-5 that represented waking after the alarm time to a Level-1 that represented waking within one to 15 minutes before the alarm time.

In brief, the SASI scores measured improvement from waking after the alarm time (18.5
minutes in week-1) to waking before the alarm time (-6 minutes in week-2). By waking six minutes before alarm time in week 2, SASI findings indicated that the sample not only self-awakened before the alarm time, the sample woke within the Wake Before Alarm Cue Index interval (negative 1 to negative 10 minutes) that represents the word-for-word cue to “wake 5-minutes before alarm” in the first week after using the DMRT. Furthermore, I posit that the total sleep time increase of 18 minutes on Day-2 in week-2 is a major contributing factor to the decrease of SASI scores from waking after the alarm (18.5 min) in week-1 to waking before the alarm time (-6 min) in week-2.

The DMRT Cue-Mentation process that includes the cues to “rest,” “relax,” and “sleep” to facilitate memory-traces formations and sleep-learning was demonstrated in the following trends with their effect size delta (d) statistic: (1) decreasing difficulty falling asleep (d = .69), (2) decreasing waking after sleep-onset (d = .79), (3) decreasing number of wakes (d = .60), (4) decreasing difficulty waking before the alarm time (d = 1.5), and (5) increasing total sleep time 19 minutes (d = -.29).

Most individuals are not accustomed to telling themselves when to wake up. Very active individuals, like students for instant, are more than likely alarm-dependent; that is, they depend on the “alarm” clock or some other technology to awaken when the need arrives (Crabb, 2003; Moorcroft et al., 1997). All of the students in this study were “alarm-dependent.” As a means of control, participants were instructed (1) to set their alarms at their usual time of awakening or when they wanted to meet schedule after nighttime sleep and (2) to enter this Expected Wakeup Time in the sleep diary question number two on the sleep diary.

Wake Before Alarm Index repeated-measures ANOVA results indicated a highly significant increasing treatment effect with a multivariate partial η2 (.81) and power (.94). Wake
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Before Alarm Index week-1 to week-2 paired sample results indicated a marginally significant increase in waking before the alarm time. The delta (-.52) results indicated a moderate value that represents an important effective increase. The Wake Before Alarm Index week-2 to week-3 results produced highly significant treatment effects with a very large effect size delta (-.92) and power (.76). Also, the overall trends from week-1 to week-3 linear effects were highly significant with an excessively large effect size delta (-1.54) and power (.99) in the paired sample tests and the ANOVA linear trend effect with a partial $\eta^2$ (.73) and power (.96).

Both SASI scores and the Wake Before Alarm Index scores indicated that the sample immediately began to wake before the alarm time in week-2 after the DMRT was added to their sleep/wake behavior. According the Wake Before Alarm Index level-index results, the students’ scores increased from Level-5 (trivial consistent self-awakening) to Level-1 (extremely high consistent self-awakening) that represented waking before the alarm five days out of the seven-day-week. In other words, participants began the study as Non-Self-Awakeners but completed the study as Self-Awakeners with a “high consistency success” rate represented by a Wake Before Alarm Index on Level-1 in the DMRT study.

I conclude that the findings indicated that the participants were (1) alarm-dependent before the study; (2) DMRT helped increase the frequency of the ability to wake before the alarm time; and (3) the participants became “skilled Self-Awakeners.” I conclude that the DMRT cue to “wake 5-minutes before the alarm” is the sleep-dependent learned memory-trace that helped “cause” this increased self-awakening ability. Also, I conclude that the Wake Before Alarm Index’s findings indicated that the DMRT was effective in the first week of its use. Furthermore, I conclude that the findings of this study confirmed Hypothesis-1: The DMRT will increase the frequency of the ability to wake before the alarm time; thereby, the level-index effect size is
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Level-1 (extremely high consistent self-awakening [5 times per 7-day-week]).

The Self-Awakening Scale Index scores (raw-times) and the Wake Before Alarm Index scores (consistency success results) represented the full range of the success of the cue to “wake 5-minutes before the alarm.” Psychically, the development of the theory behind the cue to “wake 5-minutes before the alarm” rests in the idea for individuals to obtain as much sleep in the sleep period at the length the individuals choose to be asleep, but also, to wake before the alarm pre-set at bedtime. However, the Wake Before Alarm Cue Index, specifically, focused on the letter-of-the-law of the cue to “wake 5-minutes before alarm” with the cue-consistency success behavior.

The Wake Before Alarm Cue Index consists of the interval that ranges from a negative one to a negative 10 minutes (center = -5 min). The repeated-measures ANOVA results indicated a wake before the alarm cue time significantly increasing treatment effects with a multivariate partial $\eta^2$ (.73) and power (.79). Paired sample test indicated the Wake Before Alarm Cue Index week-2 to week-3 results indicated a significant treatment effect with a high moderate effect size delta (-.77). The overall week-1 to week-3 trend effect indicated a highly significant increase with a very large effect delta (-1.30) and power (.95) in the paired sample tests and a partial $\eta^2$ (.66) and power (.88) in the ANOVA polynomial contrast results.

These results indicated that once participants began to self-awaken, they increased the ability to wake before the alarm and began to wake within the 10-minute interval that represented the cue “wake 5-minutes before the alarm” too. In other words, the cue representing to “wake” had been fully realized in week-3, too, as indicated by the Wake Before Alarm Cue Index level-index. The level-index results indicated that the sample increased from a Level-6 (non-cue-consistent self-awakening [0]) to Level-4 (small cue-consistent self-awakening [2]).

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Cue Index scales all represent the measurement of self-awakening quality. As the findings indicated, all of these variables are interrelated, yet distinct in measurement of self-awakening quality unobservable construct with different scales that confirmed the same answer: Participants responded to the word-for-word directive of the cue “wake 5-minutes before the alarm.”

The findings in this study also provided evidence of construct validity that applies to the individual variables, as well as to the unobservable self-awakening quality construct. Moreover, the extremely high delta and partial ETA effect sizes of each of the self-awakening measures indicated that the findings were valid and reliable in assessing self-awakening quality, thereby, confirming construct validity for the self-awakening quality latent variable.

Another effect of the DMRT intervention on the sleep/wake behavior of the participants included the decreasing trend of the difficulty waking from sleep. The Elms Sleep/Alertness Scale-II (ESAS-II) measured the Difficulty Waking From Sleep Index. This instrument consists of seven descriptors that indicated what difficulty participants experienced waking from sleep for the first six hours after the last awakening. Difficulty Waking From Sleep Index week-1 to week-2 results indicated a highly significant decreasing treatment effect with a very large effect size delta (.98) that represented the importance of this effect.

Overall week-1 to week-3 results indicated a highly significant linear trend decrease with an extremely large effect size delta (1.40) and power (.97) that represented the importance of this decreasing effect with the Difficulty Waking From Sleep Index scores. The Difficulty Waking From Sleep Index level-index results indicated that the sample increased from a Level-2.4 (desired to take a nap in the fifth to sixth hour after the last awakening) to a Level-1.3 (felt alert, energetic, motivated, and focused within one hour after the last awakening from nighttime sleep that last six hours).
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I conclude that these results confirmed Hypothesis-2: The DMRT will decrease the difficulty waking from sleep; furthermore, the index-level results indicated a Level-1.3 that represents waking-alertness beginning within one hour after waking from nighttime sleep that last at least six hours after the last awakening. Also, I conclude that the DMRT significantly decreasing difficulty waking from sleep treatment effects caused the improvement in week-2 and week-3 waking-life (sleep-offset) quality.

Summarizing the conclusion of the results, the DMRT helped the participants increase sleep-onset/sleep quality by (1) decreasing difficulty falling asleep \( (d = .69) \), (2) decreasing number of wakes \( (d = .60) \), (3) decreasing waking after sleep-onset \( (d = .79) \), and (4) increasing total sleep time 19 minutes \( (d = -29) \). The DMRT helped participants increase self-awakening quality by (1) increasing the ability to self-awaken without external means \( (d = 1.30) \), (2) increasing the frequency of the ability to wake before the alarm time \( (d = -1.54) \), and (3) increasing waking before the alarm cue time \( (d = -1.3) \). Also, the participants benefited because the DMRT increased sleep-offset quality by (1) decreasing the difficulty waking before the alarm \( (d = 1.5) \) and (2) decreasing the difficulty waking from sleep \( (d = 1.40) \).

The participants also reported they had benefited from this study by indicating that they will continue to use the DMRT after the study was completed in the evaluation and follow-up results. In follow-up evaluations, participants also indicated that they were waking within 15 minutes of the alarm with the Wake Before Alarm Index-2 results. In other words, (1) the participants’ learning had increased; (2) the DMRT was still producing successful results; and (3) Self-Awakening continued to manifest as a skill.

In conclusion, by decreasing the stress of going to sleep and improving sleep-onset quality, Hypothesis-3 was confirmed: The DMRT will decrease the difficulty of falling asleep.
By increasing self-awakening quality, Hypothesis-1 was confirmed: The DMRT will increase the frequency of the ability to wake before the alarm. And, by decreasing the stress of sleep-offset, Hypothesis-2 was confirmed: The DMRT will decrease the difficulty waking from sleep.

**Discussion of the Results**

In the conclusion of the results, the DMRT *cues* “rest,” “relax,” “sleep,” and “wake 5-minutes before the alarm” are well represented in the ANOVA, Paired Sample T Tests, and weekly means findings. The significant difference in week-1 to week-3 results indicated that participants did “rest” into the technique that “relaxed” the participants to the point that they began to “sleep” longer without waking within the sleep period or quickly returned to sleep with the use of the DMRT.

Total sleep time (TST) increased by 19 minutes from week-1 to week-3 for this sample. The increased TST allowed an increase in delta sleep experienced in Stage 3 and Stage 4 of the 90-Minutes Sleep Cycles. This was instrumental because it is in these stages of sleep when the mind and body are restored, rejuvenated, and refreshed for the following day. In essence, Stage-3 and Stage-4 are also the major times when learning takes place and memory-traces are created and filed away into the short and long-term memory banks of the psyche (Dement & Kleitman, 1957).

The literature indicated that most individuals sleep six to nine hours per night (Ferrara & Gennaro, 2001; Horne, 1988; Murphy et al., 2000; Pilcher et al., 1997). As the literature review indicated, the “core-sleep-need” is 4.5 to 6 hours of sleep per night (Horne, 1988). The literature review also indicated that one needs more than six hours of sleep per night to avoid memory deficits (Karni et al., 1994). Although the literature indicated that learning takes place in slow-wave-sleep (SWS) and rapid-eye-movement (REM) sleep, Sleep Stage-3 and Stage-4 consist of
delta sleep where learning takes place when memory-traces are formulated and stored for future reference (Dement & Kleitman, 1957). Hence, the goal of the DMRT included resting and relaxing the participants to decrease difficulty falling asleep stress that, in return, resulted in an effect that increased sleeping time in Sleep Stage 3 and Stage 4 for the formation process of the memory-traces that directed one to “rest,” “relax,” “sleep,” and “wake 5-minutes before alarm.”

Therefore, the keys to the successful findings indicated by this study resulted from the DMRT effects on sleep-onset that (1) began the Cue-Mentation process consciously; (2) began the implantation of the cues into sleep for memory-trace formation, in perhaps a trance-like state, subconsciously; and (3) initiated the unconscious processes of Sleep itself. All three states of consciousness were involved in the procedures that the DMRT employs. It was the three states of the mind that enacted the will of the “Self” to take control of the situations concerning sleep difficulty. Miraculously, the DMRT employs a procedure of self-awakening as a remedy to aid in sleep/wake difficulties.

The DMRT was very effective in improving the self-awakening sleep/wake quality in this study. There were eight participants in the sample; five showed symptoms of delayed sleep phases; three appeared to be normal sleepers. They all depended on the alarm clock to wake up daily, and 75% of the sample slept through the alarm or after the alarm five to six times per week. Although self-awakening is not considered normal for college students, the DMRT impact on the sleep/wake behavior was instrumental because once the participants began using the DMRT the students began to combat their biggest problem: waking from sleep in sleep-offset.

Naturally, if one goes to bed between 12:00 AM and 6:00 AM and expects to rise the following morning by 7:00 to 9:00 AM to be in class or attend some social event, that person will experience problems waking (1) before the alarm; (2) at the alarm; or (3) after the alarm.
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These waking problems will naturally carry over into the waking life, at least for the first six hours after the last awakening as the findings indicated. The literature dictates that in the seventh to eighth hour after the last awakening, one will naturally feel sleepy and want to take a nap because of the circadian rhythms (Mednick & Ehrman, 2006; Mednick et al., 2003).

In spite of the students who claimed they had no problems falling asleep in debriefing, however, the results of the study indicated there was a marginally significant decreasing difficulty of falling asleep treatment effect in the sample between week-1 and week-3 results. The truth of the matter is that these participants were exhausted and rapidly fell asleep when their heads hit the pillow, perhaps, because they were delayed sleep phased or sleep deprived or both. Yet, the Difficulty Falling Asleep Index’s level-index results indicated that participants moved from number three to number two on Level-1 (normal sleep quality) with the use of the DMRT, and the Paired Sample results indicated a difficulty falling asleep highly significant decreasing trend effect with a high moderate effect size delta (.69).

In debriefing, participants noted their main complaints: (1) difficulty waking from sleep, (2) feeling sluggish and tired throughout the day, and (3) forced to take naps to relieve this discomfort. In other words, participants had no complaints of difficulty falling asleep, but the sleep they received did not make them feel rested, relaxed, or awake. Thereby, the DMRT cues to “rest,” “relax,” “sleep,” and “wake 5-minutes before the alarm” were instrumental in initiating the participants’ abilities to develop Self-control to determine their own fate to remedy their major complaint: difficulty waking from sleep.

From the findings of this study, I conclude that the DMRT Cue-Mentation system was very effective in developing “Self-control” that initiated Sleep-control for the participants in this study. I conclude that the DMRT sleep-dependent learning feature was very instrumental in
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participants learning through sleep how to (1) physically wake before the alarm and (2) subconsciously wake from sleep for at least the first six hours after the last awakening. Furthermore, I conclude from these findings that the *Sleep-Learning Memory-Trace Cue Consolidation Theory* (SMTCT) was confirmed (Hennevin et al., 2000; Karni et al., 1994; Mednick et al., 2002, 2003; NIH, 2002; Stickgold et al., 2000a, 2000b, 2003).

I conclude from the findings of this study, that the DMRT initiated sleep-onset before sleep and within the sleep period that reduced or eliminated waking after sleep-onset that helped increased total sleep time for six to seven hours of uninterrupted sleep per night. I conclude that it was the addition of the increased rest, relaxation, and sleep that allowed the implantation of the memory-trace of the *cue* to “wake 5-minutes before the alarm” that contributed (1) to waking before the alarm physically and (2) to the participants’ distinct waking-alertness for at least six hours in sleep-offset or in their waking life.

In addition, I conclude that the participants’ increased ability to awaken before the alarm and increased frequency of waking within 10 minutes of the alarm contributed to the validations that the Self-Awakening Phenomenon does exist; and in the DMRT study, it was demonstrated, remarkably, by (1) increasing participants ability to wake five days out of a seven day week and (2) increasing waking within 10 minutes of the alarm for at least two days out of the week.

Specifically, insomniacs may suffer from sleep-onset insomnia, waking after sleep-onset insomnia, early morning waking insomnia, hypersomnia, and etcetera. The findings of this study indicated that those suffering from insomnia would benefit from the use of the DMRT because of the DMRT’s psycho-physiological systems that help develop *Self-control* that results in the ability to (1) initiate sleep-onset at the beginning of sleep; (2) initiate sleep-onset within the sleep period that reduces waking after sleep-onset or eliminates waking within the sleep period totally;
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(3) initiate longer sleep periods that include more Stage 3 and Stage 4 sleep for mind/body rejuvenation and memory-trace formation of the cues (i.e., to rest, relax, and sleep) planted into short- and long-term memory; and (4) initiate waking in sleep-offset. Method wise, with the DMRT, the cue to “wake” may be dropped for insomniacs (sleep-onset difficulties) that need to sleep, yet, included for hypersomniacs (excessive sleeping) that need to sleep but awake during the daylight hours.

Delayed Sleep Phase Insomnia (DSPI) includes symptoms of the difficulty of falling asleep before 12:00 to 6:00 AM, nightly. It also includes symptoms of difficulty waking from sleep, daily. In some cases, this inability to fall asleep before 12:00 AM may be due to medical problems that include the deficiency of the hormonal production of melatonin (Dagan et al., 1998; Kayumov et al., 2001; Okawa et al., 2002).

Yet, DSPI is often implemented, unknowingly, by the student himself or herself. DSPI problems may begin with the habitual late night activities of the student-lifestyle that includes late night studying, playing video games, watching TV, surfing the WEB, completing research projects, and etcetera. Hence, when the student finally enter the bed to sleep, there is little problem going to sleep, perhaps, because of exhaustion.

Naturally, if one delays falling asleep (e.g., 1:00 to 3:00 in the morning), he or she will have problems waking the following morning if there is an early morning class or some social engagement that one must attend. Yet, it is not until this special engagement arises that the student realizes that he or she suffers difficulty waking at the alarm by feeling sleepy throughout his or her presence at that special activity that arose out of routine. Hence, the student may suffer difficulty waking from sleep described by the sleep disorder called the Delayed Sleep Phase Syndrome (Brown et al., 2001; DSM, 2000; Lack, 1986).
Yet, for example, it is not until the student is placed in another setting besides school, more like a work setting, that he or she realizes that there is also a concomitant difficulty falling asleep that may develop because of the voluntary implantation with the habitual late night “student-lifestyle” activities. One such case exists in the study who I named the co-op student.

In debriefing, the co-op student stated she joined the study because she wanted to wake up and had no problems falling asleep; yet, she felt sluggish during the day and, occasionally, took naps because of tiredness. This particular student, also, never went to bed before 3:00 to 4:00 AM; that is, her sleep behavior automatically placed her in the delayed sleep phased category. The co-op student study results indicated that she did not wake before the alarm one time in the second week of the study with the use of the DMRT. She was able to wake at least once in the week of pretesting. However, her total sleep time increased one hour and 13 minutes in week-2. Hence, the co-op student perfected waking at the alarm and not after the alarm in week-2 with the DMRT.

The co-op student’s findings indicated that the DMRT first rested, relaxed, and then put the delayed sleep phase individual to sleep. Only after the individual had received the necessary rested sleep needed, did the DMRT begin to awaken this student in week-3. This individual was able to increase waking before the alarm, as well as waking before the alarm cue in week-3.

The co-op student was not satisfied with the increased total sleep time received because she wanted to “wake up” more. In other words, sleep quality was more important than sleep quantity, thereby, providing credence and validating the Sleep-Quality More Important Theory proposed in the study. In fact, this student admitted she had fallen asleep before completing the DMRT as instructed on some nights, thereby, not completing the full process every night.
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because she was too sleepy and fell asleep within three to five minutes almost every night, as her records indicated for week-2.

However, the co-op student was dissatisfied with her own personal performance in the study in spite of her (1) increased total sleep time that exceeded an hour; (2) increased ability to wake from sleep physically at least two times that included waking within five minutes before the alarm as the cue instructed in week-3; (3) decreased difficulty waking before the alarm time; and (4) decreased difficulty waking from sleep that indicated an effect size on Level 1.1 (*Felt alert, energetic, motivated, and/or focused after the last awakening from nighttime sleep from first opening eyes that last 6 hours*).

After reviewing the participant’s results with her in debriefing, and noting her disappointment in her personal performance, she commented, “I want to wake up more.” In an instantaneous response, I stated, “How do you know that the DMRT did not wake you up subconsciously?” I asked the student did she feel alert, energetic, and motivated for the first six hours after the last sleep period in her waking-life. The student nodded, with a surprisingly look on her face.

Perhaps, the student had perceived the idea that the study consisted of some “magical pill” that would automatically “put her to sleep” and “wake her up” without putting the necessary work in to achieve these goals. Yet, it was not until this student began her co-op assignment in another state when she realized that she possessed severe Delayed Sleep Phased Insomnia (DSPI) (difficulty falling asleep/difficulty waking from sleep) (Brown et al., 2001; DSM, 2000; Lack, 1986). In debriefing, the student talked about her co-op position that would follow the fall quarter.
Looking at the co-op student’s pretest scores, she had little difficulty falling asleep at three to four o’clock in the morning. Inquiring if she believed she would have problems falling asleep in a different setting (i.e., a work setting) that required 8:00 or 9:00 AM attendance on a daily basis, she stated, “I will just go to bed around 10:00 or 11:00 PM.” After pointing out literature findings that indicated that if there are delayed sleep phase symptoms that indicate it is hard to wake from sleep, more than likely, difficulty falling asleep problems exist too (Brown et al., 2001; DSM, 2000; Lack, 1986); the individual left debriefing feeling confident that she would be able to fall asleep with no problems in a work setting. The co-op student had, also, indicated on the first evaluation form that she doubted if she would continue to use the DMRT.

However, once the co-op student did leave UC to begin her co-op assignment, she realized that falling to sleep was not as easy as she had fathomed. Anxiously excited at her discovery of this difficulty of falling asleep outside of her usual sleeping routine (3:00 to 4:00 AM), the student began to use the DMRT to go to sleep before 12:00 AM in order to wake up before 7:00 AM to meet the co-op engagement, she reported.

In other words, in spite of her probable decision to stop using the DMRT in the first evaluation form sent one week after the experimental phase of the study, DMRT was the tool she possessed to help in her DSPI symptoms once she realized difficulty falling asleep was definitely a problem for her in a work setting. These results indicated that the DMRT is both a cost effective and time effective “tool” that the participants now possess to use at will.

The co-op student did not hesitate to send an email to proclaim her deepest thanks for possessing the tool called the DMRT. The DMRT removed her difficulty of falling asleep and her difficulty waking from sleep when adjustments to both behaviors were needed the most, that is, in a work setting. The co-op student agreed that her ability to fall asleep quickly while in
school was probably due to her exhaustion of only going to bed when the body refused to stay awake any longer. Similar, perhaps, to the other four participants that possessed delayed sleep phase symptoms, the co-op student was unaware that a problem existed until forced to go out of routine or her comfort zone that called for waking earlier in a changing setting that required adjustments to meet set obligations, like work.

The co-op student’s findings indicated that she continued to use the DMRT after the experimental phase was completed. In the follow-up form sent five weeks after the experimental phase was completed, the co-op student indicated a rise in her opinion on the DMRT Continue Use Index. The implications of these findings explains why participants’ opinion of whether they would continue to use the DMRT after the study indicated a significant rise in the DMRT Continue Use Index score from the first response on the evaluation form one week after the experimental phase to the second response on the follow-up evaluation form one month later.

All five of the individuals whose sleep/wake behavior resembled delayed sleep phased symptoms were able to wake before the alarm by week-3; whereas before, they experienced difficulty not just waking from sleep for the first six hours after the last awakening from sleep, they also experienced difficulty waking before the alarm or slept through the alarm often; that is, they experienced sleep-offset stress before leaving the bed.

From the findings of this study and the specific experience of the co-op student, I conclude that the DMRT is a self-generated, sleep-control instrument that may be used to treat sleep disorders: (1) Insomnia (difficulty falling asleep), (2) Delayed Sleep Phase Syndrome (difficulty waking from sleep), (3) Delayed Sleep Phase Insomnia (difficulty falling asleep/difficulty waking from sleep), and (4) mild sleep difficulties, in general.
As the results of study indicated, total sleep time was not significant in any of the experimental weeks. Scientifically, the increase in total sleep time was significant in respects to advancing the sample from six hours of sleep to seven hours of sleep per night that increased the amount of time spent in Sleep Stage 3 and Stage 4 where and when learning takes place and improves cognitive performance during the daylight hours.

However, this improvement in total sleep time was not the concern of the co-op student above, nor was it a concern of the sample as a whole. In debriefing, most of the students spoke of the need to “wake from sleep” in the waking-life as being the most important goal, and perhaps, the main reason they joined the study after viewing a flyer that stated, “The DMRT will ‘put you to sleep’ and ‘wake you up!”’

Including the findings that indicated (1) difficulty waking from sleep along with (2) waking before the alarm time were the most significant differences in this study, the participants, also, indicated that difficulty waking from sleep was their major concern. The students indicated in debriefing and with their results that they wanted to “wake up” in the sleep-offset hours, hence, to turn sleep off in the waking-life activities. Debriefing indicated that the students were not that much concerned about total sleep time because they could always take a power nap to make up for missed sleep when they felt tired because of, in essence, the college setting.

From the above experiences noted by (1) the students in debriefing, (2) the co-op student above, and (3) the statistical findings of this study, I conclude that this evidence validated the *Sleep Quality More Important Theory* proposed in this study. In other words, sleep quality is more important than sleep quantity to some individuals, especially university students in this DMRT sleep study.
The findings of this study produced many effects of the DMRT that are too numerous to discuss here. In the above discussion, the focus was directed toward DSPI and the benefits that the DMRT may contribute to aiding similar disorders along with other sleep difficulties. However, the sample consisted of normal sleepers too. Most individuals sleep six to nine hours per night. Research has determined that there is a “core-sleep-need: 4.5 to 6 hours” that individuals must obtain on a nightly basis to fill refreshed the following day (Horn, 1988).

However, there are some individuals who sleep less than five hours a day and have been called short sleepers. The following discussion focuses on normal sleepers who were either short sleepers or students who needed to adjust the alarm back because of the decreased waking after sleep-onset within the sleep period after using the DMRT.

In week-2, once 50% of participants began “waking before the alarm,” they discontinued waking after the alarm time completely for the remaining of the study. One person, who we will call short sleeper, woke before the alarm all 7 nights in week-2 and week-3 with the use of the DMRT. The short-sleeper, who self-awakened all 14 nights after receiving the DMRT, began the study with a (1) sleep-onset latency of 35 to 45 minutes per night, (2) waking after sleep-onset time of 30 to 110 minutes nightly; and (3) total sleep time of 5:59 (hours/minutes) in week-1. In week-1 pretesting, the short-sleeper enter-bed-times were 8, 9, 10, or 10:30 PM on some nights and week-1’s averaged enter-bed-time was 9:35 PM; yet, she set the alarm for 4:00 AM, that is, a six, seven, and sometimes eight hour sleep period in relationship to the time she entered the bed.

Then, the short-sleep would awaken within three to four hours after sleep-onset. Within the waking after sleep-onset period, she would be awake for one to two hours. Upon returning to bed, the waking in the middle of the sleep period for such a long time made it hard to return to sleep and awake by 4:00 AM. Hence, the student major focus was on reducing the difficulty of
waking from sleep; that is, to be awake in the sleep-offset time. Ironically, this student’s schedule did not include naps during the day.

After the first night with the DMRT, the short-sleeper woke 10 minutes before the alarm and, completely, stopped waking after the alarm or at the alarm time throughout the remaining of the study. Before the DMRT, the short-sleeper (1) slept a total of 5:59 hours/minutes, (2) entered the bed early, and (3) would awake approximately one hour plus within the sleep period. Yet, with the application of the DMRT therapy, the short-sleeper’s wake after sleep-onset latency decreased to a four minutes average in week-3, and with the exception of a 15 minutes wake time in the sleep period on Wednesday in week-3, she did not wake up within the sleep period for six days in week-3. Hence, the short-sleeper’s waking after sleep-onset for one to two hours in the sleep period decreased this time from an average of 53 minutes in week-1 to 18 minutes in week-2 to four minutes in week-3.

This decrease in waking after sleep-onset did not increase her total sleep time, however. The short-sleeper began to sleep for five hours on and average per night in week-2 and week-3. Because the short-sleeper had received her total sleep time that averaged about 5 hours per night, the attempts to obtain more hours than needed is seen in the miscalculation of pre-setting the alarm as the findings indicated by the large amount of time of waking before the alarm seen in the results that averaged 58 minutes in week-3.

These results indicated that if students knew how much sleep they really needed to feel rested and refreshed the following day, they would be more accurate in setting the alarm closer to the expected wakeup time and be more consistent in during so. In other words, if this student had been aware of her sleep-need after adjustments with the DMRT and set the alarm
accordingly, the short-sleeper would have been one who did wake within the 5-minutes before the alarm cue, consistently, with the DMRT.

Informatively, the short-sleeper results indicated that the averaged 42 minutes in week-2 and 58 minutes in week-3 waking before the alarm times are the approximate amount of time that she needs to begin decreasing her alarm time from the 4:00 AM routine time pre-set in the beginning of the study, in order, to wake closer to the alarm time; that is, a 3:00 AM pre-set time is more appropriate for the short-sleeper after the mind/body conditioning with the DMRT.

In other words, once the DMRT had adjusted the short-sleeper’s sleep pattern averages by (1) decreasing waking after sleep-onset from 53 to four minutes; (2) decreasing the number of wakes from 11 to two per week; (3) decreasing difficulty waking before the alarm from 11 to zero per week; (4) decreasing difficulty falling asleep from Level 2 to Level 1; (5) decreasing difficulty waking from sleep from Level 1.3 to Level 1.1; (6) increasing self-awakening from one to seven days per week; and (7) decreasing the interrupted total sleep time period from 5:59 (hrs/min) in week-1 to 5:00 (hrs/min) in week-2 to 5:06 (hrs/min) in week-3, the DMRT conditioning helped provide all the rest, relaxation, and sleep needed for the short-sleeper.

Thereby, the short-sleeper’s sleep-need had changed, and she only required five hours of sleep to feel rested, motivated, and mentally alert the following day; that is, this student needed only five hours of sleep after the DMRT corrections and adjustments to her sleep/wake behavior.

Also, these findings indicated that once the DMRT “wakes one up” and the sleep-need is met, it is not so easy to return to sleep. One student entered the bed weekday nights in the ten o’clock hour. This student is called the working-student who entertained normal enter-bed-time hours. The working-student set the alarm for an eight hour sleep period. However, the working-student also would awaken in the middle of the night and stay awake for one or two hours, and
then return to sleep when he felt sleepy again. Naturally, the working-student slept passed the alarm, occasionally, in the pretesting period, and he was “alarm-dependent.”

After receiving the DMRT intervention, the working-student’s waking after sleep-onset time decreased from an average of 52 minutes in week-1 to 18 minutes in week-2; that is, the waking after sleep-onset was decreased. However, total sleep time only increased by three minutes in week-2 after receiving the DMRT. Once the working-student began waking before the alarm in day-two with the use of the DMRT, he never slept pass the alarm again in week-2 or week-3. The working-student began sleeping all night, and he woke before the alarm within 10 minutes the first time he self-awakened on the second night in week-2 after the use with DMRT.

However, the working-student’s findings indicated the beginning of waking more than an hour before the alarm on some nights (e.g., 75, 87, 45, and 59 min) that average to 36 minutes waking before the pre-set alarm time in week-2. The increased waking before the alarm time continued and leveled off to about 40 minutes waking before the alarm time in week-3.

Also, total sleep time decreased from 6:55 (hrs/min) in week-1 to 6:35 (hrs/min) in week-3. In debriefing, the student indicated he performed the technique for 45 minutes trying to return to sleep one morning but failed to go back to sleep. I asked if he felt sleepy in the waking life for the first six hours. He indicated that he did not, and the difficulty waking from sleep final results verified his answer that indicated a Level 1.3 (Felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours). The news of failing to return to sleep with the DMRT puzzled me at first.

Logically speaking, these findings indicated that once the participant had received 5:10 (hrs/min) total sleep time on the third day after using the DMRT, he had received his “core sleep need: 4.5 to 6 hours,” (Horne, 1988), and the mind/body systems were satisfied with the rest and
relaxation obtained. Hence, the working-student had received all the sleep he needed! These findings also indicated that once the DMRT accomplished its goals of resting, relaxing, helping one to obtain their sleep-need-time, and once awake, one will remain awake for at least 6 hours after the last awakening, fully alert. In other words, this wakefulness will naturally flow into the waking-life and decrease the difficulty waking from sleep index because of the increased distinct self-awakening effect. Mentally, self-awakening turns on waking-alertness in sleep-offset.

Along with the above short-sleeper and working-student, who began waking in excess of 30 minutes before the alarm, the DMRT increased both sleep-quality and sleep-offset quality. This increase in sleep quality and sleep-offset quality were highly affected by the increased ability to wake before the alarm that increased self-awakening quality. Both the short-sleeper, who woke before alarm 14 days (7 days/2 weeks), and the working-student, who woke before the alarm 10 days (5 days/2 weeks) displayed good self-awakening quality. Similar to the short-sleeper, the working-student’s alarm time needed an adjustment that would fit the individual’s sleep/wake needs after the increase sleep/wake quality obtained with the DMRT conditioning.

The working-student results indicated: (1) He woke before the alarm four times in pretesting; (2) he increased waking before the alarm time from four times in pretesting to five times in both week-2 and week-3; (3) he only slept pass the alarm once after receiving the DMRT on day-1 in week-2; and (4) his waking before the alarm minutes only increased after using the DMRT. These findings indicated that the working-student began miscalculating the amount of sleep needed and the right time to pre-set the alarm from the very beginning. Perhaps, his chosen eight-hour sleep period was idealized from the general consensus that we all need eight hours of sleep per night to feel rested and refreshed the following day.
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The working-student findings indicated the DMRT helped adjust his sleep/wake behaviors by (1) decreasing difficulty waking before the alarm from Level 2.5 (somewhat difficulty self-awakening) to Level 1.3 (low difficulty self-awakening); (2) decreasing the wake after sleep-onset time week average from 52 minutes to 20 minutes in week-2 to 18 minutes in week-3; and (3) decreasing difficulty waking from sleep from Level 2.6 (desired to take a nap in the 1st to 2nd hour after the last awakening from nighttime sleep) to Level 1.3 (felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours).

These findings indicated that if the working-student was aware of the amount of total sleep time decrease from 6:55 (hrs/min) in week-1 to 6:35 (hrs/min) in week-3 for a total decrease of 20 minutes and pre-set his alarm time accordingly, he too would, more than likely, awake 5-minutes before the alarm, consistently, with the use of the DMRT.

In essence, both the short-sleeper and the working-student were classified as normal sleepers in this study. Study results indicated that once they reduced the waking after sleep-onset, slept throughout the period of time they wanted to sleep (increased sleep efficiency), their waking before the alarm time increased. Perhaps, these findings indicate that students are special animals and with a highly activated mind, sleep is an inconvenience. Therefore, the DMRT would aid the student in obtaining the deep-sleep needed to remove a sleep-debt; thereby, allowing the student the mental rejuvenation and stamina needed to pursue his high academic goals mentally alert in sleep-offset with less unconsciousness (Sleep) needed.

The study findings indicated that the difference in the normal sleepers and the delayed sleep phased individuals produced two distinct results. First, the delayed sleep phased individuals became consistent self-awakeners who awaken close to the alarm time, awakened within the cue
time more, and was mentally alert in waking life. Whereas, once the two normal sleepers corrected their oversleeping by almost totally eliminating waking after sleep-onset, they began to awaken more than 30 minutes before the alarm time. It appears that once they had made adjustments to their sleep-wake behavior that were needed to pay the sleep debt, they began on a path that identified the exact amount of sleep they needed as individuals with the busy schedules they performed.

These findings indicated that students with minor sleep difficulties (e.g., sleep deprivation) will benefit from using the DMRT too. The short-sleeper and the working-student, both normal sleepers, both student and worker, and both functioned on a high academic level (e.g., one a doctorate student); sleep was more of an inconvenience than anything else. In fact, the delayed sleep phased individuals were much younger than the short-sleeper and the working student.

In debriefing, the third normal sleeper commented that she was so “awake” in sleep-offset that she did not know what to do at times. Noting this comment, focus was placed on her young age and just beginning college as an undergrad. However, the short-sleeper and working-student were much older and the increased waking-alertness time was fulfilled with school work and the job. In other words, they were on a higher academic level and their mind being activated on a higher level would not let them sleep. Because of the increased “distinct” waking-alertness in sleep-offset that self-awakening provides in the DMRT conditioning, the DMRT would benefit the normal sleeping student to help achieve his or her academic goals without losing the sleep needed to accomplish such task.

People very seldom measure the amount of sleep they obtain, let alone know how much sleep is needed for the mind/body to feel refreshed the following day. The brief analysis of the
two participants (short-sleeper and working-student) above indicated this with the obvious changes that were needed in adjusting the alarm time once the DMRT had (1) removed the difficulty of falling asleep; (2) increased the frequency of the ability to wake before the alarm; and (3) decreased the difficulty of waking in sleep-offset.

When the delayed sleep phased individuals must meet schedule out of routine the following morning, study findings indicated the DMRT will help the awakening with the full alertness needed to attend the event (e.g., class, social event, work) for at least 6 hours. If one did not obtain the full sleep-need-time earlier in the sleep period because of the out of routine event the following morning, the students would have little problem returning to sleep quickly for a “power nap” with the use of the DMRT.

In debriefing, some students indicated that they wished they could sleep for long periods of time. Perhaps, the best way to assure this wish is to indulge in some other means besides natural sleep (e.g., sleeping pills, narcotics, sedative hypnotic, or increased melatonin). These none natural means tend to put one to sleep, but fails to wake one instantaneously, and the person finds himself lethargic/sleepy/sluggish when he needs to be awake in waking-life activities.

However, the findings of this study indicated that once participants used the DMRT, the DMRT (1) reduced sleep-onset stress; (2) increased self-awakening; (3) increased wakefulness in sleep-offset, and (4) waking-alertness extended for six hours after the last awakening. Unlike chemical means of obtaining sleep, with the use of the DMRT waking-alertness were guaranteed, at least for six hours after the last awakening from sleep. Thus, the DMRT is a “tool” that “puts one to sleep in sleep-onset” and “wakes one up in sleep-offset!” Furthermore, the DMRT is a “tool” that only allows one to sleep as long as the sleep-need requires, and it will not consistently wake one before the alarm or close to the alarm time until the sleep-debt is paid.
As indicated by samples’ wake before the alarm level-index score of self-awakening five days out of a seven-day week, the findings of this study indicated that all the participants eventually began to wake before the alarm at one point or another. Also, the findings of this study indicated that participants began to “wake 5-minutes before the alarm” in week-3 consistently for at least two to four days out of the week. I conclude from these findings that Non-Self-Awakeners are capable of becoming skilled Self-Awakeners with the use of the DMRT. Furthermore, I conclude that with the evidence provided in this study on the DMRT, the Self-Awakening Phenomenon is once again validated.

In studies examining the Self-Awakening Phenomenon, researchers indicated that participants needed several waking periods before they could awake close to the pre-set alarm time to be successful consistently (Moorcroft et al., 1997; Zepelin, 1986). Their findings led them to speculate that this increase in the number of wakes helped insure waking close to the pre-set time. Because their findings indicated that most awakenings occurred in REM sleep, they also indicated that there must be “gating periods” that allowed the waking to occur (Lavie et al.’s 1979; Zepelin, 1986). In addition, researchers indicated that there must be some type of time-interval within sleep (Zepelin, 1986). However, some tend to disbelieve that one can tell time in sleep, yet most are still at a lost for how it happens.

This study indicated that the cues rested, relaxed, and aided the participants’ sleep. Once the participants had learned how to sleep, they did not, per se, wake up for the remainder of the night, especially in week-3. In other words, the participants had learned how to sleep and how to stay asleep until the pre-set hour with the DMRT conditioning. Yet, these students who did not wake up in the night or there were no number of wakes, they were able to wake before the alarm within 10 minutes four times per week for one student, three times a week for three students, and
so on. These findings indicated that instead of “gating periods” that guide ones awakening close to a pre-set hour or increased number of wakes to check the clock, perhaps it was the obedience of the Self responding to the cue to “wake 5-minutes before the alarm” that caused the awakening.

Concerning the question of whether one can tell time in sleep or not, the Mind Never Sleep! This fact is evident when one awakens with a dream. Just because you were unconscious while asleep, this did not stop the brain from controlling the body systems from performing the job of keeping you alive. Just because you were unconscious, the mind did not stop performing its functions that include formulating memory-traces of the events of the day or rejuvenating and restoring the mind and body for the following day.

In fact, because the DMRT includes the unconscious processes of sleep, a memory-trace to “wake before the alarm” is learned. Hence, if the Self tells itself to do something or to wake before the alarm, it will not forget to do what it was told to do, just before sleep. Learning takes place in sleep! Once learning takes place as the study findings indicated, wakefulness within the hour pre-set is guaranteed with the DMRT conditioning. In other words, the Self will not forget what it told itself to do just before sleep with the DMRT.

In order to accomplish a task, with the use of the DMRT, the Self initiates the cooperation of the whole mind/body system to perform the task. If I am capable of awakening from sleep to relieve a distressed organ in pain and see myself flying above my physical body lying in the bed asleep, then why is it so impossible to believe that one, perhaps, see a view of the clock to know when to awake at the time requested through the Mind’s Eye? In other words, the “Mind Never Sleeps!” Just like we learned how to tell time consciously, we learned how to tell time unconsciously too, especially, when the Self gains the cooperation of the whole mind/body
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system initiated by the DMRT to accomplish the requested task learned in sleep and wakefulness.

In the studies that investigated the Self-Awakening Phenomenon, the findings revealed some of the methods the participants said they used to self-awakening at the pre-set time. Some of those methods included rituals: repetition of the target wake time, visions of the time on a clock, perhaps some mantra, and etcetera (Moorcroft et al., 1997). In essence, these methods consisted of the individual’s mental focus on the task. Since it was a single task, this chore for the mind to perform was easy because the participants told the Self what to do just before sleep, and learning took place in Sleep (Moorcroft et al., 1997; Stickgold et al., 2000b). Because the mind knows what time it is, the Self obeyed itself.

When the five participants who did began waking before the alarm in week-2, study results indicated that 80% of these students began their awakening within 10 minutes before the alarm time. Also, the results indicated that they did exactly what they told themselves to do. In other words, they actually “obeyed the Self” when the cue directed them to “wake 5-minutes before the alarm”! Since the mind knows how to tell time, this was an easy chore in a three-night experiment by other researchers (Bell, 1980; Moorcroft et al., 1997) or in a 21-night experiment like this DMRT sleep study.

Also, the Sleep-Quality More Important Theory was validated in this study with the highly significant statistical trends that indicated (1) an increase in self-awakening quality, (2) an increase in waking-alertness quality, (3) an increase in sleep-onset quality, and (4) the verbal reports from the participants in debriefing. In debriefing, participants admitted it was more important to feel rested, relaxed, alert, and energetic in their waking life rather than feeling tired, anxious, and/or sleepy during the day, before using the DMRT. Since participants were falling
asleep in the wee hours of the morning and able to take naps throughout the day, total sleep time was not the issue; yet, the real reasons why they possessed some sleep issue were beyond their wildest imagination.

By removing the sound of the alarm clock when first awakening, participants were removing the very source that was a “jumpstart to anxiousness.” It was more important for some students to feel awake than it was to increase total sleep time (Pilcher et al. (1997). Therefore, the decrease in difficulty waking from sleep increased the waking-alertness and motivation to perform in waking-life that required mind-power related to academic tasks, specifically, for students. From these findings, I conclude that the quality of sleep/wake behavior was more important than the quantity of sleep for these participants; thereby, confirming the Sleep-Quality More Important Theory proposed in this study.

The Sleep-Learning Memory-Trace Cue Consolidated Theory proposed in this study was also validated. The “sleep-dependent learning” theory indicated that practice on a task just before sleep produces learning of that task the following day and within 48 hours learning increases (Stickgold et al., 2000b). Past research in “sleep-dependent learning” was conducted on learning peripheral tasks, visual tasks, and motor skills (Karni et al., 1994; Maquet et al., 2000; Mednick et al., 2002, 2003; Stickgold et al., 1999. The DMRT sleep study focused on learning four cue directives: “rest,” relax,” “sleep,” and “wake 5-minutes before the alarm.” The key to the DMRT Cue-Mentation process is that the focus on these “words” is coupled with the psychological response that define the “cue” and the initiated “behavior-response” experienced in relationship to the cue are both transferred into sleep for further fertilization, unconsciously.

The findings indicated that from week-1 to week-3 participants (1) decreased waking after sleep-onset from 20 minutes to 5 minutes; (2) decreased number of wakes from 5 to 3 per
week; (3) increased total sleep time by 19 minutes; (4) decreased difficulty waking before the alarm time; (5) decreased waking after the alarm time; (6) decreased difficulty falling asleep in sleep-onset; (7) increase the ability to self-awaken before the alarm; (8) increased waking before the alarm time from one time per week to five times per 7-day week; and (9) increased waking before the alarm cue from zero times to four times per week for one student, three times per week for two students, two times per week for two students, one time per week for three students, and two times per week for the sample’s average.

Since, the cues directed the participants to rest, relax, sleep, and to wake 5-minutes before the alarm, and the aforementioned results corroborated these cues, these findings indicated that learning took place; thereby, the results support the “sleep-dependent learning” theory and confirmed the Sleep-Learning Memory-Trace-Cue Consolidating Theory proposed in this study.

Discussion of Learning Effect Time

Stickgold et al.’s (2000b) findings on sleep-dependent learning raise the question of when learning actually occurs. Research indicated that learning takes place in the actual practice of the task just before sleep, and it takes place within sleep unconscious processes (Stickgold et al., 2006b). Research conducted on peripheral, visuals, and motor skill tasks, indicated learning takes place the following day or within 48 hours (Karni et al., 1994; Maquet et al., 2000; Mednick et al., 2002, 2003; Stickgold et al., 1999, 2000a, 2000b). In previous research, participants focused on one specific task. In the DMRT sleep study, students were assigned four tasks to perform that included convincing the whole mind/body system to cooperate in a unified effort to produce the cue-behavior-response when desired.

The change-effect-times for the dependent variables assessed in this study provide a Birdseye View of when learning took place in the sample’s sleep/wake behaviors. First, the
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DMRT adjusted sleep-quality. It was the first challenge to changing sleep and wake behavior of this proven to be clinical population who possessed Delayed Sleep Phase Syndrome symptoms and moderate to severe sleep deprivation symptoms. Psychically, the DMRT initiated change in sleep/wake behavior according to the order of the “cue” directives.

Beginning with sleep-quality, DMRT change-effect-time for the wake after sleep-onset dependent variable was six hours and 57 minutes on the first night of its use. The sample (1) decreased waking after sleep-onset from 20 minutes to eight minutes in Day-1, (2) maintained a 12-minute decrease for the entire week-2, and (3) decreased waking after sleep onset further to five minutes in week-3 for a total decrease of 15 minutes in the study. Hence, learning took place in 6:57 hrs/min as indicated by the increase in sleep quality. Also, the DMRT change-effect-time for the number of wakes was 6:57 hrs/min. Participants (88%) did not wake in the sleep period on Day-1 with the use of the DMRT, and the number of wakes decreased from five in week-1 to three in week-3 for the sample’s average, thereby, increasing sleep quality.

DMRT significant change-effect-time was 48 hours on Day-2 in week-2 for an increase of 15 minutes in total sleep time compared to week-1. However, DMRT change-effect-time was 6:57 hrs/min on Day-1 in week-2 on Monday for an increase of three minutes in total sleep time for the sample in comparison to week-1. In addition, DMRT change-effect-time was about 15 minutes on Day-1 in week-2 for decreasing the difficulty falling asleep in sleep-onset and in waking after sleep-onset.

In essence, the decreased 20 minutes waking after sleep-onset time is basically the same increased 19 minutes total sleep time. The difficulty falling asleep index includes both sleep-onset latency and waking after sleep-onset concepts. If waking after sleep-onset decreased, then difficulty falling asleep decreased since the DMRT was used to return to sleep if participants
The Deep Meditative Relaxation Technique (DMRT) awakened within the sleep period. Thus, DMRT change-effect-time was about 15 minutes on Day-1 in week-2 for decreasing difficulty falling asleep in sleep-onset and in waking after sleep-onset after use of the DMRT; as indicated, by the level-index results on L1.2 (*Fell asleep within 1 to 15 minutes*) (Table 10).

Therefore, the sleep-quality parameters indicated that the DMRT had effected change in sleep-quality within six hours and 57 minutes with (1) a decrease of waking within the sleep period; (2) a decrease in number of wakes; and (3) an increase of total sleep time. In addition, participants decreased difficulty falling asleep in sleep-onset and in waking after sleep-onset in about 15 minutes on Day-1. These results indicated that learning had taken place in response to the DMRT *cue* directives to “rest,” “relax,” and “sleep” within six hours and 57 minutes with sleep-onset in less than 15 on Day-1.

The difficulty waking before the alarm index was used to diagnose the problem of awakening in this sample. Since it was capable of diagnosing if there was a problem, it was used to determine when awakening ceased to be a problem in the sample too. DMRT change-effect-time was 48 hours, Tuesday, Day-2 in week-2 for decreasing the difficulty waking before the alarm index scores in the sample. DMRT significant change-effect-time was Wednesday with a decrease of 3.0 units that indicated the sample had significantly decreased waking at the alarm or sleeping after the alarm time. Hence, these findings indicated that the sample had learned how to wake before the alarm rather than by the alarm or after the alarm time. Learning took place!

The Self-Awakening Scale Index (SASI) is the instrument that all other self-awakening parameters were based on. SASI scores indicated that DMRT change-effect-time was 48 hours, Tuesday, Day-2 in week-2 for the decrease of waking after the alarm time and increase in waking before the alarm time in this study. Also, DMRT change-effect-time was 48 hours for the
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increased frequency of the ability to wake before the alarm time index. In comparison to one person waking before the alarm in week-1, three students were waking before the alarm Day-2 in week-2 that represented a 3:1 ratio increase over week-1 average with the use of DMRT.

Although the SASI (-17) minutes results indicated that DMRT change-effect-time was 48 hours for increasing waking before the alarm cue index in week-2, the DMRT significant change-effect-time for waking before the alarm cue was 120 hours, Friday, Day-5 in week-2 when the sample increased from zero days waking within the cue in week-1 to five days waking within 10 minutes before alarm cue in week-3.

In findings of improvement in the sample’s sleep-offset (waking-life) quality, DMRT change-effect-time was 48 hours, Tuesday, Day-2 in week-2 when it aided the significantly decreased difficulty waking from sleep for the first six hours after the last awakening. These findings indicated that participants, subconsciously, were waking before the alarm time in their waking-life quality before achieving the significant results received for physically waking before the alarm time, consciously, with the wake before alarm index.

The findings of this study indicated a materialization of the cues in the order dictated by the Cue-Mentation process. Also, the findings indicated an order in the production of the results in relationship to which consciousness produced what intelligence. Findings indicated that the conscious mind produced the physical aspects of the cues to “rest,” “relax,” and enter “sleep.” One must first rest and relax before sleep, that is, DMRT “relaxed” the participants to sleep, consciously.

Findings indicated that the subconscious mind produced the wakefulness in sleep-offset. In other words, wakefulness was aided by subconscious memories of the cue’s meaning, that is, to “wake.” This is why difficulty waking from sleep was highly significant in 48 hours in
week-2. The cue’s memory-trace to “wake before the alarm” manifested itself mentally before the increased physical awakenings in the wake before alarm time index.

In addition, it was the unconscious mind (Sleep) that actually caused the participant to wake before the alarm time. Once the participants increased total sleep time of 15 minutes on Day-2 in comparison to week-1’s average, this addition of sleep allowed the participants to remain in Stage 3 and Stage 4 sleep longer. While in delta sleep, the unconscious mind was able to activate its most psychic chore, that is, to awaken the participant from sleep while unconscious.

Therefore, learning took place in this order: consciously participant learned how to rest, relax, and entered sleep quickly. Subconsciously, participants learned waking-alertness in sleep-offset (waking life). Unconsciously, participants learned how to wake before the alarm time. That is, learning took place consciously, subconsciously, and unconsciously, and in that order.

As the results indicated, the DMRT change-effect-times were in compliance with the “sleep-dependent learning” theory that indicated if tasks are practiced just before sleep, learning takes effect the next day or within 48 hours (Stickgold et al., 2000b). Not only was the “sleep-dependent learning” theory validated in this study, the results support and adds credence to one of the proposed theories of this study: Sleep-Learning Memory-Trace Cue Consolidation Theory.

In the Sleep-Learning Memory-Trace Cue Consolidation Theory, I posit that if the cues are projected to mind/body systems in a body-scan just before sleep, they will initiate a “cue behavior-response” and the experience of the cues to “rest,” “relax,” “sleep,” and “wake 5-minutes before the alarm” are transported into sleep where these seeds of knowledge are formulated, consolidated, and engraved into short- and long-term memory for instant recall in Sleep (wake before alarm) and in sleep-offset (waking-alertness); that is, learning occurs.
**Discussion Summary**

This study explored the research question: While decreasing the difficulty of falling asleep in the process, is it possible for the Deep Meditative Relaxation Technique (DMRT) to initiate self-awakening at a pre-set time (without external means) and initiate waking-alertness; and what opinions are generated by its use? As the findings indicated, the DMRT improved sleep-onset/sleep quality; thereby confirming Hypothesis 3: The DMRT will decrease the difficulty of falling asleep. The findings indicated the sample improved self-awakening quality; thereby confirming Hypothesis 1: The DMRT will increase the frequency of the ability to wake before the alarm. Also, the findings of this study indicated improved sleep-offset quality; thereby confirming Hypothesis 2: The DMRT will decrease the difficulty of waking from sleep.

In addition, the findings of this DMRT study confirmed the ability of the Self-Awakening Scale Index to measure (1) waking before the alarm; (2) waking at the alarm; and (3) waking after the alarm time, remarkably. The SASI scores indicated that the students’ level-index began on Level 5 (Did not wake before alarm [$\geq 0$ minutes]) that represented waking after the alarm time. With the DMRT, the sample SASI level-index findings indicated Level 1 (very good self-awakening) that means the students were waking within 14 minutes before the alarm.

Research has determined that waking within 15 minutes before the alarm represents the Self-Awakeners performance effect size that indicates “moderate consistently successful” self-awakening (Moorcroft et al., 1997). Remarkably, the findings in this study indicated that the Self-Awakening Scale Index (SASI) should be used in examining the Self-Awakening Phenomenon on the DMRT level of performance.

In addition, the findings of this study indicated that the “cue consistency success” rate for waking within the 10-minute interval of the alarm moved from Level 6 (non-cue-consistent
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self-awakening [zero]) to a Level 4 (small cue consistent self-awakening [2]) effect size. On the other hand, the findings of this study indicated that the sample waking before the alarm time moved from Level 5 (trivial self-awakening) that represented waking one day to Level 1 (extremely high consistent self-awakening) that represented waking five days out of a seven day week.

The findings of this DMRT study were remarkable! But, why would anyone think the lesser when an innovative “tool” like the DMRT that focused on Self-control with the initiation of the sum of its parts acting together in a unified effort to control mental and behavior-responses practiced just before sleep and learned in the unconscious processes of Sleep is activated. In other words, the power of the conscious, subconscious, and unconscious mind is a force to be reckoned with in producing a desired response both in sleep and wakefulness, like the DMRT showed in this sleep study.

**Implications of the Study**

In essence, the DMRT is designed to make adjustments to both sleep and waking behaviors, and it increases self-awakening quality to aid in these adjustments. The DMRT’s focus includes the cooperation of the Self to accomplish its goals. In the DMRT, the entire mind and body systems are tapped for cooperation in performing a task. In other words, the DMRT focuses on the whole person inner-self environment to aid in accomplishing its goals.

Ecological counseling focuses on the behavior of a person interacting with his or her environment for the treatment of some mental disorder or disturbance. In 1936, Kurt Lewin introduced the ecological concept when he introduced the formula (B = P x E): Behavior is a function of a person’s interaction within his or her environment. With this concept, he indicated that in order to treat a person one must go beyond the surface problem and venture into the
person’s interacting in his or her surrounding environment in order to help obtain the right intervention that would aid the relief of the individual’s mental distress.

According to Conyne and Cook (2004), ecological counseling is also defined as “contextualized help-giving” that is dependent on the meaning clients derive from their environmental interactions. The overarching purpose of ecological counseling is to yield ecological concordance or to obtain some sense of balance in a client’s life (Conyne & Cook, 2004). Human life depends on associations, agreements, and collaboration with others in his or her environment. Likewise, these are the elements that ecological counseling take into consideration when diagnosing the client and implementing interventions for treatment of the client’s mental imbalance.

Similar in concept yet different, the DMRT focuses on the whole person by focusing on the mind and body systems that represent the person’s inner-self-environment within that may influence and/or help solve the problem of the sleep difficulty that may exist. Rather than trying to pinpoint the cause outside of the person, the DMRT initiates the abilities of the Self to take control to help solve sleep difficulty problems. Hence, the DMRT uses the strategy of initiating the Self to help solve its problems, rather than going outside the Self for help. In essence, the DMRT major strategy of focusing on the mind/body systems is to synchronize the separate parts into one unit to accept and react to the “cue directives” at the same time to produce the desired effects. By acting as one-unit in harmony with the sum of its parts, balance is achieved and a more powerful effect is enacted.

Because of the nature of ecological counseling, therapists would benefit tremendously by employing the DMRT for all of their clients whether one mentioned sleep problems or not. Since the DMRT is an intervention that focuses on producing “balance within” the person, ecological
counselors and counselors alike should employ the aid of the DMRT in treatments involving the human mind.

Self-efficacy was increased in this DMRT sleep study! Participants realized they controlled sleep and awakening as indicated with the responses on the evaluation forms for the Wake Before Alarm Index-2 (WBAI-2), Practice Effect Index (PEI), and the Sleep-control Index (SCI) scores. In the WBAI-2, participants indicated that they were waking 15 minutes before the alarm five weeks after the study was completed. In the PEI, participants indicated that with more practice they believe they would wake within 10 minutes of the alarm, consistently. In the SCI, participants believe they possessed the ability to control sleep.

Logically speaking, if someone had just experienced a two-week trial of an innovative technique like the DMRT that introduced all of these capabilities from within, this experience, more than likely, increased sleep efficacy, as well as, self-efficacy for the participants of this study as the results indicated. In essence, ecological counselors and counselors alike would benefit from the addition of the DMRT to their professional intervention “tools” to treat clients.

In other words, begin counseling therapy by teaching the person how to increase his or her self-control. One that learns the self-control that the DMRT teaches tends to increase self-efficacy and creates a mindset that is unbelievable, unless it is personally experienced oneself. With the benefits that the DMRT showed in this study, this aid to clients with sleep difficulties, and perhaps other mental imbalances, is beneficial in aiding the human condition.

Knowledge Gaps in Science Implications

Firstly, the DMRT sleep/wake study is the only one, to my knowledge, that examined the Self-Awakening Phenomenon with a specific intervention. This study fulfilled the gap of scientific knowledge in science because it provided the mental and physical effects of
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self-awakening on sleep and waking quality among university students. Also, this study fulfilled the gap in knowledge in science because it introduces an innovative “tool” that (1) will “put one to sleep” and “wake one up” in a pre-set hour (without external means) consistently, and (2) will “wake one up” in sleep-offset (wake for the first six hours after last awakening), mentally.

On a clinical level, this study fulfilled the gap in knowledge in science because it provided a psycho-physiological “tool” that is both “cost-effective” and “time-effective” since it is self-administered and the effects are seen within six to 48 hours that will help the public, in general, and students, in particular, to combat sleep difficulties without the assistant of drugs, alcohol, sedative hypnotics, or therapists. Also, this study fulfilled the gap in knowledge in science because it introduces the research community to a psycho-physiological “tool” that combats sleep difficulties; for example, (1) sleep-onset difficulty; (2) insomnia; (3) waking after sleep-onset insomnia; (4) delayed sleep phase syndrome; (5) delayed sleep phase insomnia; (6) sleep deprivation; and/or (7) hypersomnia or the likeness of such sleep difficulty.

The DMRT sleep study helps fulfilled the gap in knowledge in science because it helps support and add credence to the “sleep-dependent learning” theory and it projects the theory specifically applying to the procedures of the DMRT with the Sleep-Learning Memory-Trace Cue Consolidation Theory. Moreover, this study fulfills the gap in knowledge in science because it supports the Sleep Quality More Important Theory that indicates sleep quality is more important than sleep quantity.

Last but not least, the DMRT sleep/wake study fulfills the gap in knowledge in science since it validates the Self-Awakening Phenomenon as seen when “alarm-dependent individuals” became skilled Self-Awakeners who consistently woke before the alarm time five out of a 7-day week and the significant learning-effect took place within six to 48 hours of using DMRT.
Limitations of the Study

As of date, I have tested the DMRT on several levels with samples of six to eight male participants in several groups in five-week intervals, as well as, with my individual clients over an 11 week/per quarter therapy sections during my master’s internship at a halfway house for ex-offenders within the community for one year. The present study was conducted with a sample of eight students (2 males, 6 females) who lived on campus and off-campus over the course of 11 weeks. The examination of the DMRT in both the controlled environment and now the uncontrolled environment produced beneficial changes to the human condition.

In the controlled environment, the participants were more clinical because of situation anxiety issues that made falling asleep difficult. The participants in the groups talked about how they used the DMRT as a “tool” for more than sleep when they began to use it in their job environments to relieve the tension they experienced. In other words, the DMRT became the instrument that aided their need to go to sleep among strangers and to relieve their anxiety and body fatigue during the day at work.

However, the participants in the present study had no problems falling asleep in sleep-onset but experienced difficulty falling asleep after waking up within the sleep period. In debriefing these participants recounted their experience of sleeping all night and feeling awake to complete their academic pursuits without the sluggishness and time spent napping during the day because of the “tool” called the DMRT that they now possess.

In spite of the individual clients and the small sample sizes obtained in the groups in internship and the small sample size in the present study, content analysis, repeated-measures analysis, paired-sample tests, means and standard deviations group analysis, and trend analysis all produced the same results that support the DMRT sleep therapeutic intervention as a valuable
The Deep Meditative Relaxation Technique (DMRT) tool for sleep difficulty. In other words, the machines and numbers validated the personal psychological experiences and the physical behavior-responses of the participants, scientifically. Based on my past experience and examination of the DMRT with participants in uncontrolled and controlled environments, I believe the results produced in this study will aid the human condition.

Lavie et al., (1979) conducted a study on self-awakening with a sample size of seven (6 males, 1 female). The study findings indicated that REM periods may be seen as “gating periods” for awakening. In addition, Kaida et al. (2005) conducted a study with a sample size of nine (7 males, 2 females). Kaida et al., (2005) determined that self-awakening prevents acute increased blood pressure and heart rate that occurred simultaneously with arousal in elderly people, and they postulated that self-awakening reduced the risks of coronary heart attack that may occur from awakening suddenly. In spite of the small sample sizes used, for example, in these studies, the knowledge gained from these findings remains in the academic community.

Whenever there are large enough random sample, almost any result will turn out to be statistically significant (Fraenkel & Wallen, 2003) with no practical value, at times. Fraenkel and Wallen (2003) stated, “Ironically, the fact that most educational studies involve smaller samples may actually be an advantage when it comes to practical significance”; that is, “smaller sample size makes it harder to detect a difference even when there is one in the population, a larger difference in means is therefore required to reject the null hypothesis” (p. 237). The authors contended this is because a smaller sample results in a larger standard error of the difference in means (SED). Fraenkel and Wallen (2003) concluded that a larger difference in means is required to reach the significance level with the smaller sample.
As Fraenkel and Wallen (2003) suggested, sample size, for example, of eight participants produced prediction dependent variables trends with a moderate to large delta and power for (1) difficulty falling asleep index (.69, .54); (2) wake before alarm index (-1.54, .99); and (3) difficulty waking from sleep index (1.40, .97) respectively, that helped aid the participants’ most challenging problem: to be awake and alert in sleep-offset in order to pursue their academic career. As the author suggested, a small sample of eight produced the two objective dependent variables’ trends with a large delta and power for (1) Self-Awakening Scale Index (1.3, .95) and (2) wake before the alarm cue index (-1.30, .95), respectively.

Therefore, the sample size was sufficient to answer the major problems of college students focused on in this study, and the researcher calls for additional studies to validate these results and examine the value that the DMRT offers to university students, in particular, and the public in general. Sample size may reduce confidence for some in the results; however, one should not ignore practical significance that showed how the powers of the conscious, subconscious, and unconscious mind affect and initiate behavior-responses to a “cue” stimulus practiced just before sleep with a “tool” called the DMRT that helped the human condition.

Factors affecting sample size in this study: Advertisement did not extend for three months as planned; ListSers were not used; participants failed screening because of the lack of familiarity of the Excel operating systems; the Thanksgiving holiday break was an interference, perhaps, because some participant withdrew fearing the lack of time to devote to the study and its procedures; and/or the approaching final exam week of the fall quarter that was paramount to their studies more so than participating in a sleep study. The researcher calls for a repetition of the study to be conducted with a larger sample under better conditions to help validate the results of this study. In fact, this study should include two academic semesters in order to obtain the
sample size needed and to conduct the experiment that includes the allowance for a dropout rate that will not hurt the sample size.

This study was a one-group pretest-posttest design, a repeated-measures design, and a time-series design. Because the pretest is added to a one-group pretest-posttest design, the researcher at least knows whether any change occurred. The one-group pretest-posttest design is classified as a weak experimental design because it lacks a control group or a comparison group; that is, it may make it harder to determine if the results are derived from the treatment.

Extraneous variables were controlled by using subjects as their own controls: When subjects are used as their own controls, their performance under both (or all) treatments is compared. However, threats to internal validity may include history, attitudes of subjects, the Hawthorne effect, and implementation. Any or all of these may influence the outcome of the study.

Notably, history threat was evident in this study. Three students (1) survived the 2-day screening by returning sleep diary and two instruments within two days; (2) survived a 7-day week of collecting sleep/wake cycles and returning them daily but no later than two; (3) survived a one-hour DMRT training day; and (4) then disappeared. After contacting the participants, (1) one said his computer crashed; (2) one was studying for exams and did not have time to sleep; and (3) one started a seasonal job for the Christmas Holidays. Yet, one may look at this group withdrawal rate in other ways too. Once participants received the DMRT, they had received the “why” they entered the study. In other words, the DMRT study needs to attract participants that have the time to invest, as well as, the care that is needed in order for the study to be successful. The students who invested their time indicated they were searching for real answers to real sleep issues. Perhaps, a more clinical sample is best for this type of study.
This is also a quasi-experimental design because it does not include the use of random assignment. This quasi-experimental design included a repeated-measures design and a time-series design when a single group of participants were measured 21 nights or three weeks in the experimental part of this study: seven nights without treatment and 14 nights with the DMRT (intervention). If the group scores essentially the same on the pretests and then considerably improves on the posttests, the researcher has more confidence that the treatment is causing the improvement than if just one pretest and one posttest are given (Frenkel & Wallen, 2003).

Time-series designs usual threats to internal validity (instrumentation and testing leading to practice effect) were controlled in the experiment as indicated in the Method section of this study, but history threat is unpredictable. However, once the experimental weeks began, eight participants remained in the study to its completion; the sleep diary’s requests of time estimates did not change; and testing was not a threat because participant used the sleep diary to record the times of their sleep/wake behavior in the space and time that it occurred or within hours of the occurrence of the behavior. Hence, the time-series design is a strong research design to employ.

The inclusion of a repeated-measures design in this study was instrumental in reducing the subject differences in the study because the $F$-ratio statistic was used to calculate the data. Repeated-measures design removes the individual differences from the data and, therefore, tends to reduce the sample variance. Sample variance is equivalent to noise and confusion in the data. Reducing sample variance makes it easier to see patterns in the data and increases the likelihood of finding significant results (Gravetter & Wallnau, 2000). Gravetter and Wallnau (2000) stated “Reducing the sample variance also reduces the standard error and produces a more precise and sensitive test for mean differences” (p. 354).
The Deep Meditative Relaxation Technique (DMRT)

However, a small sample size may have played a role in the outcome of the results. Although the self-awakening quality and the waking quality variables produced significant results with power greater than .90, the sleep continuity variables (difficulty falling asleep, waking after sleep-onset, number of wakes, and total sleep time) did not produce power values greater than .80. This could be a result of the sample size or it may be a result of the fact that the participants were, basically, not a clinical sample. In other words, their sleep behaviors were basically normal or mildly normal or on the edge of being normal. Yet, the new facets of the study centered on waking before the alarm and waking-alertness for the first six hours after the last awakening, both of which produced substantial differences from pretesting to posttesting.

Sample size has been calculated to include at least 30 participants, and if there are only 15 in the group, the study must be repeated before actual confidence may be placed in the results (Fraenkel & Wallen, 2003). Yet, one must take in consideration the fact that in this repeated-measures time-series designed study eight participants produced 21 measurements in three weeks for a total of 168 measurements on each one of the variables. The day-to-day measurements were reduced to averages per week to produce three scores for three weeks. Yet, the three weekly measurements provided each participant with three votes in comparison to one vote per person in other study designs; that is, the sample represented 24 votes on each variable. Since this number is less than the traditional 30 participants to validate a study, the study should be repeated to increase confidence in the results.

Finally, DMRT is a psycho-physiological mind/body system that is self-generated to produce a task requested by the Self just before sleep. The most obvious limitation is the failure to believe in one’s Self. The only requirement is to: Tell the Self What to Do, Just Before Sleep!
DMRT Future Research

Since we are dealing with the powers of the conscious, subconscious, and unconscious mind, I propose that the DMRT be examined on even a higher level of performance than seen in this study. Although I have used the DMRT for years now, I have experienced “waking 5-minutes before the alarm” on a consistent basis just by Thinking It! If I can do it, others are capable of doing it too. Perhaps, some are already doing it. Since, I have this DMRT conditioning, it is hard to determine when this “skill” would materialize for others.

Most sleep interventions that attempt to change sleep/wake behavior are tested for approximately 10 weeks before results are collected. However, as the findings of this study revealed, participants indicated they were waking within 15 minutes of the alarm five weeks after the study was completed, and they indicated that with more practice they believed they could wake within 10 minutes before the alarm time, consistently. This increasing sleep-efficacy, sleep-control, and self-control indicated that with practice the mind is capable of doing what is suggested just before sleep.

Therefore, I propose that the DMRT will increase the frequency of the ability to “wake before the alarm” just by “thinking” the cue to “wake 5-minutes before alarm” just before sleep without the actual projection of the thought to the body parts, but silently spoken to the Self. I posit that the DMRT conditioning must occur first, or not. However, how much conditioning is the question that needs to be answered to determine when just “thinking” the cue to “wake 5-minutes before alarm” will be effective, consistently.

Also, developing this “skill” of the DMRT’s increased waking ability would benefit the population in general and students in particular since students are so pressed for time and meeting schedule is paramount to achieving their academic goals without the burden of sleep.
difficulty problems. In other words, the DMRT would increase student’s physical waking ability before the alarm to meet schedule, and it would increase the distinct self-awakening feature of waking mentally in waking-life that produces the increased waking-alertness, increased mind/body rejuvenation, and increased motivation that were seen in the results of this study.

In addition, based on the findings of this study, the DMRT should be explored in examining sleep difficulty problems (e.g., insomnia, wake after sleep-onset insomnia, delayed sleep phase syndrome). Sleep difficulties have been approached in the manner of attempting to increase the clients total sleep time, as well as relieve sleep-onset difficulty. Perhaps, an approach should be attempted with a focus on the whole mind/body systems that incorporate the unified effort of the Self to aid in this process with the use of the DMRT.

The DMRT focuses on removing the issues of falling asleep by initiating rest and relaxation in order to achieve quality sleep. The goal of achieving restful and relaxing sleep is to rejuvenate the mind/body system that prepares one for the following day’s activity. Without this restful sleep, cognitive issues as well as fatigue interfere with waking life activities.

The DMRT offers a “tool” to help aid sleep difficulties, and the benefits to those with minor or severe sleep difficulties would be beneficial to the human condition. Future research should pursue the many possibilities and benefits that the DMRT would, more likely than not, add to relieving sleep difficulties.

Furthermore, future research indicates that the DMRT intervention be tested in its “original-mode” rather than the “experimental-mode” used for control exercised in the present study when participants were instructed to begin the practice of the technique out-of-bed first. The original DMRT is done All-In-Bed. The control element was imputed to assure participant projected the “cues” to all of the mind/body systems before dozing off to sleep.
It would be scientifically noteworthy to determine if the same results are obtained if participants performed the DMRT *All-In-Bed*, only. Perhaps, a deeper level of sleep may be accomplished when participants are more relaxed by lying in bed throughout the entire process, thereby, producing (1) a “waking-alertness” that may go beyond the six hours projected in this study, (2) increase waking before the alarm time “consistency success rate” to seven days per week instead of five, and (3) increase waking-alertness in sleep-offset change-effect-time (learning-effect) to six to seven hours, like the other sleep continuity variables did in this study.

To accomplish a deeper level of sleep is the goal of all people and insomniacs alike! The out-of-bed control used in the present study produced the sleep needed for active individuals like students in this study. Perhaps, for individuals with more severe sleep difficulty like severe insomnia or hypersomnia, a deeper level of sleep may be warranted. Similar to DMRT therapy with insomnia and situation anxiety disorders in 2003, DMRT was administered all-in-bed (Elms, 2007). In essence, when adjusting sleep/wake behavior of a more severe nature, the Deep Meditative Relaxation Technique should be explored in its original procedures “All-In-Bed.”
The Deep Meditative Relaxation Technique (DMRT)

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The Deep Meditative Relaxation Technique (DMRT)


http://www.macses.ucsf.edu/Research/Allostatic(notebook/sleep.html


The Deep Meditative Relaxation Technique (DMRT)

pain. *Pain, 75*, 75-84.


## Appendix I

### Sample Size Computations

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<th>Statistical Test</th>
<th>T test Mean Difference</th>
<th>ANOVA RPM</th>
<th>MANOVA RPM</th>
<th>MANOVA RPM</th>
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<tr>
<td></td>
<td>2-Week Means</td>
<td>2-Week Means</td>
<td>2-Week Means</td>
<td>3-Week Means</td>
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<tr>
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</table>

| NI = 12 to 33 |

Note.
RPM = Repeated Measures
ANOVA = Analysis of Variance
MANOVA = Multivariate analysis of Variance
Alpha α = .05, one-tailed, significant level
Effect Size (ES) = Delta (d) or F ratio (f)
Power (1 – beta) = .80 - .82
Coef = Coefficient
r = Pearson Product Moment Statistic
Reliability Coefficient; r = .50 (large effect size)
N = Number of Individuals in the sample
NI = Sample Size Interval
NI = (Minimum to Maximum Individuals in Interval)

Appendix II: DMRT Recruitment Flyer

Deep Meditative Relaxation Technique (DMRT) Research

NOTICE: SEEKING PARTICIPANTS FOR SELF-CONTROL SLEEP STUDY!

The study is open to college communities in Ohio

ARE YOU HAVING PROBLEMS FALLING ASLEEP / AWAKENING FROM SLEEP?

Are you awakening in the middle of the night and it’s hard to go back to sleep?

Are you sleeping past the expected wake-up time?

When the hour comes to take exams or make presentations,

Are you too Anxious/Drowsy/Confused to Think?

IS IT POSSIBLE TO CONTROL WAKING BEHAVIOR THRU SLEEP?

Do you know Your REM DREAMS Miss You?

IS IT POSSIBLE TO SLEEP & TO AWAKE AT WILL?

Are you willing to take 3 weeks out of your life to study your sleep/wake behavior?

If any of the above questions are true for you,

JOIN THIS STUDY!

The purpose of the research study is to determine the DMRT’s Ability to Teach You

How to Speed-Up Sleep-Onset & Self-Awakening At a Pre-set Time

The study is conducted with the University Of Cincinnati (UC). This study has been approved by UC Institutional Review Board. Participation is Voluntary! Study ends with a Debriefing Party to share experiences with fellow Participants and/or to ask the PI questions. You Are Not Required to Have Sleep Difficulties in order to participate in this 3-week study. Invite Your Colleagues to Participate! You will be compensated for your time.

If you are interested in being selected as a Participant in this DMRT Sleep Research Study,

Please Contact Henrietta Elms at elmsh@mail.uc.edu

Contact Information
Appendix III

PI: Henrietta Elms IRB# 09042003E                                         Research Approved: 5/22/09-2012

DMRT Study Audiovisual Recording Release Form

The Deep Meditative Relaxation Technique (DMRT) research study activities “will be” Audiovisual Recorded by the Researcher. The audiovisual recording release form is provided for the potential participant to agree (or not agree) to be audiovisual taped. You are asked to sign the form with your chosen self-created fictitious 4-digit “digital signature” when you receive and return a copy of this form via email. It will be signed with your name at the door of the meeting.

The form assures the potential participant that every effort will be made to ensure the concealment of his or her identity by editing audiovisual recordings: (1) Facial features will be “camouflaged” with special camera features; (2) voice enhancements will be used to “camouflage” voice recognition; and/or (3) caption (or written language scripts) will be used on the viewing screen to eliminate voice recognition.

Cart-Written transcripts will be forwarded to the researcher 72 hours after their conception. All entrustment notes, audiotapes, videotapes, cart writings (meeting notes), and transcripts will be stored in a locked file cabinet as a permanent record of the researcher.

Legal Rights: This Release Form does not waive any legal rights you have. The Release Form does not release the investigator, the sponsor, the institution, or its agents from liability for negligence. The DMRT was developed by the investigator. You do not have the legal right to portray the DMRT as your own in any methods or publications. Any written and/or audiovisual recording of the DMRT study activities are the sole property of the Researcher, Henrietta S. Elms. Any reproduction or distribution of the DMRT or the DMRT Study sessions’ activities (writings or audiovisuals) are prohibited, unless “notarized” written permission is granted by the Researcher, Henrietta Elms. Written permission must be granted by the Researcher before DMRT study data (writings and/or audiovisuals) are reproduced, distributed, or published for any reasons (i.e., teaching aids, for sell, or publications).

I Understand That Whether or Not I Agree To Be Audiovisual Recorded Will Not Affect My Chances to Participate.

1. Participant’s Signature for Permission “To Be” audiovisual recorded in DMRT Study.

_________________________________           _______________________________
Digital Signature (4-digit number)                  Date

Or: Participant’s Signature for Permission “Not To Be” audiovisual recorded in DMRT Study.

_________________________________           _______________________________
Digital Signature (4-digit number)                  Date

2. Participant’s Signature completing this form at the Meeting

_________________________________           _______________________________
Signature                               Date

_________________________________           _______________________________
Professional Counselor, M.A.                  Date

Potential Participant ID provided at the Meeting: DMRT Study Section 3-digit ID# ____________

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Title of Study: Effects of the Deep Meditative Relaxation Technique (DMRT) On Nocturnal Self-Awakening Sleep/Wake Quality Among University Students

Introduction: In order to participate in this research study, it is important that you read this Consent Form. It is important that you understand the purpose, procedures, risks, benefits, and your right to withdraw from the study at any time. Please note that no guarantee or assurance will be made as to the results of the study.

Purpose of Study: The purpose of this study is to test a new sleep and awakening technique called the Deep Meditative Relaxation Technique (DMRT). The DMRT is used to consistently “put you to sleep” and/or “wake you up” at a time that you choose without the aid of an alarm clock or another person. Up to 33 people will participate in this research study.

Duration and Procedures: The study will include three study visits and take four weeks to complete. All three study sessions will be audiovisual taped. At-door-check-in of each meeting, each person will be given a 3-Digit ID Number to replace their name in dialogue exchanges to obscure identity during audio recording. Also, if accidently videotaped, special camera features will be used to camouflage facial recognition.

Study Visit 1 (Screening Visit):

You will be asked to sign this consent form before participation in this study. You must meet screening criteria to participate. Screening is done to determine if you have conditions that may limit your ability to safely participate in this study. However, you may qualify to participate with or without minor sleep problems.

At this visit, you will be given a DMRT screening tool to complete. Information on how to complete the sleep diary and two stress scales will be explained. You will be asked to complete the diary and sleep scales for two days and return these via email to the site by day three in the screening phase.

Individuals who qualify to participate will be notified by email. You will be asked to record your sleep and awakening behavior after nighttime sleep for one week in a sleep diary and two assessment questionnaires.
Study Visit 2: You will receive DMRT training in a 60- to 90-minute group session in week two of the study. After training, you will perform the DMRT for two weeks. You will record the results in a daily sleep diary and two assessment questionnaires. You will return the results by email each day and at the end of each week. After week three, you will receive and complete the DMRT evaluation form. You will return it by email within one week.

Study Visit 3: At this meeting, you will be debriefed. Also, you will be asked to complete the DMRT Follow-Up Form.

**Risks/discomforts:** In performing the DMRT, you are required to exercise deep breathing methods. You will focus on the words suggested by the technique. Because breathing is a process you perform every second of the day, there are minimum risks involved in using the DMRT. There may be minor discomfort in the beginning. As you learn to control your breath, practice will ease whatever discomfort you may experience in time.

**Benefits:** You will benefit from participating in this study. After learning the DMRT, you will have knowledge of ways to address minor sleeping “flaws.” Also, you may receive the results of this study by checking the “Yes” box on the screening questionnaire. You will benefit from this study because you will have learned the DMRT, and you may share it with family and friends to help with their minor sleep problems too.

**Confidentiality:** Every effort will be made to maintain confidentiality. To conceal your identity, ID Codes will replace your name and identifying information written on all paperwork and computer documents. The investigator will not allow anyone (a) to read paperwork completed by you, (b) to read your written transcripts, or (c) to review audiovisual tapes of group sessions.

All audiovisual tapes will be edited to conceal your identity: (1) Facial features will be camouflaged: “deformed,” “disfigured,” or “blotted” with special cameral features; (2) voice enhancement features will be used to disguise voices; and/or (3) caption (or written language scripts) will be used on the screen to eliminate voice recognition.

The study will be published. It may be presented at conferences. However, you will not be identified by your name unless disclosure is required by law. Disclosure required by law includes mandatory reporting of child abuse, elder abuse, or immediate danger to self or others.

**Payments to participants:** Your participation is strictly voluntary. However, for each meeting you attend, you will receive a five-dollar gas-gift certificate for related expenses at the completion of the study.

**Right to refuse or withdraw:** You may refuse to participate in this study. If you are selected for this study, you may discontinue participation at any time. However, the investigator has the right to withdraw you from the study at any time, too. You may be withdrawn from the study for reasons related solely to you. For example, you will be withdrawn if you fail to follow study related directions from the investigator. Or, you will be withdrawn because the entire study has been terminated.
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**Offer to answer questions:** If you have questions about this study, you may contact the Principle Investigator (PI), Henrietta Elms at (937) 643-3053 or elmsh@mail.uc.edu and/or contact the Co-PI, Dr. Ellen Cook at (513) 556-3343 or cookep@ucmail.uc.edu. The University of Cincinnati Institutional Review Board reviews all research projects that involve human subjects to be sure the rights and welfare of participants are protected. If you have questions about your rights as a research participant, you may contact the University of Cincinnati Institutional Review Board at (513) 558-2086. If you have a concern about the study, you may also call the UC Research Compliance Hotline at (800) 889-1547, or you may write to the Institutional Review Board, University Hall, ML 0567, 51 Goodman Drive, PO Box 670567, Cincinnati, OH 45267-0567, or you may email the IRB office at irb@ucmail.uc.edu.

**Legal Rights:** This *Consent Form* does not waive any legal rights you have. The *Consent Form* does not release the investigator, the sponsor, the institution, or its agents from liability for negligence. The DMRT was developed by the investigator. You do not have the legal right to portray the DMRT as your own in any methods or publications. Any written and/or audiovisual recording of the DMRT study are the sole property of the Researcher, Henrietta S. Elms. Any reproduction or distribution of the DMRT or the DMRT Study sessions’ activities, writings or audiovisuals, are prohibited, unless “notarized” written permission is granted by the Researcher, Henrietta S. Elms. Written permission must be granted by the Researcher, Henrietta S. Elms, before DMRT study data (writings/audiovisuals) are reproduced, distributed, or published for any reasons (i.e., teaching aids, for sell, or publications). If the DMRT technique is marketed, Dr. Elms will receive financial compensation. There are no plans to offer you financial compensation or share any profits from the commercialization of any products or processes developed from your participation in this study. However, you will not lose any legal rights to which you are entitled by signing this consent.

**I HAVE READ THE INFORMATION PROVIDED ABOVE. I VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY. I WILL RECEIVE A COPY OF THIS CONSENT FORM FOR MY INFORMATION.**

__________________________________________________________________________  ________________________
Participant Signature                                                                                     Date

__________________________________________________________________________  ________________________
Professional Counselor, M.A,                                                                                     Date
Signature and Title of Person Obtaining Consent
Appendix V

Pilot Study: DMRT Psychometrics

Pilot testing was conducted to assess the psychometric characteristics of the instruments used in the examination of the Deep Meditative Relaxation Technique (DMRT). At the very minimum, a researcher who develops a new measure should establish that it has face validity; that is, the measure apparently reflects the content of the concept in question (Bryman & Cramer, 1999). Content validity is the extent that a measurement instrument is a representative sample of the domain being measured (Cone & Foster, 2006; Fraenkel & Wallen, 2003). It refers to how well the measure (1) samples the universe of content relevant to the construct or behavior being assessed, (2) omits irrelevant content, and (3) contains a balance of indicators of the construct (Haynes, Richard, & Kubany, 1995).

Major focus of the pilot study rest in evaluating the psychometric characteristics of the dependent variables predicted: WBAI, DWFSI, and DFASI; and two objectives: SASI and WBACI. Various statistical methods were employed to assess the validity and reliability coefficients.

METHOD

Sample

Convenient sampling was used; that is, a sample that was chosen by the investigator. Also, purposive sampling was used to specifically represent the target population who may provide the richest possible feedback (e.g. articulate, perceptive, criteria, etc.). There were five participants (4 females and 1 male) with a mean age of 46.20 years (SD = 11.75, range = 34–62 years) represented in the current data set. The five participants possessed student classifications who attended universities in a southern Midwestern State. Characteristically, there were three
undergraduates, one master level student, and one doctor student. All volunteers signed a consent form to participate. The University of Cincinnati Institutional Review Board – Social Behavioral Sciences approved this study in 2009.

**Apparatus**

Computers and Microsoft Office (2007) *Excel Workbooks* were used to transport the data via email. The Statistical Package for the Social Sciences (SPSS) (2002) Software was used for data analysis. Microsoft Office (2007) *Word* Spell Checker was use for readability statistical analysis.

**Measures**

There were 13 dependent variables (DVs) derived from the rating scales from the following instruments: (1) the DMRT Sleep Diary (DmrtSD), (2) the Elms Sleep/Alertness Scale-II (ESAS-II), (3) the Elms Sleep-Onset Stress Scale-II (ESOS-II), (4) the Self-Awakening Scale (SAWS), and (5) the Sleep/Wake Efficiency Scale. In the DmrtSD, DVs produced without several variables time’ calculations were (1) Sleep-onset latency (SOL); (2) Wake after sleep-onset (WASO); (3) Number of wakes (NOW); (4) Sleep quality (SQual); (5) Sleep mood (SMood); and Total Sleep time (TST) (Appendix VI).

In addition, the ESAS-II produced the Difficulty Waking From Sleep Index (DWFSI). The ESOS-II produced the Difficulty Falling Asleep Index (DFASI). The Sleep/Wake Efficiency Scale produced the sleep efficiency (SE) variable. The Self-Awakening Scales produced (1) Self-Awakening Scale Index (SASI), (2) Wake Before Alarm Index (WBAI), (3) Wake Before Alarm Cue Index (WBACI), and (4) Difficulty Waking Before Alarm Index (DWBAI). All 13 DVs and their scales’ descriptions are described in (a) the Instrumentation section of the proposal and/or (b) DmrtSD Manual (Appendix VI).
The Deep Meditative Relaxation Technique (DMRT)

**Procedures**

In three two-hour meetings, participants (separately or in couples) examined the DMRT Informed Consent Form, DMRT Screening Questionnaire, DmrtSD, ESAS-II, and ESOS-II. Participants were instructed to read and follow the instructions listed on the instruments. They were also informed to ask questions for clarity if necessary. The researcher addressed and clarified all questions raised about the instruments. Participants were presented the instruments in the order that they are expected to be used in the original study. The DMRT Informed Consent Form (IRB Approved) was read and signed before the instruments were introduced.

Participants collected sleep-wake cycles for two weeks on the DmrtSD, the ESOS-II, and the ESAS-II. Microsoft Office (2007) Excel Workbooks were used to transport the instruments via email. Participants returned workbooks every three days and/or after their completion at the end of the week. As instructed, participants placed a copy of the DmrtSD, ESOS-II, and the ESAS-II by their bedside for easy access to record sleep-wake cycles.

**Data Analysis**

The participants’ data from the two-week sleep-wake cycles on the various instruments evaluated content, criterion-related concurrent, criterion-related predictive, and construct evidence of validity with the validity coefficients. Also, test-retest reliability was obtained for the 13 DVs in the study with reliability coefficients. Logic validity and correlation coefficients were used for data reduction. SPSS (2002) procedures were used to produce the validity and reliability coefficients. Microsoft Office (2007) Word was used to produce readability statistics.

**Discussion of the Results**

Pilot testing indicated the students’ questions for understanding centered on the following sleep diary DVs’ requested times and questions: (1) sleep-onset latency (SOL), (2) wake after
The Deep Meditative Relaxation Technique (DMRT)

Sleep-onset (WASO), (3) the number of wakes (NOW), and (4) the final wakeup time in calculating total sleep time (TST). After explicit explanations and examples, the participants were able to respond appropriately. Wording was changed for clarity.

The format of the rating-scales on the instruments was changed via a student’s suggestion to make the instruments “user friendly.” Students’ understanding of the content of the instrument was demonstrated in the results of their scores on the various scales that produced validity coefficients and reliability coefficients. Evidence of face validity, content validity, logic validity, and responsiveness to the content of the scales were achieved.

**Readability Statistics**

Readability of instruments is critical to their psychometric performance (Heppner et al., 1999). Readability of the instruments was determined with the Spell Checker in Word in Microsoft Office (2007). Readability statistics for “Flesch Reading Ease” and “Fresch-Kincaid Grade Level” for the instruments include the following: (1) DMRT Screening Questionnaire results were 72.6 and 5.5, (2) the DMRT Sleep Diary results were 71.4 and 5.8, (3) the Elms Sleep-Onset Stress Scale-II results were 52.6 and 7.7, (4) the Elms Sleep/Alertness Scale-II results were 68.1 and 6.1, and (5) the DMRT Evaluation Form results were 79.9 and 4.7, respectively.

All instruments produced a “large” to “moderately high” readability level (52.6 to 79.9) that ranged from a fourth to seventh grade level. These fourth to seventh grade level readability statistics are appropriate for most instruments used in the general population (Devellis, 2003).

**Pilot-5 Data**

The two-week sleep-wake cycles’ data provided by the sample (N = 5) were labeled *Pilot-5 Data*. By collecting this data, problems with administration and scoring were identified.
early and corrected before the original study began. Statistically, Pilot-5 Data helped to ensure that the scoring plan is accurate and consistent for all measures used in the DMRT study.

**Normality Confirmation**

Normality was examined to determine whether or not parametric tests were appropriate for the data collected on the instruments. The descriptive statistics for the Pilot-5 Data results are located in Table-V1 and Table-V2. The overall kurtosis and skewness indicated a distribution that was not significantly different from normal (Table-V1, V2). Evidence of normality was also seen in the One-Sample Kolmogorov-Smirnov Test (nonparametric test) (Table-V3, V4). The One-Sample Kolmogorov-Smirnov Test produces a $Z$ statistic to determine whether the distribution of the members of a single group differ significantly from a normal (or uniform, or Poisson) distribution.

For example, the One-Sample Kolmogorov-Smirnov-$Z$ (K-S-$Z$) Test results were (1) SASI, K-S-$Z$(5) = .351, $p = 1.00$, 2-tailed; (2) WBAI, K-S-$Z$(5) = .714, $p = .687$, 2-tailed; (3) DWFSI, K-S-$Z$(5) = .402, $p = .997$, 2-tailed; (4) DFASI, K-S-$Z$(5) = .882, $p = .510$, 2-tailed; and (5) WBACI, K-S-$Z$(5) = .882, $p = .510$, 2-tailed (Table-V4). The Kolmogorov-Smirnov-$Z$ indicated a probability of 1.00, .997, .510, and .510 for the SASI, WBAI, DWFSI, DFASI, and WBACI, respectively. These large significance $p$-values indicate that the distribution of final points do not differ significantly from normal, and other procedures beside nonparametric statistics may be used for this type of data (George & Mallery, 2006).

The descriptive statistics (skewness and kurtosis) (Table-V1, V2) and the One Sample Kolmogorov-Smirnov-$Z$ (K-S-Z) Tests (Table-V3, V4) results indicated the distributions of Pilot-5 Data are not significantly different from normal. Consequently, verification of Normality of Pilot-5 Data scores’ distributions allows the use of more powerful parametric statistic tests.
The Deep Meditative Relaxation Technique (DMRT)

**Table-V1: Descriptive Statistics – Week1**

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<th>Std. Dev</th>
<th>Varian</th>
<th>Skewness</th>
<th>Kurtosis</th>
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a. Test distribution is Normal.  b. Calculated from data

**Table-V2: Descriptive Statistics – Week2**

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a. Test distribution is Normal.  b. Calculated from data

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The Deep Meditative Relaxation Technique (DMRT)

**Table V3: One-Sample Kolmogorov-Smirnov Test – Week1**

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a. Test distribution is Normal.  
b. Calculated from data.

**Table V4: One-Sample Kolmogorov-Smirnov Test – Week2**

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a. Test distribution is Normal.  
b. Calculated from data.
Validity/Reliability Coefficients

Validity Coefficients

Similar to the case of reliability, validity is a property of the scores and not of the instruments (Heppner et al., 1999). The validity characteristics of the scores on the respective scales for the developed instruments for this study focused on the following evidence: (1) face validity, (2) content validity, (3) criterion-related concurrent validity, (4) criterion-related predictive validity, (5) convergent validity, (6) construct validity, and (7) logic validity.

Fraenkel and Wallen (2003) explained, “When a correlation coefficient is used to describe the relationship that exists between a set of scores obtained by the same group of individuals on a particular instrument and their scores on some criterion measure, it is called a validity coefficient” (p. 162). A validity coefficient expresses the relationship that exists between scores of the same individuals on two different instruments (Fraenkel & Wallen, 2003).

Validity and reliability coefficients were obtained with the Pearson Product Moment (r) statistic in the Bivariate Correlations procedure in SPSS (2002). The Pearson’s r statistic (one-tailed level) was calculated for the 13 DVs of the Pilot-5 Data (Table V5, V6). For example, the validity coefficients for the DVs of interest include: (a) SASI and DWFSI, $r(5) = .86$, $p = .029$, at the .05, one-tailed, level; (b) SASI and DFASI, $r(5) = .17$, $p = .393$, at the .05, 1-tailed, level; (c) SASI and WBAI, $r(5) = -.95$, $p = .007$, at the .05, 1-tailed, level; (d) WBAI and DWFSI, $r(5) = -.78$, $p = .061$, at the .05, 1-tailed, level; (e) WBAI and DFASI, $r(5) = .000$, $p = .50$, at the .05, 1-tailed, level; (f) WBACI and SASI, $r(5) = -.677$, $p = .105$, at the .05, 1-tailed, level; (g) WBACI and WBAI, $r(5) = .43$, $p = .235$, at the .05, 1-tailed, level; (h) WBACI and DWFSI, $r(5) = -.732$, $p = .080$, at the .05, 1-tailed, level; (i) WBACI and DFASI, $r(5) = -.612$, $p = .136$, at the .05, 1-tailed, level; and (j) DWFSI and DFASI, $r(5) = .61$, $p = .138$, at the .05, 1-tailed (Table V5).
### Table-V5: Bivariate Correlations-Validity Coefficients Week1

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**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).
### Table-V6: Bivariate Correlations-Validity Coefficients Week2

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* Correlation is significant at the 0.05 level (1-tailed).

** Correlation is significant at the 0.01 level (1-tailed).
Convergent Validity

The scores have convergent validity if they relate to scores on other ways of assessing the same behavior of a construct. For example, sleep-onset latency (SOL) and wake after sleep-onset (WASO) are validated standard measures in a sleep diary. The newly developed Elms Sleep-Onset Stress Scale-II was developed to assess difficulty falling asleep by combining the SOL and WASO concepts to define the behavior explicitly. The validity coefficient for the difficulty falling asleep index (DFASI) and SOL was $r(5) = .41, p = .248$, at the .05, one-tailed alpha level; and validity coefficient for the DFASI and WASO was $r(5) = .32, p = .302$ at the .05, one tailed, alpha level (Table-V5).

The validity coefficients for both pairs indicate the effect size of DFASI and SOL ($r = .41$) and the DFASI and WASO ($r = .32$) maintain a medium relationship in magnitude. Hence, the scores produced by the DFASI, SOL, and WASO scales are evidence of both concurrent validity and convergent validity. Also, the DFASI, SOL, and WASO results provide evidence of construct validity because together they measure a characteristic that will not be directly inferred (Cone & Foster, 2006).

Criterion-Related Concurrent Validity

Criterion-Related Concurrent validity is obtained if scores on the criterion are available at the same time as scores being validated (Fraenkel & Wallen, 2003). Concurrent validity may be tested by identifying the correlation between a new instrument and a previously validated instrument for measuring the same concept (Seong, 2002). Concurrent validity evidence was provided with the Difficulty Falling Asleep Index (DFASI) and sleep-efficiency (SE).

The Sleep/Wake Efficiency Scale measures SE (Table V7, V8). SE is calculated with wake after sleep-onset (WASO), Sleep-Onset Latency (SOL), and Total Sleep Time (TST); that
### Table V7: Sleep/Wake Efficiency Calculation Scale

<table>
<thead>
<tr>
<th>Description</th>
<th>Severely Poor SE</th>
<th>Somewhat Poor SE</th>
<th>Good SE</th>
<th>Very Good SE</th>
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<tbody>
<tr>
<td>Hour (h)</td>
<td>1 h</td>
<td>3/4 h</td>
<td>1/2 h</td>
<td>1/4 h</td>
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<tr>
<td>Minutes (m)</td>
<td>60 m</td>
<td>45 m</td>
<td>30 m</td>
<td>15 m</td>
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<tr>
<td>Total Wake Time (TWT)</td>
<td>46 to 60 m</td>
<td>31 to 45 m</td>
<td>16 to 30 min</td>
<td>1 to 15 min</td>
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<tr>
<td></td>
<td>TWT X %</td>
<td>TWT X – ¼ %</td>
<td>TWT X – ½ %</td>
<td>TWT X – ¼ %</td>
</tr>
<tr>
<td>Hour-2</td>
<td>1/2 .50</td>
<td>1.25 .62</td>
<td>1.5 .75</td>
<td>1.75 .87</td>
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<td>Hour-3</td>
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<td>2.25 .75</td>
<td>2.5 .83</td>
<td>2.75 .91</td>
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<td>3.25 .81</td>
<td>3.5 .87</td>
<td>3.75 .93</td>
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<td>4.25 .85</td>
<td>4.5 .90</td>
<td>4.75 .95</td>
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<td>Hour-6</td>
<td>5/6 .83</td>
<td>5.25 .87</td>
<td>5.5 .91</td>
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<td>6.5 .92</td>
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<td>7.5 .93</td>
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<td>11.25 .93</td>
<td>11.5 .95</td>
<td>11.75 .97</td>
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</table>

| TWT SWES | 46-60 m | 80-84% | 16-30 m | 90-94% | 1-15 m | 95-97% |

Note 1. Formulas based on (5 hrs ≤ TST ≤ 9 hrs)
TWT: [WASO + SOL]
ST: [EBT – FWT]
TST: [ST – TWT]
SE: TST / [TWT + TST] = %

Minute: m, min. h = Hour. % = Percentage.
ST = Sleep Time (enter bed time (EBT) minus final wakeup time (FWT)
TWT: Total Wake Time
TWT = Wake after sleep-onset (WASO) plus sleep-onset latency (SOL).
TWT: It is anchored on a graph linear line (1 to 60) minutes on 4 levels (1/4 hour or 30-minute intervals).
TST: Total Sleep Time. TST = ST – FWT
SE = Sleep Efficiency
SE is graphed on a linear line: 80% ≤ SE ≤ 97%.
Percentages: Two Significant digits (no rounding off).
SWES consists of calculations based on criteria for TST in a sleep period for average population = (5 hrs ≤ TST ≤ 9 hrs)
TWT: Wake after sleep-onset (WASO) plus sleep-onset latency (SOL).
TWT: It is anchored on a graph linear line (1 to 60) minutes on 4 levels (1/4 hour or 30-minute intervals).
TWT is a Ratio Scale
SE is graphed on a linear line: 80% ≤ SE ≤ 97%.


### Table V8: Sleep/Wake Efficiency Scale (SWES)

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<th>Descriptive</th>
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<th>Good SE</th>
<th>Somewhat Poor SE</th>
<th>Severely Poor SE</th>
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<td>TWT SE%</td>
<td>TWT SE%</td>
<td>TWT SE%</td>
<td>TWT SE%</td>
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<tr>
<td>1-15 m</td>
<td>95-97%</td>
<td>16-30 m</td>
<td>90-94%</td>
<td>31-45 m</td>
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</tbody>
</table>

Note. Minute (m). Percentage (%).
SWES consists of calculations based on criteria for Total Sleep Time (TST) for average population: (5 hrs ≤ TST ≤ 9 hrs)
TWT: Total Wake Time.
TWT = Wake after sleep onset (WASO) plus sleep-onset latency (SOL).
TWT: It is anchored on a graphic linear line (1 to 60) minutes on 4 levels (1/4 hour or 30-minute intervals).
TWT is a Ratio Scale
ST = Sleep Time (enter bed time (EBT) minus final wakeup time (FWT)
TST = ST – FWT
SE = TST divided by [TWT + TST] = percentage (%).

The Deep Meditative Relaxation Technique (DMRT) is, SE is measured by validated sleep continuity variables (See details in DmrtSD-VS-Manual, Appendix-VI; Sleep Continuity Psychometric History Chart (1967-2003), Appendix-X).

Sleep efficiency (SE) is the proportion of time in bed to “actual sleep” obtained. Logically, if one has difficulty falling asleep, SE (actual sleep time) will be reduced as indicated with the validity coefficient for DFASI and SE, $r(5) = -.54$, $p = .177$ at .05, one-tailed, level (Table-V5). The effect size of the pair ($r = -.54$) was large. Since the two constructs are basically measuring the same behavior concept or sleep quality, convergent validity evidence was provided. Also, evidence of construct validity was provided because they both measure a characteristic that will not be directly inferred.

Criterion-related concurrent validity evidence was provided for the Difficulty Waking From Sleep Index (DWFSI) with the sleep quality (SQual) and sleep mood (SMood) DVs. Sleep quality and sleep mood are known sleep continuity variables measured on a sleep diary. They describe participants’ perception of their waking life quality in relationship to the sleep received the night before (See details in DmrtSD-VS-Manual in Appendix-VI.).

The Elms Sleep/Alertness Scale-II (ESAS-II) also measures the perceptions of the participants’ waking-life quality in relationship to sleep received the night before. Because both are measuring the same behavior that refers to sleep-offset quality (waking-life quality), the validity coefficients for (1) DWFSI and SQual, $r(5) = .81$, $p = .048$ at .05, one-tailed, level and (2) DWFSI and SMood, $r(5) = .77$, $p = .065$ at .05, one-tailed, level provide evidence of concurrent, convergent, and construct validity for the DWFSI (Table-V5).

The Self-Awakening Scale (SAWS) consists of the rating scales for four variables: (1) Self-Awakening Scale Index (SASI), (2) Wake before alarm index (WBAI), (3) Wake before alarm cue index (WBACI), and (4) Difficulty waking before alarm index (DWBAI). In the
The Deep Meditative Relaxation Technique (DMRT)

literature, the SAWS is used to measure awaking (1) before alarm; (2) at the alarm; and (3) after the alarm times (Moorcroft et al, 1997). Similar, the SASI represents the same three times interval (average), thereby, providing evidence of concurrent validity with a traditionally known scale. Unlike the SAWS (negative 120 minutes to positive 120 minutes), the SASI measures awakening times but also places the times on five performance levels (Table 2).

The WBAI measures the frequency of waking before the alarm time per 7-day week. Although measured in “number of times” the behavior occurs, WBAI is represented by the SAWS (negative 120 minutes to negative 1 minute) waking time before the alarm. The WBACI measures the frequency of waking before the alarm within 10 minutes before the alarm time. The DWBAI measures the frequency of the combined behavior of (1) waking at the alarm time and (2) waking after the alarm time.

The self-awakening DVs validity coefficients are as follows: (1) SASI and WBAI, \( r(5) = -.95, p = .007 \) at .05, one-tailed level; (2) SASI and WBACI, \( r(5) = -.68, p = .105 \) at .05, one-tailed level; (3) SASI and DWBAI, \( r(5) = .97, p = .003 \) at .05, one-tailed level; (4) WBAI and WBACI, \( r(5) = .43, p = .235 \) at .05, one-tailed level; (5) WBAI and DWBAI, \( r(5) = -.96, p = .004 \) at .05, one-tailed level; and (6) WBACI and DWBAI, \( r(5) = -.58, p = .152 \) at .05, one-tailed level. All six pairs of self-awakening DVs provided evidence of concurrent and convergent validity because they are measuring self-awakening quality in relationship to sleep received the night before (Table-V5).

Logically, if WBAI or WBACI increases, the DWBAI decreases as indicated by the coefficient with a large effect size \( r = -.96 \) or \( r = -.58 \), respectively. Thus, evidence of content validity and construct validity were provided with these results because of the relevance of the relationships, and the variables measure a characteristic that will not be directly inferred.
The Deep Meditative Relaxation Technique (DMRT)

**Predictive Validity and Convergent Validity**

Criterion-related predictive validity exists if the scores have to be obtained sometime in the future (Bryman & Cramer, 1999). To obtain criterion-related predictive validity, researchers allow a time interval to elapse between administrations of the instrument and obtaining the criterion scores (Bryman & Cramer, 1999; Cone & Foster, 2006; Fraenkel & Foster, 2003; George & Mallery, 2000; Green et al., 2000). The Paired-Samples $t$ Test correlation (one-tailed) results in Table-V9 and/or the Bivariate Correlations-Reliability Coefficients in Table-V10 represent the correlation of the scores from both week-one and week-two of the Pilot-5 Data.

Criterion-related predictive validity evidence provided with the two weeks of validity coefficients for the three predicted DVs includes the following: (1) WBAI, $r(5) = .93$, $p = .011$ at the .05, one-tailed level; (2) the DWFSI, $r(5) = .98$, $p = .002$ at the .05, one-tailed level; and (3) the DFASI, $r(5) = .61$, $p = .136$ at the .05, one-tailed level (Table-V9). The scores indicated high statistical significance in their ability to predict behavior that extends for at least a two-week time period for WBAI and DWFSI at the .05 level. Collectively, the three prediction DVs have large (DFASI, $r = .61$) to high (WBAI, $r = .93$; DWFSI, $r = .98$) effect sizes.

Cone and Foster (2006) contend convergent validity is also assessed when an item is correlated with its own scale; and, an item should be correlated more with its own scale than with scales assessing different constructs that provide discriminant validity. The researcher is concerned with demonstrating that measures harmonize with other measures (Bryman & Cramer, 1999). The Paired Sample Correlation-Reliability Coefficients in Table-V9 consist of the validity coefficients’ estimates that provide evidence of convergent, construct, and predictive evidence of validity (e.g., for WBAI, DWFSI, and DFASI).
The Deep Meditative Relaxation Technique (DMRT)

**Table-V9: Paired Samples Correlations-Reliability Coefficients**

<table>
<thead>
<tr>
<th>Pair</th>
<th>Description</th>
<th>N</th>
<th>Correlation</th>
<th>Sig. 2-tailed</th>
<th>Sig. 1-tailed</th>
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<td>Pair 1</td>
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**. Correlation is significant at the 0.05 level (1-tailed).**

**. Correlation is significant at the 0.01 level (1-tailed).**
### Table-V10: Bivariate Correlations-Reliability Coefficients

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<th>wbai-</th>
<th>dwfs-</th>
<th>dfas-</th>
<th>wbac-</th>
<th>sasi-w2</th>
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<td>5</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).
Construct Validity

Construct validity is the extent that an instrument measures a characteristic that will not be directly inferred (Cone & Foster, 2006; Heppner et al., 1999). One way to establish construct validity is to examine the relation between scores on the instrument and scores on other instruments intended to measure the same and other constructs (Heppner et al., 1999). Fraenkel and Wallen (2003) contend “There are three steps involved in obtaining construct-related evidence of validity: (1) The variable being measured is clearly defined; (2) hypotheses, based on a theory underlying the variable, are formed about how people who possess a ‘lot’ versus a ‘little’ of the variable will behave in a particular situation; and (3), the hypotheses are tested both logically and empirically” (p. 164).

Construct validity evidence will be provided by identifying the groups that are expected to have contrasting scores on the instrument (Yi, Shin, & Shin, 2006). The Self-Awakening Scale (SAWS) helped produced the Self-Awakening Scale Index (SASI). The SASI provided scores from both extreme points on the scale as well as the mid-point of zero. The SASI differs from SAWS in that it also consists of five performance effect size level-indexes.

For example, descriptive statistics results of the minimum score of waking before the alarm was -38 minutes; the maximum score of waking after the alarm was 56 minutes (Table-V1). For SASI, the score of -38 minutes represents the Level 3 severity category, and the score of 56 minutes represents Level 5 severity category (Table-2). Also, Pilot-5 Data Week-1 results consisted of two SASI’s scores (-4 and -14 minutes) in the Level-1 severity category for normal self-awakeners. Consequently, the findings indicated that level differences were identified that provided evidence of group differences, that is, construct validity.
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Group differences are also recognized with the WBAI scores. Descriptive statistics indicated a minimum of zero to a maximum of five for the WBAI week-1 results (Table V1). The zero indicated the WBAI Level 6 (*none consistent self-awakening*) and the 5 indicated Level 1 (*extremely high consistent self-awakening*). WBAI scores demonstrated levels difference detection by producing scores on the upper and lower levels of the WBAI scale, thereby, producing group differences and construct validity.

The Elms Sleep/Alertness Scales-II is the rating scale for the Difficulty Waking from sleep index (DWFSI). DWFSI’s evidence of construct validity was provided through the scale’s ability to distinguish group severity levels. Descriptive statistics results for the DWFSI’s scores ranged from a minimum of one to a maximum of nine points (Table-V1).

While two participants received threes that distinguished Level-1 differences, one participant received a perfect index of one in the DWFSI’s Level-1 category. In addition, one participant received an eight and another received a nine index score that represented Level-3 severity category of the construct. Thus, evidence of construct validity was provided with the level differences of the DWFSI. Similarly, in the descriptive statistics results for the DFASI, DFASI received construct validity evidence by distinguishing severity category differences only on Level 1 (minimum = 1, maximum = 2) (Table-V1).

**Construct/Logic Validity-Data Reduction**

Construct validity evidence is examined with various statistical methods: (1) factor analysis, (2) multivariate regression models, and (3) bivariate correlations (validity coefficients) (Frost et al., 2007). Similar to factor analysis, correlation coefficients were used to demonstrate the inferred latent variable that measured the underlying dimension represented within the 13 observed DVs. Correlation coefficients and logic validity were used as tools for data reduction.
Illustrated in Table-2, four factors described the self-awakening sleep/wake quality. Factor-1 represents sleep-onset quality. Factor-2 represents sleep-quality. Factor-3 represents self-awakening quality. Factor-4 represents sleep-offset quality. Table-V5 contains the validity coefficients produced for the 13 DVs that describe the theorized self-awakening sleep/wake quality latent variable construct.

Factor-1 constructs include the following: (1) Difficulty falling asleep index (DFASI). Factor-2 constructs include: (1) wake after sleep-onset (WASO), (2) number of wakes (NOW), and (3) total sleep time (TST). The Elms Sleep-Onset Stress Scale-II rates the DFASI. DFASI measures the concept of both SOL and WASO together in one scale. Validity coefficients had medium effect sizes: (1) DFASI and SOL, $r(5) = .41, p = .248$ at the .05, one-tailed level and (2) DFASI and WASO, $r(5) = .32, p = .302$ at .05, one-tailed level (Table-V5).

Logically speaking, difficulty falling asleep affects sleep efficiency (SE) too. SE was calculated from SOL, WASO, and total sleep time (TST) that, indirectly, includes the number of wakes (NOW) in the evaluation too. DFASI and SE validity coefficient was $r(5) = -.54, p = .177$ at the .05, one-tailed, level (Table-V5). The DFASI and SE’s DVs produced a large effect size ($r = -.54$) that indicated they are effective representatives of the sleep quality inferred construct.

Because the variables are measuring the same inferred latent variable, data reduction included removing SOL and SE from Factor-2 variables. DFASI will be used to represent the sleep-onset quality inferred latent variable in the study, and WASO, NOW, and TST DVs results represent sleep-quality that helps support the production of the DMRT procedures. Consequently, logic validity evidence supports the data reduction. In addition, both construct validity and content validity evidences were provided through the examination of the relationship between the DFASI and the Factor-2 constructs: SOL and SE.
Constructs representing sleep-offset quality under Factor-4 include (1) Difficulty waking from sleep index (DWFSI), (2) sleep quality (SQual), and (3) sleep mood (SMood). DWFSI is measured on the Elms Sleep/Alertness Scale-II. Validity coefficients for DWFSI and SQual, \( r(5) = .81, p = .048 \) at the .05, one-tailed level and DWFSI and SMood, \( r(5) = .77, p = .065 \) at the .05, one-tailed level are highly correlated (Table-V5). Their large effect sizes \((r = .80, .77)\) indicate they are good determinants of sleep-offset quality and evaluate it, effectively.

Logically speaking, since the DWFSI is designed to evaluate waking-life quality beyond participants’ perception of their sleep behavior immediately upon-awakening and extends six hours into the waking-life period of time, the DWFSI captures the perception of their sleep-offset and waking-life behavior on a deeper level. In light of this fact, DWFSI is the logical choice to represent sleep-offset (or waking-life) quality in comparison to the remaining Factor-4 constructs. Thus, logic validity evidence reduces Factor-4 constructs (DWFSI, SQual, SMood) to only include the DWFSI. In the process, evidence of construct validity was provided for the DWFSI by the examination of the relations between the Factor-4 constructs intended to measure the same inferred latent sleep-offset quality variable.

Constructs that represent self-awakening quality under Factor-3 include (1) the Self- Awakening Scale Index (SASI), (2) Wake before alarm index (WBAI), (3) Wake before alarm cue index (WBACI), and (4) Difficulty waking before alarm index (DWBAI). All four constructs are measured on the Self-Awakening Scale (SAWS). The SAWS’s points ranged from a negative 120 minutes to a positive 120 minutes.

The SASI is calculated with the full spectrum of the Self-Awakening Scale. SASI is calculated by averaging (1) waking before the alarm time (negative [-] 120 to -1 minutes), (2) waking at the alarm time (= zero), and (3) waking after the alarm time (positive [+] 1 to + 120
minutes). On the other hand, WBAI describes the frequency of waking before the alarm (-120 minutes to -1 minute), and DWBAI describes the frequency of (1) waking at the alarm time (zero point) and (2) sleeping beyond the alarm time (1 to 120 minutes).

SASI and WBAI validity coefficient, $r(5) = .95$, $p = .007$ at the .05, one-tailed level and SASI and DWBAI validity coefficient, $r(5) = .97$, $p = .003$ at the .05, one-tailed level produced high large effect sizes for self-awakening quality (Table-V5). These high large effect sizes ($r = .95; r = .97$) indicate the SASI and WBAI and SASI and DWBAI constructs were good determinants of the self-awakening quality latent variable. However, SASI’s evaluations are based on the full spectrum of the Self-Awakening Scale, and SASI represented the Factor-3 inferred latent variable construct on a broader level. Evidence of construct validity was provided by the examination of the relation between the SASI, WBAI, and DWBAI constructs in Factor-3 that are used to measure the same self-awakening quality inferred latent variable.

SASI and WBACI validity coefficient was $r(5) = -.68$, $p = .105$ at .05, one-tailed, level (Table-V5). The large effect size ($r = -.68$) represents the two variables are good determinants of the self-awakening quality inferred latent variable. Because the SASI and WBACI are measuring different degrees of waking before the alarm, Factor-3 reserves WBACI to represent precision of the cue consistency success level of waking within 10 minutes before the alarm.

The WBACI is directly related to the cue-command (wake 5-minutes before the alarm) that contains the “negative 5-minutes” within the precision-point-interval (-1 to -10 minutes). WBACI is used as the cue-power-indicator of this specific cue-command to self-awaken. All of the Factor-3 constructs (SASI, WBAI, DWBAI, and WBACI) that measure the dimension of the inferred latent construct of self-awakening quality were retained to provide proof needed to identify, support, and provide validity evidence for the scores on their scales in the study.
Reliability Coefficients

A reliability coefficient expresses a relationship between scores of the same individuals on the same instruments at two different times or between two parts of the same instrument (Fraenkel & Wallen, 2003). The easiest way to compute a reliability coefficient is through the use of SPSS’s Bivariate Correlation procedures (Fraenkel & Wallen, 2003; Green et al., 2000). Thus, the correlation coefficient is the reliability coefficient (Cone & Forster, 2006; Fraenkel & Wallen, 2003). Reliability of a measure is the extent that an instrument yields consistent results. Pilot testing focused on one method of reliability testing: test-retest reliability.

The Paired Sample t Test was employed to obtain the validity coefficients seen in Table-V9: Paired Samples Correlations-Reliability Coefficients (one-tailed level) for evidence of predictive validity. The Bivariate Correlation procedure was employed to obtain the reliability coefficients seen in Table-V10: Bivariate Correlation-Reliability Coefficients (one-tailed level). Both procedures used to examine Pilot-5 Data yielded the same test-retest reliability coefficients for the five dependent variables focused on in this study (Table-V9, V10).

Concerning the DVs of interest in the study, for example, the dependent variables’ reliability coefficients include (1) SASI, $r(5) = .95, p = .007$ at the .05, one-tailed, level; (2) WBAI, $r(5) = .93, p = .011$ at the .05, one-tailed level; (3) the DWFSI, $r(5) = .98, p = .002$ at .05, one-tailed, level; and (4) the DFASI, $r(5) = .61, p = .136$ at the .05, one-tailed level; and (5) WBACI, $r(5) = .67, p = .110$ at the .05, one-tailed level (Table-V9). These scores effect sizes were large (SASI, $r = .95$; DFASI, $r = .61$; WBACI, $r = .67$) to high (WBAI, $r = .93$; DWFSI, $r = .98$) in magnitude in its ability to consistently predict behavior that extends for at least a two-week time period in providing the test-retest reliability evidence for this data set.
Conclusion

Five individuals, one male and four females, ages 34 to 62, participated in the pilot study. Pilot-5 Data was used to assess the psychometric characteristics of the 13 dependent variables derived from the rating scales of the DMRT Sleep Diary, the Elms Sleep-Onset Stress Scale-II, the Elms Sleep/Alertness Scale-II, the Self-Awakening Scale, and the Sleep/Wake Efficiency Scale examined in this study.

Through the examination of the scores produced by Pilot-5 Data, validity and reliability evidences were provided. Through construct and logic validity, the data were reduced from 13 observed dependent variables to three prediction dependent variables: WBAI, DWFSI, and DFASI; four DVs to support DMRT procedures: WASO, NOW, TST, and DWBAI; one dependent variable to represent the standardized self-awakening scale Index: SASI; and one dependent variable to represent the cue consistency success rate: WBACI.

WBACI remains as a precision-point-interval to determine waking before alarm consistency success rate to assess cue-power effect size. Therefore, all three dependent variable constructs (WBAI, DWFSI, and DFASI) may represent self-awakening sleep/wake quality, and the WBACI remains as a cue-power-indicator of the cue consistency success rate.
Appendix VI

**DMRT Sleep Diary Variables/Scales Manual (DmrtSD-VS-Manual)**

A *Sleep Diary* is a standard validated instrument in the field used to record sleep/wake behavior. A sleep diary (or log) is a daily, written record of an individual’s sleep-wake patterns (Coates et al., 1982; Hawkins & Shaw, 1992). The DMRT Sleep Diary (DmrtSD) consists of the following information: (1) expected wakeup time (EWT), (2) enter bed time (EBT), (3) sleep time (ST), (4) wake time (WT), (5) final wakeup time (FWT), (6) leave bed time (LBT), (7) estimated total sleep time (TST), (8) sleep-onset latency (SOL), (9) duration of waking after sleep-onset (WASO), (10) number of wakes (NOW), (11) sleep quality (SQual), (12) sleep mood (SMood), (13) sleep alertness upon awakening, (14) naptime (NT), (15) total nap time (TNT), (16) use of medications or caffeine beverages before sleep (MBBS), (17) number of DMRT (N-DMRT) performed before sleep, and (18) other data.

Participants will record sleep/wake behavior in the DMRT Sleep Diary (DmrtSD) on a daily basis. A *Sleep Period* is the enter bed time (EBT) to go to sleep to the final wakeup time (FWT) after nocturnal sleep. The DmrtSD produced several dependent variables (DV)s used in this study. The DVs were assessed from various methods that are developed from the requested times and questions reported by the participants in the sleep diary for a nocturnal sleep period.

The observed DVs produced in the DmrtSD include the following: (1) sleep continuity variables (SOL, WASO, NOW, SE, TST, NT, TNT); (2) sleep quality variables (sleep mood [SMood], sleep quality [SQual]); (3) self-awakening variables (WBAI, WBACI, DWBAI); and (4) other data (MBBS, N-DMRT). The sleep diary parameters and the validity/reliability sources are described in the following.
Sleep-Onset Latency

Sleep-Onset Latency (SOL) is the amount of time it takes to go from a consciousness state of mind (wakefulness) to an unconsciousness state of mind (sleep). SOL is also used to determine the degree of sleep difficulty of initiating sleep after entering the bed to go to sleep. SOL is reported in the DmrtSD with a response to this request: “Estimate the hours and/or minutes it took to fall asleep the first time after ‘lights out’ to go to sleep.” Responses to this requested estimate are reported nightly in a 7-day-week interval.

SOL is assessed on a linear graphic scale anchored by one minute (normal) to 60 minutes (severe). These daily time values are used to calculate the SOL’s absolute value (ABS) (SOLABS) used in data analysis. The SOLABS is calculated with sleep diary variables by using two methods: (1) the minute-time-calculation method and (2) the hour-minute-time-calculation method.

The minute-time-calculation method uses the requested time estimate “minutes” reported by the participant to calculate the SOLABS. The SOLABS is calculated with two formulas: (1) \( \sum f = N \) and (2) \( M_T = \frac{\sum T}{N} = \frac{\sum (SOL)}{7 \text{Days}} \). Formula-1 indicates that the sum of (\( \sum \)) the frequency (\( f \)) of the reported SOL’s times equals the number (\( N \)) of days the behavior occurred. Formula-2 indicates that the sum of (\( \sum \)) the times (\( T \)) divided by the number (\( N \)) of days equals Mean-Time (\( M_T \)) of SOL. Formula-2 indicates that the SOLABS equals Mean-Time (\( M_T \)).

The hour-minute-time-calculation method uses the actual time in “hour and minutes” the participants estimated first going to sleep (ST1) and the actual enter bed time (EBT) to calculate the SOLABS. SOLABS is calculated with four formulas: (1) \( \sum f = N \), (2) \( M_{T1} = \frac{\sum T}{N} = \frac{\sum \text{ST1}}{7} \), (3) \( M_{T2} = \frac{\sum T}{N} = \frac{\sum \text{EBT}}{7} \), and (4) \( M_{TD} = (M_{T1} - M_{T2}) \) or \( M_{TD} = (M_{\text{ST1}} - M_{\text{EBT}}) \).
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\[ M_{[EBT]} \]. Formal-1 indicates that the sum of \( \sum \) the frequency \( f \) of SOL’s times (hours and minutes) equals to the number \( N \) of days the behavior occurred. The \( N \) equals the seven in this case because of the 7-day-week interval of data collection in the pretest and experimental phases of the study.

Formula-2 calculates the means of the daily times reported for the sleep time-1 (ST1) reported in the sleep diary. Mean-Time-1 \( (M_{T1}) \) equals to the sum of \( \sum \) ST1’s times \( (T) \) divided by the number \( (N) \) of days the behavior occurred. Formula-3 indicates that the Mean-Time-2 \( (M_{T2}) \) equals to the sum of \( \sum \) the EBT’s times \( (T) \) divided by the number \( (N) \) of days the behavior occurred.

Formula 4 calculates the Mean-Time Difference \( (M_{TD}) \). \( M_{TD} \) equals \( M_{T1} - M_{T2} \) or \( M_{[ST1]} - M_{[EBT]} \). \( M_{TD} \) equals the mean \( (M) \) of ST1 minus the mean \( (M) \) of EBT \( (M_{[ST1]} - M_{[EBT]}) \). The formula indicates that SOL_{ABSV} equals to the Mean-Time Difference \( (M_{TD}) \) between the first going to sleep time (ST1) and enter bed time (EBT) of the daily times reported in the sleep diary. SOL_{ABSV} is the SOL index.

Both the minute-time-calculation method (Mean-Time) and the hour-minute-time-calculation method (Mean-Time Difference) produce the SOL_{ABSV}, that is, the SOL index. The two methods act as a check and balance system built into the design of the study.

SOL_{ABSV} is also defined by four clinical levels: Level-1 (Normal SOL [1-15 minutes]), Level-2 (Mild SOL [16-30 minutes]), Level-3 (Moderate SOL [31-45 minutes]), and Level-4 (Severe SOL [46-60 minutes]). Clinically, the smaller-numbered levels (e.g., Level 1) are the preferred SOL behavior.

SOL is used to calculate (1) total wake time (TWT), (2) total sleep time (TST), and (3) sleep efficiency (SE). Research determined that SOL greater than or equal to 31 minutes
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(SOL ≥ 31) more than three times per week is insufficient sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

**Wake After Sleep-Onset**

*Wake After Sleep-Onset* (WASO) is the length of time spent awake after going to sleep the first time after “lights out.” WASO is reported in the sleep diary nightly and averaged per 7-day week. WASO is obtained with the DmrtSD’s request: “Estimate the time spent awake in a Sleep Period” (in hours & minutes). In a sleep period, WASO represents the intra-waking time after sleep-onset to the final wakeup time (FWT). WASO is also used to determine the degree of sleep difficulty and the failure to maintain sleep throughout the night.

WASO is used to calculate (1) total wake time (TWT), (2) total sleep time (TST), and (3) sleep efficiency (SE). Research has determined that the time waking after sleep-onset greater than or equal to 31 minutes (WASO ≥ 31) more than three times per week is insufficient sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

WASO is assessed on a linear graphic scale anchored by one minute (*normal*) to 60 minutes (*severe*). These daily times (raw scores) are used to calculate the WASO index; that is, daily times averaged per seven-day-week are the WASO’s absolute values. WASO absolute value (ABSV) (WASO_{ABSV}) is calculated with two formulas: (1) \( \sum f = N \) and (2) \( M_T = \sum T / N = \sum (\text{WASO}) / 7\text{Days} \). Formula-1 indicates that the sum of (\( \sum \)) the frequency (\( f \)) of waking after sleep-onset *times* reported daily equals the number (\( N \)) of days the behavior occurred in a 7-day-week interval. Formula 2 indicates that the sum of (\( \sum \)) the WASO’s times (\( T \)) divided by the number (\( N \)) of days the waking after sleep-onset behavior occurred equals Mean-Time \( M_T \).
Thus, Formula-2 indicates that $\text{WASO}_{\text{ABSV}}$ equals the Mean-Time ($M_T$) of the WASO’s daily times ($T$) to produce the WASO index used in data analysis. $\text{WASO}_{\text{ABSV}}$ is also defined on four levels: Level-1 (Normal WASO [0-15 minutes]), Level-2 (Mild WASO [16-31 minutes]), Level-3 (Moderate WASO [31-45 minutes]), and Level-4 (Severe WASO [46-60 minutes]). Clinically, the smaller-numbered levels (e.g., Level 1 [0 to 15 min]) are the preferred wake after sleep-onset behavior.

**Number of Wakes**

*Number of Wakes* (NOW) is the specific number of times one awakes in a nocturnal sleep period (entered bed time [EBT] to final wakeup time [FWT]). Participants are asked this question: “How many times did you wake up in a Sleep Period?” NOW is also used to determine the frequency degree of sleep difficulty of maintaining sleep. Research has determined that NOW less than or equal to 3 (NOW ≤ 3) in a nocturnal sleep period represents normal sleep (Bonnet & Arand, 2003; Lichstein et al., 2003).

NOW is assessed on a linear graphic scale anchored by 0 (normal) to 10 (severe). NOW’s absolute value (ABSV) ($\text{NOW}_{\text{ABSV}}$) is calculated with two formulas: (1) $\sum f = N$ and (2) $M_X = \sum X / N = \sum (\text{NOW}) / 7$ days. Formula-1 indicates the sum of ($\sum$) the frequency ($f$) of the behavior equals the number ($N$) of days the behavior occurred. Formula-2 indicates that the sum of ($\sum$) the scores ($X$) for the NOW divided by the number ($N$) of days equals the Mean-Score ($M_X$). Thus, the $\text{NOW}_{\text{ABSV}}$ equals the Mean-Score ($M_X$) of the NOW’s daily scores. $\text{NOW}_{\text{ABSV}}$ is the index for NOW.

Also, the NOW is defined on four clinical levels: Level-1 (Normal NOW [0-3]), Level-2 (Mild NOW [(4-6]), Level-3 (Moderate NOW [7-9]), and Level-4 (Severe NOW [10]). Clinically, the smaller-numbered levels (e.g., Level-1, 0 to 3 points) are the preferred.
**Total Sleep Time**

Total Sleep Time (TST) is sleep time (ST) measured by (enter bed time [EBT] minus final wakeup time [FWT]) minus total waking time (TWT) measured by (the sum of the length of waking after sleep-onset [WASO] plus sleep-onset latency [SOL]). The formula is TST = ST (EBT – FWT) – TWT (WASO + SOL) in minutes. TST is recorded in hours and minutes in the sleep diary. Also, TST’s daily times (T) are used to calculate daily sleep efficiency percentages.

The TST’s absolute value (ABSV) (TST_{ABSV}) is assessed by two formulas: (1) ∑f = N and (2) \( M_T = \frac{\sum T}{N} = \frac{\sum (TST)}{7\text{Days}} \). Formula-1 indicates the sum of (f) the frequency (f) of TST’s times reported in the sleep diary equals the number (N) of days the behavior occurred. Formula-2 indicates the sum of (∑) TST’s times (T) divided by the number (N) of days equals the Mean-Time (\( M_T \)) of the total sleep times. Thus, the TST_{ABSV} or index equals the Mean-Time of the TST daily times.

Research determined that there are short sleepers (5 hours or less) (Ferrara & Gennaro, 2001; Hartmann, Baekland, Zwilling, Hoy, 1971; Monk, Buysse, Welsh, Kennedy, & Rose, 2001); normal sleepers (6 to 9 hours) (Ferrara & Gennaro, 2001; Horne, 1988; Murphy et al., 2000; Pilcher et al., 1997); and long sleepers (10 hours or more) (Ferrara & Gennaro, 2001; Hartmann et al., 1971; Monk et al., 2001). In the DmrtSD, TST, theoretically, is developed based on the “core sleep need” time: 4.5 to 6 hours (Horne, 1988). In the DmrtSD, TST is assessed by TST greater than or equal to five hours, less than or equal to nine hours (5 hrs ≤ TST ≤ 9 hrs) in a sleep period.

**Sleep/Wake Efficiency Scale**

Sleep/Wake Efficiency Scale (SWES) measures sleep efficiency (SE) (actual sleep in
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proportion to time in bed) in a sleep period. SE is calculated from the times reported in the DmrtSD. Hence, SE is the total sleep time (TST) divided by the sum of total waking time (TWT) plus TST. The formula is \( SE = \frac{TST}{TWT + TST} = \text{percentage} \). SE calculations are based on TST greater than or equal to 5 hours, less than or equal to nine hours (5 hrs \( \leq \) TST \( \leq \) 9 hrs). This formula is used to calculate the daily SE from the sleep diary times. Participants are not asked to calculated SE. SE is assessed daily with the times requested in the SE formula above based on the requested times reported by participants.

SWES is a linear graphic scale anchored by one minute (Very Good SE [95-97%]) to 60 minutes (Severely Poor SE [80-84%]). The SE’s absolute value (ABSV) (SE_{ABSV}) is assessed with two formulas: (1) \( \sum f = N \) and (2) \( M_X = \frac{\sum X}{N} = \frac{\sum (SE)}{N_{Days}} \). Formula-1 indicates the sum of (\( \sum \)) the frequency (f) of the “actual sleep time” equals the number (N) of days the behavior occurred. Formula-2 indicates that the sum of (\( \sum \)) the SE percentage’s raw scores (X) divided by the number (N) of days the behavior occurred equals to SE’s Mean-Score (\( M_X \)).

As a result, the SE’s index equals SE_{ABSV} of the Mean-Score of the daily scores. The SE’s index is also defined by four clinical levels: Level-1 (Very Good SE [1-15 minutes, 95-97%]); Level-2 (Good SE [16-30 min, 90-94%]); Level-3 (Somewhat Poor SE [31-45 min, 85-89%]); and Level-4 (Severely Poor SE [46-60 min, 80-84%]). Therefore, the lower levels (e.g., Level-1) are the preferred sleep efficiency behavior.

**Subjective Sleep Quality Scale**

Subjective Sleep Quality Scale (SQual-S) assesses the subjective sleep quality index (SQual) that describes the participant’s satisfaction with sleep quality upon-awakening. SQual is reported in the DmrtSD per night and averaged per 7-day-week to produce the
absolute values. Participants respond to the DmrtSD’s question: “How satisfied are you with Sleep Quality?”

The SQual-S is a linear graphic scale anchored by 1 (Very Satisfied/Rest/Refreshed) to 10 (Severe Fatigue). The SQual index is assessed with the SQual’s absolute value (ABSV) (SQual_{ABSV}). The SQual_{ABSV} is calculated with two formulas: (1) \( \sum f = N \) and (2) \( M_X = \frac{\sum X}{N} = \frac{\sum (SQual)}{7 \text{Days}} \). Formula-1 indicates the sum of (\( \sum \)) the frequency (\( f \)) of the behavior equals the number (\( N \)) of days the behavior occurred. Formula-2 indicates that the sum of (\( \sum \)) the raw scores (\( X \)) of sleep quality divided by the number (\( N \)) of days the behavior occurred equals the Mean-Score (\( M_X \)).

The SQual_{ABSV} equals the Mean-Score (\( M_X \)) of the daily SQual scores. SQual_{ABSV} is also defined on four performance levels: Level-1 (Very Satisfied/Rest/Refreshed SQual [1-3]), Level-2 (Somewhat Satisfied/Rest SQual [4-6]), Level-3 (Not Satisfied/Tiredness SQual [7-9]), and Level-4 (Severe Fatigue SQual [10]). In essence, the less-rated difficulty of sleeping is the preferred sleep quality, and the higher numbers mean the poorer perception of sleep quality. The SQual-S is, theoretically, developed from the format indicated by Mayers et al. (2003).

Sleep/Mood Scale

Sleep/Mood Scale (SMood-S) measures the sleep-mood index (SMood) that assesses mood upon-awakening. SMood is reported in the DmrtSD per night and averaged per 7-day week to produce the absolute value. SMood-S is a 10-point linear graphic scale anchored by 1 (Very Good Mood) to 10 (Severely-Moody) to produce the SMood’s absolute value (SMood_{ABSV}). SMood_{ABSV} is calculated with two formulas: (1) \( \sum f = N \) and (2) \( M_X = \frac{\sum X}{N} = \frac{\sum (SMood)}{7 \text{Days}} \). Formula-1 indicates the sum of (\( \sum \)) the frequency (\( f \)) of the behavior
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equals the number \(N\) of days the behavior occurred. Formula-2 indicates that the sum of \(\sum\) the scores \(X\) for sleep mood divided by the number \(N\) of days the behavior occurred equals Mean-Score \(M_X\).

The SMood\_ABSV equals the Mean-Score \(M_X\) of the daily sleep mood raw scores. Also, the SMood\_ABSV is defined on four performance levels: Level-1 (Very Good Mood [1-3]), Level-2 (Somewhat Good Mood [4-6]), Level-3 (Very Bad Mood [7-9]), and Level-4 (Severely Moody [10]). In essence, SMood\_ABSV indicates the less-rated sleepiness is better than the increased sleepiness that increases mood or negative effect. The SMood-S is, theoretically, developed from the format indicated by Mayers et al. (2003).

**Self-Awakening Scale**

*Self-Awakening Scale* (SAWS) assesses when the participant wakes when an alarm is used. The *time* of the *behavior* is reported in the DmrtSD. The SAWS uses a linear graphic scale ranging from a negative (-) 120 minutes (wake before alarm minutes [WBAM]) to a positive (+) 120 minutes (wake after alarm minutes [WALM]). The “Zero” point represents waking at the expected wakeup time \(W_{EWT}\) or alarm time. The scale’s format is developed from models indicated by Moorcroft et al. (1997) and Lavie et al. (1979). There are four variables measured on the SAWS: SASI, WBAI, WBACI, and DWBAI.

**Self-Awakening Scale Index**

*The Self-Awakening Scale Index (SASI)* measures self-awakening at a pre-set time without an alarm or other external means. SASI is developed from the SAWS (a linear graphic scale ranging from -120 minutes to +120 minutes). However, SASI also consists of performance levels measured on a linear graphic scale anchored by Level 1 (-1 minute to -15 minutes) to Level 5 (0 to +120 minutes). The SASI is assessed with the *time-of-the-behavior*
reported in the sleep diary. The daily SASI’s raw scores are assessed with the time-of-the-behavior with the WBAM, WALT, and W_EWT.

SASI’s daily raw scores are calculated in the following three steps: (1) The wake before alarm minutes (WBAM) equal (=) the wake before alarm time (WBAT) minus (-) the expected wakeup time (EWT) (target time) noted in negative (-) minutes. The formula is WBAM = WBAT – EWT. (2) The wake after alarm minutes (WALM) equal the wake after alarm time (WALT) minus the expected wakeup time (EWT) noted in positive minutes. The formula is WALM = WALT – EWT. And (3), the waking at expected wakeup time (W_EWT) is the chosen target time or alarm time reported by each participant.

The absolute value (ABSV) of the daily times is the index-value used in the initial data analysis. The SASI’s ABSV (SASI_{ABSV}) is calculated with the times’ raw scores collected daily and then averaged to produce the index’s absolute value. The mean (M) is commonly known as the arithmetic average and is computed by adding all the scores in the distribution and dividing by the number of scores (Gravetter & Wallnau, 2000).

This study consists of averaging times (T), and the average is termed Mean-Time (MT). Also, it consists of averaging scores (X), and the mean is termed Mean-Score (MX). In addition, the SASI_{ABSV} is calculated with sleep diary variables by using two methods: (1) the minute-time-calculation method and (2) the hour-minute-time-calculation method. The formulas are located in the Sleep/Wake Pattern Index Formulas Chart (Appendix IX).

The minute-time-calculation method uses the WBAM and the WALM to calculate the SASI_{ABSV}. The SASI_{ABSV} minute-time-calculation method uses four formulas: (1) \( \sum f = N_{Days} \), (2) \( MT_1 = \frac{\sum T}{N} = \frac{\sum_{WBAM}}{7_{Days}} \), (3) \( MT_2 = \frac{\sum_{WALM}}{7_{Days}} \), and (4) \( MT_D = (MT_1 – MT_2) \) or \( MT_D = (M_{WBAM} – M_{WALM}) \). Formula-1 indicates that the sum of (\( \sum \)) the frequency (f) of the
index-minutes it took to produce the behavior equals the number (N) of days the behavior occurred. The number of days equals to seven in this case because we are mainly assessing the 7-day-week intervals in the pretest and experimental phases of the study.

Formula-2 calculates the *arithmetic average* or the Mean-Time ($M_T$) of the minutes of the SASI$_{ABSV}$. Formula-2 indicates that Mean-Time-1 ($M_{T1}$) equals the sum of ($\sum$) WBAM’s times (T) divided by the number (N) of days. Formula-3 indicates Mean-Time-2 ($M_{T2}$) equals the sum of ($\sum$) WALM’s times (T) divided by the number (N) of days. Formula-4 indicates that the Mean-Time Difference ($M_{TD}$) equals the Mean-Time-1 ($M_{T1}$) of the WBAM minus Mean-Time-2 ($M_{T2}$) of the WALM. Thus, the SASI$_{ABSV}$ equals the Mean-Time Difference ($M_{TD}$) of WBAM minus WALM.

The hour-minute-time-calculation method uses the actual “hours and minutes” of the expected wakeup time (EWT) and final wakeup time (FWT) to calculate the SASI$_{ABSV}$. The SASI$_{ABSV}$ hour-minute-time-calculation method uses four formulas: (1) $\sum f = N_{Days}$, (2) $M_{T1} = \sum T / N = \sum_{EWT} / 7_{Days}$, (3) $M_{T2} = \sum_{FWT} / 7_{Days}$, and (4) $M_{TD} = (M_{T1} - M_{T2})$ or $M_{TD} = (M_{[EWT]} - M_{[FWT]})$. Formula-1 indicates that the sum of ($\sum$) the frequency ($f$) of the time-of-the-behavior equals the number (N) of days the behavior occurred. The number of days equals to seven in this case because we are mainly assessing 7-day-week intervals in the pretest and experimental phases of the study.

Formula-2 indicates that Mean-Time-1 ($M_{T1}$) equals the sum of ($\sum$) the EWT’s times (T) divided by the number (N) of days. Formula-3 indicates that the Mean-Time-2 ($M_{T2}$) equals the sum of ($\sum$) the FWT’s times (T) divided by the number (N) of days. Formula-4 indicates that Mean-Time Difference ($M_{TD}$) equals Mean-Time-1 ($M_{T1}$) of EWT minus Mean-Time-2 ($M_{T2}$) of the FWT. Therefore, the SASI$_{ABSV}$ equals the Mean-Time Difference ($M_{TD}$)
of the EWT minus FWT.

Both the minute-time-calculation (MTC) and hour-minute-time-calculation (HMTC) methods produce the \( \text{SASI}_{\text{ABSV}} \). Internally controlled, the MTC and HMTC methods reveal a hidden check and balance system in the design in calculating the \( \text{SASI}_{\text{ABSV}} \). The MTC method calculates the Mean-Time and the HMTC method calculates the Mean-Time Difference to produce the \( \text{SASI}_{\text{ABSV}} \).

Next, the \( \text{SASI}_{\text{ABSV}} \) is converted to levels to represent the meaning of the final index number of the SASI’s value. The SASI’s performance levels of the behavior are measured on a linear graphic scale consisting of five levels ranging from Level 1 (Very Good Self-Awakening [-1 to -15 minutes]) to Level 5 (Did not wake before the alarm [\( \geq 0 \) minutes]).

SASI’s absolute values converted to levels (1 to 5) represent (1) the smaller numbers (e.g., -1 to -15 minutes) produce the better performance by waking before the alarm time and (2) the larger numbers (e.g., -46 to -60 minutes) represent more time used in waking before alarm while Level 5 represents waking at the alarm or not waking before the alarm time. Thus, an increase in the behavior represented by the SASI refers to the better performance of waking before alarm and is indicated by the smaller-numbered levels.

**Wake Before Alarm Index**

The *Wake Before Alarm Index* (WBAI) measures self-awakening at a pre-set time without an alarm or other external means. WBAI measures self-awakening quality. The WBAI is the number of times one wakes before the alarm time (WBAT) or the frequency of self-awakening within one week. Simply, while the SASI measures the success of self-awakening at a pre-set time in minutes, WBAI measures the *consistency success rate* of self-awakening.
WBAI’s absolute value ($WBAI_{ASV}$) formula is $\sum f (WBAT) = N_{Days}$ (Appendix IX).

The formula indicates $WBAI_{ASV}$ is the sum of ($\sum$) the frequency ($f$) of WBAT equals to the number ($N$) of days the behavior occurred. In other words, the $WBAI_{ASV}$ is the sum of the frequency that the WBAT occurred within a 7-day period. Thus, the number of days is the $WBAI_{ASV}$.

Next, the WBAI’s absolute values are converted to WBAI’s performance levels measured on a linear graphic scale anchored by Level-1 (Extremely High Consistent Self-Awakening [5 to 7 days]) to Level-6 (Non-Consistent Self-Awakening [0 days]). Consequently, the smaller-numbered levels produce the better performance of waking before the alarm consistency success rate.

**Wake Before Alarm Cue Index**

**Wake Before Alarm Cue Index** (WBACI) is used as the cue-power-indicator of the participants’ ability to wake within 10 minutes of the target time, consistently. In other words, WBACI measures the cue-consistency success rate of the behavior at the 10-minute level. Research determined that the ability to self-awake at the 10-minute interval is rated high consistency success (Moorcroft et al., 1997).

WBACI measures self-awakening’s cue-consistency success with the wake before alarm cue minutes (WBACM). WBACM are the designated DMRT’s “precision point interval” because it contains the cue-time range to self-awake. WBACM are the minutes that range from a negative 1 minutes to a negative 10 minutes (-1 to -10) from the expected wakeup time (EWT). Participants choose their own individual wake up time, but must say the “cue” (wake 5-minutes before alarm). The precision-point-interval (-1 to -10 minutes) contains the precision point of “negative 5-minutes” to wake before alarm time.
Although WBACI measures consistency-success, it also indicates it is measuring the power of the *cue-command* (wake 5-minutes before the alarm) stated before sleep, theorized to consolidate within sleep, and perhaps manifest itself in wakefulness within the precision-point interval (-1 to -10 minutes) before alarm. The WBACI is derived from the EWT reported in the sleep diary. The WBACM equal the EWT less than or equal to negative 10 minutes, but less than zero. The formula is $EWT \leq -10 < 0$ minutes.

WBACI’s absolute value ($WBACI_{ABSV}$) formula is $\sum f (EWT \leq -10 < 0 \text{ min}) = N_{Days}$. The formula indicates $WBACI_{ABSV}$ is the sum of ($\sum$) the frequency ($f$) of EWT less than or equal to negative 10 minutes less than zero equals to the number ($N$) of days the behavior occurred. In other words, the $WBACI_{ABSV}$ is the sum of the frequency that the WBACM (-1 min to -10 min) from EWT (= zero) occurred within a 7-day period. Thus, the number of days is the $WBACI_{ABSV}$. $WBACI_{ABSV}$ is also defined by WBACI’s performance levels measured on a linear graphic scale ranging from Level-1 (*Extremely High Cue-Consistent Self-Awakening [5 to 7]*) to Level-6 (*Non Cue-Consistent Self-Awakening [0]*). Consequently, smaller-numbered levels produce the better performance of the *cue-consistency-success* rate.

**Difficulty Waking Before Alarm Index**

*Difficulty Waking Before Alarm Index* (DWBAI) measures the individuals’ somnolence before leaving the bed. The DWBAI is calculated from the times ($W_{_EWT}$, $WALT$) reported in the sleep diary, and it is reported by the participants’ responses on the ESAS-II’s Level-4 (*Severe Sleepiness [points 8 to 10]*). The wake after alarm minutes ($WALM$) equal the wake after alarm time ($WALT$) minus the expected wakeup time ($EWT$) noted in *positive* minutes. The formula is $WALM = WALT - EWT$. Yet, the waking at expected wakeup time ($W_{_EWT}$) is the time participant sets alarm.
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DWBAI is developed from the SAWS (linear graphic scale ranging from -120 to +120 minutes). Since the W_EWT (= zero) and the WALM (= +1 to +120 minutes) represent the waking in the sleep period at alarm or returning to sleep and waking after alarm, both the W_EWT and the WALT were combined to refer to the frequency of these behaviors occurring per day to represent the DWBAI.

 DWBAI’s absolute value (ABSV) (DWBAI_{ ABSV}) is calculated with the following formula: \( \sum f \ (W_{EWT}) + \sum f \ (WALT) = N \). The formula indicates the DWBAI_{ ABSV} is the sum of (\( \sum \)) the frequency (f) of waking at W_EWT’s times (T) plus the sum of (\( \sum \)) the frequency (f) of WALT’s times (T) equals the number (N) of times the behaviors occurred. The number (N) is the absolute value of the DWBAI.

The DWBAI’s absolute values are also defined by performance levels measured by a linear graphic scale consisting of four levels ranging from Level-1 (Low Difficulty Self-Awakening \([0-3]\)) to Level-4 (Severe Difficulty Self-Awakening \([10-14]\)). Thus, the smaller-numbered levels represent the preferred performance of the behavior of difficulty waking before the alarm.

**Nap Time**

*Nap Time* (NT) is the time that one lies down to take a “short sleep” outside of nocturnal sleep. The nap time is reported in the sleep diary at the end of the nap or at the end of the day in hours and minutes. Total nap time’s (TNT) absolute value is calculated with the formula: \( \sum NT = TNT \). The formula indicates that the sum of (\( \sum \)) NT equals TNT. In other words, TNT is the total amount of time spent napping or sleeping outside of nocturnal sleep per 7-day-week interval.
**Medicine/Beverage Before Sleep Scale**

*Medicine/Beverage Before Sleep Scale* (MBBS-S) measures the type of medicines or beverages taken one hour before sleep. MBBS-S is anchored by 1 (caffeine) to 8 (other). The MBBS-S is, theoretically, developed from the format indicated by Sanofi-Aventis (2008).

**Number of DMRT**

The number of times the DMRT (N-DMRT) is performed by the participant is reported in the DmrtSD. Responses are requested with two questions: “What is the number of times you performed the DMRT before going to sleep?” and “What is the number of times you performed the DMRT to return to sleep after an awakening within the sleep period?” The participants respond with “Does not apply” if it is the pretest phase of the study, and they respond with numbers ranging from (0 to 4) in the experimental phases of the study.

The N-DMRT may be the determining factor in whether the specific participant’s data is used in the study results. Logically, if the participant did not indicate he performed the DMRT when instructed to do so, his results may not be valid or reliable, and the results will be expunged from data analysis or calculated as missing data.

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Appendix VII

**DMRT Screening Questionnaire (SCNQ)**

To be filled out by the Researcher: ID Code SCNQ-0000___________     Date:_________________

Potential Participant: Please fill out the following:

1. Name: ____________________________________
2. Date:_____________________________________
3. Email:____________________________________
4. Home Phone:_______________________Cell:_______________________________
5. Student Grade Level: (1) Undergraduate____ (2) Graduate____ (Check one with “X”)  
6. Participant: (1) Non-Student____  (2) Student____                  (Check one with “X”)  
7. Occupation ________________________ (Do you do alternating shift work?)  Yes___   No___  
8. Residence: (1) On-Campus____ (2) Off-Campus______ (Check one with “X”)  
9. Age: __________Birthday_____________________
10. Gender: Male_____  Female______                                            (Check one with “X”)  
11. Marriage status: (1) Single____ (2) Married____  (3) Divorced _____  
12. List the ages of children younger than 6 years old? (12a)____  (12b)____ (12c)___ (12d)____  
14. Name of University/College___________________________________________

Title of Study: *Effects of the Deep Meditative Relaxation Technique (DMRT) On Nocturnal Self-Awakening Sleep/Wake Quality Among University Students*

1. Do you practice any form of meditation? If yes, what is its name?  
   Please check one with X.  (1a) No___    (1b) Yes___ (1c) Name: ____________________________

2. Do you practice any relaxation technique(s)? If yes, what is its name(s)?  
   Please check one with X.  (2a) No____  (2b) Yes___ (2c) Name: ____________________________

3. Do you have any reservations about learning how to meditate?  
   Please check one with X.  (3a) No____      (3b) Yes_______

4. Do you have any reservations about learning how to relax?  
   Please check one with X.  (4a) No____      (4b) Yes_______

5. Do you want to learn how to initiate sleep at a pre-set time naturally without external means?  
   Please check one with X.  (5a) No____      (5b) Yes_______

6. If you have a specific method of habitually self-awakening at a pre-set time, what is its name?  
   (6a) Name______________________________________________________________________  
   (6b) Briefly describe it: ___________________________________________________________
### DMRT Screening Questionnaire (Continued)

To be filled out by the Researcher: ID Code SCNQ-0000___________ Date:_____________

Name:_________________________ Date______________

7. Do you have sleep difficulties? Check all difficulties with “X” that occur more than 3 nights per week.

<table>
<thead>
<tr>
<th>Please mark “all that apply” with a X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>7a. No sleeping problems.</td>
<td></td>
</tr>
<tr>
<td>7b. Difficulty falling asleep.</td>
<td></td>
</tr>
<tr>
<td>7c. Difficulty staying asleep.</td>
<td></td>
</tr>
<tr>
<td>7d. Early morning awakenings</td>
<td></td>
</tr>
<tr>
<td>7e. Over sleeping or hard to wake.</td>
<td></td>
</tr>
<tr>
<td>7f. Excessive waking throughout the night.</td>
<td></td>
</tr>
<tr>
<td>7g. Daytime napping.</td>
<td></td>
</tr>
<tr>
<td>7h. Not rested after sleep.</td>
<td></td>
</tr>
</tbody>
</table>

8. How long does it take you to fall asleep after “lights out” to go to sleep in minutes? (8a) _____ minutes.

9. How satisfied are you with your sleep quality?

<table>
<thead>
<tr>
<th>Circle “only one” number from 1 to 10 below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Satisfied “Rested/Refreshed”</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

10. Rate difficulty of falling asleep

<table>
<thead>
<tr>
<th>Circle “only one” number from 1 to 10 below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Difficult “Normal Stress”</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

11. Rate difficulty waking from sleep within the first 6 hours after awakening.

<table>
<thead>
<tr>
<th>Circle “only one” number from 1 to 10 below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Difficult “Alert/Energetic”</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
**DMRT Screening Questionnaire (Continued)**

To be filled out by the Researcher: ID Code SCNQ-0000________ Date:_________________

Name:_________________________Date____________________

12. Are you willing to keep a detailed Sleep Diary to record sleep behavior nightly for 3 weeks, and return it via email daily?
   Please check one with X. (12a) No____ (12b) Yes____

13. Do you take naps? Please check one with X. (13a) No____ (13b) Yes____

14. What time of the day do you usually take a nap? (14a) Weekdays____ (14b) Weekends____

15. Do you have access to a computer and the internet? Please check one with X.
   (15a) No____ (15b) Yes____

16. What’s the average amount of time you spend awake in a “Sleep Period”? *A Sleep Period is the time you first enter bed to go to sleep to the final wake up time. Answer here (16a) ______Minutes.

17. What’s the average number of times do you wake up in a night’s sleep or in a Sleep Period?
   Place answer here: (17a)____

18. What’s the average time do you go to bed to sleep on weekdays? Mark in AM or PM (18a) _____
   How many weeks or months have you kept this schedule? (18b) _____Weeks (18c) _____Months.

19. What is the average time do you go to bed to sleep on weekends? Mark in AM or PM (19a) _____
   How many weeks or months have you kept this schedule? (19b) _____Weeks (19c) _____Months.

20. How do you routinely awaken on weekdays?

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>20a. Never use an alarm or external source.</td>
<td></td>
</tr>
<tr>
<td>20b. Use an alarm, yet will awaken before the alarm goes off.</td>
<td></td>
</tr>
<tr>
<td>20c. Use an alarm, but sometimes awaken before the alarm goes off.</td>
<td></td>
</tr>
<tr>
<td>20d. Use an alarm, but do not awaken before the alarm goes off.</td>
<td></td>
</tr>
</tbody>
</table>

21. How do you routinely awaken on weekends?

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>21a. Never use an alarm or external source.</td>
<td></td>
</tr>
<tr>
<td>21b. Use an alarm, yet will awaken before the alarm goes off.</td>
<td></td>
</tr>
<tr>
<td>21c. Use an alarm, but sometimes awaken before the alarm goes off.</td>
<td></td>
</tr>
<tr>
<td>21d. Use an alarm, but do not awaken before the alarm goes off.</td>
<td></td>
</tr>
</tbody>
</table>
The Deep Meditative Relaxation Technique (DMRT)

**DMRT Screening Questionnaire (Continued)**

To be filled out by the Researcher: ID Code SCNQ-0000     Date:_________________

Name:_________________________

22. Who or what wakes you up when you have to awaken at a specific time to perform a task?

   Please mark “only one” choice with an X   Mark X Below
   
   22a. Alarm clock
   22b. Another person
   22c. Self
   22d. Other

23. Do you have access to an alarm clock and a night light by your bedside?

   Mark X. (23a) No__ (23b) Yes___

24. What type of medications do you routinely take doing the day?

   (24a)_____________________________________

25. What type of sleeping aid do you take before going to nighttime sleep?

   (25a)_____________________________________

26. What’s your average total amount of sleep per weekday night? (26a) _____Hours   _____Minutes

27. What’s your average total amount of sleep per weekend night? (27a) ____Hours    _____Minutes

Please mark “only one” choice with an X Mark X Below

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>Do you drink alcoholic beverages within one hour of entering bed to do</td>
</tr>
<tr>
<td></td>
<td>nighttime sleep?</td>
</tr>
<tr>
<td>29</td>
<td>Do you take recreational drugs or substances to help put you to sleep?</td>
</tr>
<tr>
<td>30</td>
<td>If for some unplanned reason you are not able to complete the 3 weeks</td>
</tr>
<tr>
<td></td>
<td>of this study, will you contact the Principle Investigator (PI) by email</td>
</tr>
<tr>
<td></td>
<td>to make this known, immediately?</td>
</tr>
<tr>
<td>31</td>
<td>Have you ever been told that you snore in your sleep?</td>
</tr>
<tr>
<td>32</td>
<td>Do you wake from your sleep feeling like you are choking?</td>
</tr>
<tr>
<td>33</td>
<td>Do cramps in your legs disturb your sleep at night or wake you from</td>
</tr>
<tr>
<td></td>
<td>sleep?</td>
</tr>
<tr>
<td>34</td>
<td>Have you been told that parts of your body jerk while you are asleep?</td>
</tr>
<tr>
<td>35</td>
<td>Do you have narcolepsy?</td>
</tr>
<tr>
<td>36</td>
<td>Do you have gastro-esophageal reflux disorder?</td>
</tr>
<tr>
<td>37</td>
<td>Do you have restless leg syndrome?</td>
</tr>
<tr>
<td>38</td>
<td>Do you have sleep apnea?</td>
</tr>
<tr>
<td>39</td>
<td>Do you do shift-work?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Normal</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Rate level of Depression for the past week.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Rate level of Anxiety for the past week.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Rate level of Stress for the past week.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**DMRT Screening Questionnaire (Continued)**

To be filled out by Researcher: ID Code SCNQ-0000                  Date____________________

**********************************************************************************
Name:__________________________________

43. Are you participating in a concurrent pharmacological and/or a non-pharmacological treatment for sleep difficulties? Please check one with X.  (43a) No_____ (43b) Yes____

44. Do you have insomnia (difficulty going to sleep or maintaining sleep more than 3 times a week)? Please check one with X.  (44a) No_____ (44b) Yes____

45. Are you interested in receiving a summary of the results of this study after publication? Please check one with X.  (45a) No_____ (45b) Yes____

46. The Informed Consent seals our agreement of confidentiality and your agreement to not disclose your knowledge of the DMRT to anyone until after Publication. The Informed Consent Form is approved by the University of Cincinnati Institutional Review Board. You must sign the consent form to participate in the study? Do you agree with these terms? Please check one with X.  (46a) No____ (46b) Yes____

47. There will be three weeks of data collection of sleep-wake patterns. Testing will be done after week one and three. Participants will be required to assemble in a classroom for a 90-minute session for introductions, signing consent forms, to receive instructions on completion of the sleep diary, DMRT training, and/or debriefing; yet, most testing will be done via email. Will you agree to complete this 3-week study? Please check one with X.  (47a) No____ (47b) Yes____

48. Do you have a working familiarity with the Excel Workbook in the Microsoft Office (2007) Computer Program?

   Please check one with X: (48a) No ___ (48b) Yes ___ (48c) Somewhat____

   Which Excel program do you have? (48d) Microsoft Excel: 2003 ___ or (48e) Excel 2007___

*You do not have to have sleep difficulties to participate in this study. We are testing to see if the DMRT initiates sleep-onset and wakefulness, naturally.

*[“By taking part in these activities”] you indicate your consent to participate in this study.

Participant_________________________________

Please return this DMRT Screening Questionnaire to the researcher at the end of the meeting. You will be notified by email if you meet screening criteria for inclusion or exclusion in this study in one week.

If you want a summary of the results of the study, please place your name and email address here.

Name:__________________________________ Email:__________________________________
DMRT Screening Questionnaire (Continued)

Thank you for your time, future participation, and input.

**Henrietta S. Elms, M.A.**
Counseling Program, CECH, University of Cincinnati

**Email:** elmsh@mail.uc.edu

### Appendix VIII

**DMRT SLEEP DIARY**

<table>
<thead>
<tr>
<th>ID CODE: SD-0000</th>
<th>Study Week #: 1, 2, 3, 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: / /2011</td>
<td>Write Date’s Day# in spaces→</td>
</tr>
<tr>
<td>Week Day:</td>
<td>Mon Tue Wed Thu Fri Sat Sun</td>
</tr>
</tbody>
</table>

### Answer Questions Before Sleep

1. Medicine/Beverages taken Before Sleep?*
   - (#1) MBBS Scale: 1= Caffeine (within one hour of Bedtime). 2= Alcohol (within one hour of bedtime). 3= Antihistamine. 4= Medicines. 5= Sleep Aid. 6= Energy drink. 7= Herbal supplement. 8= Other.
   - Note: Use all numbers that apply (e.g., 1, 6, 8) in each space above.

2. What is the “Expected Wakeup Time”? “Alarm Time”
3. What is the Enter Bed Time? “EBT”

### Answer Questions After Nighttime Sleep

(##4-9) Theoretically, you are only required to answer questions in this section after sleep in the morning. In order to help keep track of your sleep behavior, the “Sleep & Wake” times noted in questions 5-9 are only used if you awake at night and experience a hard time going back to sleep and/or have long wakeups after “first” sleeping in Sleep#1.

4. What time did you first go to sleep? “Sleep-1”
5. What time did you first wake up? “Wake-1”
6. What is the second time you slept? “Sleep-2”
7. What’s the second time you awoke? “Wake-2”
8. What’s the third time you slept? “Sleep-3”
9. What’s the third time you awoke? “Wake-3”
10. What is Final Wakeup Time? “FWT”
11. What time did you leave the bed?
12. What is the last “TIME” did you wake before the “Expected Wakeup Time” (alarm time)?
13. Estimate the hours &/or minutes it took to fall asleep the first time after “lights out” to go to sleep (Write hr & min) “SOL”
14. Estimate the time spent “AWAKE” in a “Sleep Period” (Write in hours & minutes). “WASO”
15. How many times did you wake up in a Sleep Period? “NOW”
16. Estimate Total Sleep Time (Write in hours & minutes) 
   - (#16) Total Sleep Time = “Sleep Period” time minus total time spent awake in a “Sleep Period” in hours & minutes. Write the number of minutes plus the minutes with a colon in between (e.g., slept 7 h & 45 min = 7:45.
17. How Satisfied With Sleep Quality?*
   - (#17) Choose a number from 1 = Very Satisfied-Rested/Refreshed” to 10 = “Severe Fatigue” from the SQUAL Scale. SQUAL Scale: L1: Very Satisfied “Rested/Refreshed” (1 to 3), L2: Somewhat Satisfied “Restored” (4 to 6), L3: Not Satisfied “Tiredness” (7 to 9); L4: “Severe Fatigue” (10).
18. Rate Mood Upon Awakening.*
   - (#18) Choose a number from 1= “Very Good Mood” to 10 “Severe-Moody” from the Sleep/Mood Scale (SMood): L1: Very Good Mood (1 to 3), L2: Somewhat Good Mood (4 to 6), L3: Very Bad Mood (7 to 9); L4: Severe “Moody” (10).
19. What is the Number of Times you performed DMRT before going to sleep?*
   - (#19, #20) Number of times DMRT was performed 0 1 2 3 4.
20. What is the Number of times you performed DMRT to return to sleep after waking from sleep?

### Answer Questions At End of Day

21. What time did you take a Nap? “Nap time-1”
22. Total Time Napping #1 (in hours & minutes). “TNT#1”
23. What time did you take a Nap? “Nap time-2”
24. Total Time Napping #2 (in hours & minutes). “TNT#2”

**Instructions:** Write the Date. Write an “X” in the “Study Week” above. Use scales and/or directions above or below the questions to answer the corresponding numbers: In #1, 4-9, 14, 15, 16, 17, 18, 19, 20. For questions 13, 14, 16, 22, and 24, write answer in hours and minutes: for example, 0:15 or 1:25 (15 minutes or one hour and 25 minutes, respectively). Write the time by the 12-hour cycles with (A = a.m.) or (P = p.m.) in the spaces that ask for the Times (e.g., 7:45 AM). If you did not perform the DMRT, write zero (0).

**Key:** L= Level, SOL= Sleep-Onset Latency, WASO= Wake after sleep-onset; NOW= number of wakes.
### Appendix IX

**Sleep/Wake Pattern Index Formulas Chart**

<table>
<thead>
<tr>
<th>Index</th>
<th>Number of Days</th>
<th>Mean-Score</th>
<th>Mean-Time-1</th>
<th>Mean-Time-2</th>
<th>Mean-Time Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSV</td>
<td>$\sum f = N$</td>
<td>$M_X = \sum X / N$</td>
<td>$M_T = \sum T / N$</td>
<td>$M_T = \sum T / N$</td>
<td>$M_{TD} = M_{T1} - M_{T2}$</td>
</tr>
<tr>
<td><strong>Sleep-Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WASO</td>
<td>$\sum f_{WASO} = N$</td>
<td>$\sum (WASO) / N_{Days}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOW</td>
<td>$\sum f_{NOW} = N$</td>
<td>$\sum (NOW) / N$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TST</td>
<td>$\sum f_{TST} = N$</td>
<td>$\sum (TST) / N_{Days}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DFASI</td>
<td>$\sum f_{DFASI} = N$</td>
<td>$\sum (DFASI) / N$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sleep-offset Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWBAI</td>
<td>$\sum f_{W-EWT} + \sum f_{WALT} = N$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWFSI</td>
<td>$\sum f_{DWFSI} = N$</td>
<td>$\sum (DWFSI) / N$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Self-Awakening Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SASI</td>
<td>$\sum f_{SASI} = N$</td>
<td>$\sum (WBAM) / N_{Days}$</td>
<td>$\sum (WALM) / N_{Days}$</td>
<td>$M_{WBAM} - M_{WALM}$</td>
<td></td>
</tr>
<tr>
<td>SASI</td>
<td>$\sum f_{SASI} = N$</td>
<td>$\sum (EWT) / N_{Days}$</td>
<td>$\sum (FWT) / N_{Days}$</td>
<td>$M_{EWT} - M_{FWT}$</td>
<td></td>
</tr>
<tr>
<td>WBAI</td>
<td>$\sum f_{WBAI} = N$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WBACI</td>
<td>$\sum f_{(EWT \leq -10 &lt; 0 \text{ Min})} = N$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:

- **Indices**
- **Symbol – Definition**
- **Formulas**


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## Appendix X

### Sleep Continuity Psychometric History Chart (1967-2003)

#### A. Clinical Classification Normal Sleep/Wake Patterns

<table>
<thead>
<tr>
<th>POP</th>
<th>Sleep-Onset Latency</th>
<th>Wake After Sleep-Onset</th>
<th>Number of Wakes</th>
<th>Sleep Efficiency</th>
<th>Hour NPW/Months Duration</th>
<th>Validity/Reliability Criteria</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abr.</td>
<td>SOL</td>
<td>WASO</td>
<td>NOW</td>
<td>SE</td>
<td>Hr/NPW/Mo</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≤ 15 m</td>
<td></td>
<td></td>
<td>NOW ≤ 1</td>
<td>≥ 92%</td>
<td>4 h ≤ TST ≤ 5 h</td>
<td>Monroe, 1967</td>
</tr>
<tr>
<td>Volunteer</td>
<td>WASO ≤ 30 m</td>
<td></td>
<td></td>
<td></td>
<td>≥ 92%</td>
<td>6 h ≤ TST</td>
<td>Browman &amp; Tepas, 1976</td>
</tr>
<tr>
<td>Students</td>
<td>WASO ≤ 30 m</td>
<td></td>
<td></td>
<td></td>
<td>≥ 92%</td>
<td>6 h ≤ TST</td>
<td>Pilcher et al., 1997</td>
</tr>
<tr>
<td>Volunteer</td>
<td>WASO ≤ 30 m</td>
<td></td>
<td></td>
<td></td>
<td>≥ 92%</td>
<td>6 h ≤ TST</td>
<td>Murphy et al., 2000</td>
</tr>
<tr>
<td>Students</td>
<td>7 h ≤ TST ≤ 8 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ferrara &amp; Gennaro, 2001</td>
</tr>
<tr>
<td>Students</td>
<td>6 h ≤ GS ≤ 9 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ferrara &amp; Gennaro, 2001</td>
</tr>
<tr>
<td>Students</td>
<td>SS TST &lt; 6 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ferrara &amp; Gennaro, 2001; Monk et al., 2001</td>
</tr>
<tr>
<td>Students</td>
<td>LS TST &gt; 9 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ferrara &amp; Gennaro, 2001; Monk et al., 2001</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≤ 5 m</td>
<td></td>
<td>WASO ≤ 5 m</td>
<td></td>
<td>≥ 97%</td>
<td>QS TST &gt; 8 h</td>
<td>Ferrara &amp; Gennaro, 2001</td>
</tr>
<tr>
<td>Adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Core SN: 4.5 to 6 h</td>
</tr>
<tr>
<td>Students</td>
<td>WASO ≤ 5 m</td>
<td></td>
<td></td>
<td>&lt; 1 m</td>
<td>≥ 95%</td>
<td></td>
<td>Akerstedt et al., 2002</td>
</tr>
<tr>
<td>Students</td>
<td>WASO ≤ 5 m</td>
<td></td>
<td></td>
<td></td>
<td>≥ 95%</td>
<td></td>
<td>Akerstedt et al., 2002</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≤ 30 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bonnet &amp; Arand, 2003</td>
</tr>
<tr>
<td>Volunteer</td>
<td>NOW ≤ 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mayers et al., 2003</td>
</tr>
<tr>
<td>Mega Study</td>
<td>SOL ≤ 30 m</td>
<td></td>
<td>WASO ≤ 30 m</td>
<td></td>
<td></td>
<td></td>
<td>Lichstein et al., 2003</td>
</tr>
</tbody>
</table>

#### B. Clinical Classification of Insufficient Sleep/Wake Patterns

<table>
<thead>
<tr>
<th>POP</th>
<th>Sleep-Onset Latency</th>
<th>Wake After Sleep-Onset</th>
<th>Number of Wakes</th>
<th>Sleep Efficiency</th>
<th>Hour NPW/Months Duration</th>
<th>Validity/Reliability Criteria</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abr.</td>
<td>SOL</td>
<td>WASO</td>
<td>NOW</td>
<td>SE</td>
<td>Hr/NPW/Mo</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 30 m</td>
<td></td>
<td>WASO ≤ 45 m</td>
<td></td>
<td>&lt; 82%</td>
<td>4 h ≤ TST</td>
<td>Monroe, 1967</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 45 m</td>
<td></td>
<td>WASO ≤ 45 m</td>
<td></td>
<td>≥ 85%</td>
<td></td>
<td>Carrera &amp; Eleneewski, 1980</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 30 m</td>
<td></td>
<td>≥ 85%</td>
<td></td>
<td>Shealy et al., 1980</td>
</tr>
<tr>
<td>Patients</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≤ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>Hauri, 1981</td>
</tr>
<tr>
<td>Patients</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≤ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>Hauri et al., 1982</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 60 m</td>
<td></td>
<td>WASO ≥ 60 m</td>
<td></td>
<td></td>
<td></td>
<td>Ott et al., 1983</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 45 m</td>
<td></td>
<td>WASO &gt; 45 m</td>
<td></td>
<td></td>
<td></td>
<td>Lichstein, 1983</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>VanderPlate &amp; Eno, 1983</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 40 m</td>
<td></td>
<td>WASO ≥ 40 m</td>
<td></td>
<td></td>
<td></td>
<td>Lovibond et al., 1996</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 60 m</td>
<td></td>
<td>WASO ≥ 60 m</td>
<td></td>
<td></td>
<td></td>
<td>McClusky, et al., 1991</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 45 m</td>
<td></td>
<td>WASO ≤ 31 m</td>
<td>NOW &gt; 3</td>
<td>≥ 80%</td>
<td>TST ≤ 5 h</td>
<td>Engle-Friedman et al.,1992</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>Blisswise et al., 1995</td>
</tr>
<tr>
<td>Patients</td>
<td>SOL ≥ 40 m</td>
<td></td>
<td>WASO ≥ 40 m</td>
<td></td>
<td>≥ 85%</td>
<td></td>
<td>Hauri, 1997</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 31 m</td>
<td></td>
<td>≥ 85%</td>
<td></td>
<td>Riedel et al., 1998</td>
</tr>
<tr>
<td>Volunteer</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>Morin et al., 1999</td>
</tr>
<tr>
<td>Students</td>
<td>SOL &gt; 3 m</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 80%</td>
<td>TST ≤ 5 h</td>
<td>Ferrara &amp; Gennaro, 2001</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td></td>
<td>&gt; 3 m</td>
<td>≥ 80%</td>
<td></td>
<td>Akerstedt et al., 2002</td>
</tr>
<tr>
<td>Students</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>≥ 80%</td>
<td></td>
<td>Bonnet &amp; Arand, 2003</td>
</tr>
<tr>
<td>Mega Study</td>
<td>SOL ≥ 31 m</td>
<td></td>
<td>WASO ≥ 31 m</td>
<td></td>
<td></td>
<td></td>
<td>Lichstein et al., 2003</td>
</tr>
</tbody>
</table>

Note. Abbreviation (Abr.). Minutes (m). Hour (h) (Hr). Month (Mo). Percentage (%). Nights per week (NPW).

POP = Population assessed.

TST = Total sleep time.

GS = Good Sleepers, SS = Short Sleepers, LS = Long Sleepers.

QS = Quick Sleepers (Sleepy Sleepers: fall asleep quickly, no daytime sleepiness, & sleep when wish).

Core SN: Core Sleep Need Time.

TIB = Time in bed. TOB = Time Out of Bed.

Conversion to Military Time (00:00 to 24:00 hours).

Conventional TIB & TOB = The Norm sleep phases

Non-Conventional TIB & TOB = Delayed sleep phases.

Ins-sleep = Insufficient sleep or Insomnia.

Ins-sleep Severity Level ≥ 3 NPW ≥ 6 mo.

DSPI = Delayed sleep phase Insomnia.

DSPI Severity Level > 12 mo.

### Appendix XI

**ELMS SLEEP/ALERTNESS SCALE-II (ESAS-II)**

<table>
<thead>
<tr>
<th>ID CODE: ESAS2-0000</th>
<th>Study Week #: 1, 2, 3, 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: / /2011</td>
<td>Write Date's Day# in spaces →</td>
</tr>
<tr>
<td>Week Day:</td>
<td>Mon</td>
</tr>
</tbody>
</table>

Answer Questions 6 Hours After Last Awakening

Mark an “X” for ONE Number (1-7) below that best describes waking from sleep as

1 = (Not Difficult-Alert/Energetic) to 7 = (Very Difficult) from the last wakeup time to the 6th hour. Mark an “X” for One Number (8, 9, or 10) below that best describes difficult waking before alarm.

“MARK ONLY ONE NUMBER (1-7) and if applicable mark (8, 9 or 10) (per column) PER DAY!”

**Variable: Difficulty Waking From Sleep Index (DWFSI)**

<table>
<thead>
<tr>
<th>Not Difficult (Alert/Energetic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Felt alert, energetic, motivated, and/or focused after the last awakening from nighttime sleep from first opening eyes that last 6 hours.</td>
</tr>
<tr>
<td>2. Felt alert energetic, motivated, and/or focused within 20 minutes after the last awakening from nighttime sleep that last 6 hours.</td>
</tr>
<tr>
<td>3. Felt alert, energetic, motivated, and/or focused within one hour after the last awakening from nighttime sleep that last 6 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Somewhat Difficulty (Sleepy/Sluggish)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Desired to take a nap in the 5th or 6th hour after the last awakening from nighttime sleep.</td>
</tr>
<tr>
<td>5. Desired to take a nap in the 3rd or 4th hour after the last awakening from nighttime sleep.</td>
</tr>
<tr>
<td>6. Desired to take a nap in the 1st or 2nd hour after the last awakening from nighttime sleep.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Very Difficult (Lethargic/Sleepy/Sluggish)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Nodded and/or dozed off to sleep within 1 to 6 hours after the last awakening from sleep.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Severe Sleepiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Woke 1-10 minutes before “Expected Wakeup Time”; but I fell back to sleep and awoke by alarm, or slept past “Expected Wakeup time.”</td>
</tr>
<tr>
<td>9. Heard the alarm, pressed the snooze button, and/or fell asleep at least once after the alarm or the “Expected Wakeup Time.”</td>
</tr>
<tr>
<td>10. Slept through the alarm or past the “Expected Wakeup Time” at least once.</td>
</tr>
</tbody>
</table>

Instructions: Write Date. Mark “X” in Study-Week. Mark only ONE Number with “X” for numbers (1 thru 7) per day within 6 hours after last wake up time. If applicable, Mark only One Number with “X” for numbers (8 thru 10) per day within 6 hours after last wake up time. Each column per day will contain one X or, if applicable, two X’s.

### ELMS SLEEP-ONSET STRESS SCALE-II (ESOS-II)

<table>
<thead>
<tr>
<th>Variable: Difficulty Falling Asleep Index (DFASI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not Difficult Falling Asleep (Normal Stress)</strong></td>
</tr>
<tr>
<td>1. Fell asleep within 1-15 minutes; if I awoke before “Expected Wakeup Time,” each awakening was less than 5 minutes.</td>
</tr>
<tr>
<td>2. Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min.</td>
</tr>
<tr>
<td>3. Fell asleep within 1-15 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 min.</td>
</tr>
<tr>
<td><strong>Somewhat Difficulty (Stressfulness)</strong></td>
</tr>
<tr>
<td>4. Fell asleep within 16-30 minutes; awoke before “Expected Wakeup Time”; each awakening was less than 5 minutes.</td>
</tr>
<tr>
<td>5. Fell asleep within 16-30 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min.</td>
</tr>
<tr>
<td>6. Fell asleep within 16-30 minutes; awoke before “Expected Wakeup Time, but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 min.</td>
</tr>
<tr>
<td><strong>Very Difficult (Stressful)</strong></td>
</tr>
<tr>
<td>7. Fell asleep between 31-45 minutes; awoke before “Expected Wakeup Time”; each awakening was less than 5 minutes.</td>
</tr>
<tr>
<td>8. Fell asleep between 31-45 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I was awake more than 4 minutes, but less than 30 min.</td>
</tr>
<tr>
<td>9. Fell asleep between 31-45 minutes; awoke before “Expected Wakeup Time”; but in at least one of the awakenings, I tried to return to sleep, but I was awake for more than 30 minutes.</td>
</tr>
<tr>
<td><strong>Severe Stress</strong></td>
</tr>
<tr>
<td>10. Fell asleep after 45 minutes.</td>
</tr>
</tbody>
</table>

Instructions: Write the Date. Mark “X” in Study-Week. Mark only ONE Number (1 thru 10) for each day after sleep.

Appendix XIII

DMRT Evaluation Form (EVF) / DMRT Follow-Up Form (FUF)

To be filled out by Researcher:  ID Code: EVF: 0000    Date: ________

****************************************************************************************

Participant: Please complete the following and answer all that apply:

Name: ________________________________      Date: _____________________________

1. Do you feel you will continue to use the DMRT after you are released from this study?

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Definitely Yes</td>
<td></td>
</tr>
<tr>
<td>1b. Probably Yes</td>
<td></td>
</tr>
<tr>
<td>1c. Maybe</td>
<td></td>
</tr>
<tr>
<td>1d. Undecided</td>
<td></td>
</tr>
<tr>
<td>1e. Definitely No</td>
<td></td>
</tr>
</tbody>
</table>

2. Can you habitually self-awake at a pre-set time (without an alarm or help) within 15 minutes before alarm?

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a. 5 times per week</td>
<td></td>
</tr>
<tr>
<td>2b. 4 times per week</td>
<td></td>
</tr>
<tr>
<td>2c. 3 times per week</td>
<td></td>
</tr>
<tr>
<td>2d. 2 times per week</td>
<td></td>
</tr>
<tr>
<td>2e. 1 time per week</td>
<td></td>
</tr>
<tr>
<td>2f. 0 time per week</td>
<td></td>
</tr>
</tbody>
</table>

3. Rate the effects the DMRT had on your ability to achieve relaxation.

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a. Extremely high relaxation effect</td>
<td></td>
</tr>
<tr>
<td>3b. Large relaxation effect</td>
<td></td>
</tr>
<tr>
<td>3c. Medium relaxation effect</td>
<td></td>
</tr>
<tr>
<td>3d. Small relaxation effect</td>
<td></td>
</tr>
<tr>
<td>3e. Trivial relaxation effect</td>
<td></td>
</tr>
<tr>
<td>3f. No relaxation effect</td>
<td></td>
</tr>
</tbody>
</table>

4. Did the DMRT help you in your daily activities of your life?

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a. Definitely Yes</td>
<td></td>
</tr>
<tr>
<td>4b. Probably Yes</td>
<td></td>
</tr>
<tr>
<td>4c. Maybe</td>
<td></td>
</tr>
<tr>
<td>4d. Undecided</td>
<td></td>
</tr>
<tr>
<td>4e. Definitely No</td>
<td></td>
</tr>
</tbody>
</table>
The Deep Meditative Relaxation Technique (DMRT)

**DMRT Evaluation Form (EVF) / DMRT Follow-Up Form (FUF) (Continued)**

To be filled out by Researcher:  ID Code: EVF: 0000    Date: _________

****************************************************************************************

Participant: Please complete the following and answer all that apply:

Name: ________________________________      Date: _____________________________

5. Rate the effects more practice with the DMRT will have on the ability to consistently wake within 10 minutes before the alarm sounds.

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a. Extremely high practice effect.</td>
<td></td>
</tr>
<tr>
<td>5b. Large practice effect.</td>
<td></td>
</tr>
<tr>
<td>5c. Medium practice effect.</td>
<td></td>
</tr>
<tr>
<td>5d. Small practice effect.</td>
<td></td>
</tr>
<tr>
<td>5e. Trivial practice effect</td>
<td></td>
</tr>
<tr>
<td>5f. No practice effect</td>
<td></td>
</tr>
</tbody>
</table>

6. Rate the effects the DMRT has on initiating sleep.

<table>
<thead>
<tr>
<th>Please mark “only one” choice with an X</th>
<th>Mark X Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>6a. Extremely high sleep control effect.</td>
<td></td>
</tr>
<tr>
<td>6b. Large sleep control effect.</td>
<td></td>
</tr>
<tr>
<td>6c. Medium sleep control effect.</td>
<td></td>
</tr>
<tr>
<td>6d. Small sleep control effect.</td>
<td></td>
</tr>
<tr>
<td>6e. Trivial sleep control effect</td>
<td></td>
</tr>
<tr>
<td>6f. No sleep control effect.</td>
<td></td>
</tr>
</tbody>
</table>

7. If the DMRT helped you, please explain how.

(7a)________________________________________________________________________________
___________________________________________________________________________________

8. Please write any additional comments you may have about your use of the DMRT and any suggestions you feel may be pertinent to its use.

(8a)___________________________________________________________________________________
_______________________________________________________________________________________

## Sample Demographics

### Preliminary Phase Study Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Consented</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Males</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Adults</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>13</td>
</tr>
</tbody>
</table>

### Ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Consented</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>White</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Biracial</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>13</td>
</tr>
</tbody>
</table>

### Experimental Phase Study Participants

#### Gender * Age/Race/Education/Residence Crosstabulation

**Age**

<table>
<thead>
<tr>
<th>Gender</th>
<th>18 to 30</th>
<th>31 to 40</th>
<th>51 to 65</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>100.0</td>
</tr>
<tr>
<td>Percent</td>
<td>75.0</td>
<td>12.5</td>
<td>12.5</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

**Race**

<table>
<thead>
<tr>
<th>Gender</th>
<th>African American</th>
<th>Biracial</th>
<th>White</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>100.0</td>
</tr>
<tr>
<td>Percent</td>
<td>37.5</td>
<td>12.5</td>
<td>50.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

**Education**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>100.0</td>
</tr>
<tr>
<td>Percent</td>
<td>75.0</td>
<td>25.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

**Residence**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Campus</th>
<th>Off-Campus</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td>100.0</td>
</tr>
<tr>
<td>Percent</td>
<td>25.0</td>
<td>75.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
The Deep Meditative Relaxation Technique (DMRT)