南華大學

自然生物科技學系自然療癒碩士班

碩士論文

探討正念靜坐課程對大學生的學習及認知效能的影響

Exploring the Effects of a Mindfulness Meditation Course in a University on Students' Learning and Cognitive Performance

指導教授：陳秋媛 博士

研究生：何海鵑

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Exploring the Effects of a Mindfulness Meditation Course in a University on Students' Learning and Cognitive Performance

by

Hoi Ching Ho

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研究生：何逢彰

經考試合格特此證明

口試委員：釋慧開

連秋婷

溫宇晉

指導教授：連秋婷

系主任(所長)：葉月嬌

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When I started learning about mindfulness in the first semester in natural healing sciences, I instantly felt a deep connection with it and felt like doing a research about it in order to learn more. However, ironically and naively, I thought I was already very mindful, however, I was actually mindless and even "out-of-my-mind" through the process (until woke up from the biggest mistake and regret of my life). When I was writing this thesis, the more I read about mindfulness, the more I realized that it's really a lot easier to have knowledge about mindfulness than to apply it to life and make it a habit. The more I learn, the more I believe mindfulness is the most fundamental, important, essential and useful life skill we can learn to inherently and intrinsically increase our health and happiness.

I am very grateful for the chance to be able to learn mindfulness and write this thesis. There are a lot of people I would like to thank for making this study possible.

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Chinese Abstract

中文摘要

背景和目的：正念是佛法八正道的內涵之一，1979 年由卡巴金帶進西方現行醫療體系後，受到越來越多之注目，並被普遍地運用與研究。許多研究證實正念課程的效用，以正念為基礎的方法被運用到不同的臨床領域，處理各種身心議題。在國外有很多正念應用在病人身上的研究，特別是癌症病人。近年來開始在比較年輕族群研究，例如醫護學院學生、大學生及中學生，主要是針對壓力、情緒及心理困擾。英國國會及教育部開始討論正念可能帶給學生的好處及考慮將正念課程納入學校正規教育中。在國內正念的研究及應用則相對較少。本研究的目的是探討正念課程對大學生的學習效能及認知功能的影響，以作為瞭解、評估及推廣或全面引入正念課程於大學通識教育的參考。

研究方法：本研究採用兩組平行前後測之類實驗設計，實驗組進行 10 週的正念靜坐課程，每週一次，每次 50 分鐘。研究使用工具包括中文版的大學生學習效能量表（College Learning Effectiveness Inventory, CLEI）認知測驗軟體 (Computer Cognitive Tasks)。CLEI 包括「情緒滿意度」、「計畫與時間管理」、「成就追求」、「學業壓力」、「學業專注力」、「課堂溝通」、「學業自信」、「校園活動參與感」和「同儕交流」等九個分量表，全量表共 38 題。認知測驗包括持續性注意力(Digit vigilance task)、專注與警醒(Choice reaction time)、空間工作記憶(Spatial working memory) 和記憶掃描(Memory scanning task)等測驗題組，分別紀錄反應時間(ms)與反應正確率(%)。數據使用 PASW Statistics 18 統計軟體分析，以獨立 t 檢定分析 CLEI

得分以及電腦認知測驗的反應時間和反應正確率。

研究結果：本研究共招募受試者 282 人(實驗組 152 人，對照組 130 人)。結果顯示正念組的 CLEI 總分略有增加（從 127.25 到 129.77），而對照組保持穩定（從 127.40 到 127.87）。兩組受試者之前測在 CLEI 得分部分無顯著差異。在 CLEI 分量表的「計畫與時間管理」、「學業壓力」和「課堂溝通」等三項因素之得分，實驗組明顯高於對照組。認知測驗部分，前測各項數值兩組間無顯著差異。後測部分， 實驗組在 Digit vigilance task 的反應正確率和反應時間，以及 Choice reaction time task 的反應正確率等三個項目的表現明顯優於對照組；工作記憶認知測驗部分兩組無顯著差異。

結論與建議：從本研究結果顯示正念靜坐對提升學習效能和專注力有正面的影響，與其他研究結果一致。有越來越多的研究指出連貫的正念練習，不僅促進更好的學習和認知的表現，同時也提高了整體的身心健康。本研究證明專注力、持續的專注以及專注的控制是可以訓練的，因而提高學生的學習成效和認知功能。研究人員和教育工作者建議正念訓練是適合大學的教育（與教育目標相匹配），並且可以成為卓越教育。建議其他大學及其他高等學校把正念納入通識教育，從而幫助學生提高自己的學業學習表現，擴及身心健康。

關鍵字：正念靜坐、學習效能、電腦認知測驗、專注力、工作記憶

Abstract

Background and Aims: Since the early 1980s, mindfulness training has increasingly found a place in mainstream health care and medicine because of evidence of benefits for emotional and physical health. There is a substantial amount of empirical research and popular literature showing mindfulness is beneficial to a wide range of population both clinically and non-clinically. Mindfulness is gaining momentum in Western societies where there is a growing movement in education. In contrast, there are few studies and applications of mindfulness in Taiwan and in Asia. The aim of the study is to explore the effects of a mindfulness meditation course on learning effectiveness, attention and working memory in year-one freshman students.

Methodologies: The study used a pretest-posttest and quantitative research design. The intervention group was recruited from mindfulness classes and the control group was recruited from students without the mindfulness course. The mindfulness meditation course was an 18-week course taken over a semester with 50 minutes per class. Tools used in the study were a Chinese version of the College Learning Effectiveness Inventory (CLEI) and a computer software program focused on specific cognitive tasks for attention and working memory. Data was analyzed with PASW Statistics 18 (formerly SPSS Statistics). The total scale score and subscale scores of the CLEI as well as cognitive tasks on reaction times and correct responses were analyzed with independent t-tests.

Results: Two hundred and eighty-two freshmen students volunteered to take part in this study (mindfulness meditation group n=152, control group n=130). The total CLEI scores did not reach statistically difference between the two groups at the pre-test period. The total CLEI score of the mindfulness group increased slightly from 127.25 to 129.77 while control group remained stable (127.40 and 127.87). There were significant differences between the two groups on subscales in regards to management (p=0.009), stress (p=0.034) and class communication (p=0.010). For the cognitive task, the results did not reach statistically difference between two groups at pre-test. At post-test, there were significant difference between the two groups for cognitive tests measuring attention: digit vigilance task for both accuracy (p=0.036) and reaction time (p=0.018), as well as accuracy for the choice reaction time task (p=0.015) but not reaction time. There was no significant difference for memory tasks between the two groups

Conclusion and Recommendations: The findings from this study show mindfulness meditation provides positive effects on learning effectiveness and cognitive performance on attentional tasks. It is well documented in an increasing number of research studies that consistent mindfulness meditation promotes not only learning and cognition performance, but also overall wellness. It has also been suggested by researchers and educators that mindfulness is suitable for schools and colleges (matching with educational objectives) and may be the education *par excellence*. This study is consistent with the idea that

attention, sustained attention, and attentional control can be trained in order to improve student learning and cognitive effectiveness. It is recommended this University and other universities to adopt mindfulness training into their education context to improve students' academic learning and performance as well as well-being.

Keywords: mindfulness meditation, learning effectiveness, computer cognitive tasks, attention, working memory

Glossary of Terms

Cognition: Cognition is a term referring to the mental processes involved in gaining knowledge and comprehension. These processes include thinking, knowing, remembering, judging, and problem-solving. These are higher-level functions of the brain and encompass language, imagination, perception, and planning.

(Source: http://psychology.about.com/od/cindex/g/def_cognition.htm)

Attention: the active cognitive processing of a limited amount of information from the vast amount of information available through the senses, in memory, and through cognitive processes; focus on a small subset of available stimuli.

(Source: Sternberg, R. J. & Sternberg, K. (2011). *Cognitive Psychology*. Sixth Edition. Cengage Learning)

Attentional Control: is a central component of working memory and is conceptualized and defined as part of an executive system for organizing and planning goal-directed behavior and intellect. (Source: Smith E. E., Jonides J. *The cognitive neuroscience of categorization*. Cited in Nestor, P. G., Nakamura, M., Niznikiewicz, M., Levitt, J. J., Newell, D. T., Shenton, M. E., & McCarley, R. W. (2015). *Attentional Control and Intelligence: MRI Orbital Frontal Gray Matter and Neuropsychological Correlates*. Behavioural Neurology, 2015, 354186.)

Sustained Attention: Sustained attention is "the ability to direct and focus cognitive activity on specific stimuli." A distraction can interrupt and consequently interfere in sustained attention. Sustained attention is important as

"a basic requirement for information processing" and also important for cognitive development. When a person has difficulty in sustaining attention, they often present with an accompanying inability to adapt to environmental demands or modify behaviour and inhibition of inappropriate behaviour.

(Source: http://penta.ufrgs.br/edu/telelab/3/sustaine.htm)

Working Memory: is a system for temporarily storing and managing the information required to carry out complex cognitive tasks such as learning, reasoning, and comprehension. Working memory is involved in the selection, initiation, and termination of information-processing functions such as encoding, storing, and retrieving data; that is the ability to hold information in mind and manipulate it.

(Source: Rusnáková, Š. & Rektor, I. *The Neurocognitive Networks of the Executive Functions*. In Ajeena, I. M. (2012). *Advances in Clinical Neurophysiology*. Rijeka: InTech, s.161-170, 10 s. ISBN 978-953-51-0806-1)

Executive Function: Executive functions are associated with complex mental operations, such as planning, internal ordering, time perception, working memory, inhibition, self-monitoring, self regulation, motor control, regulation of emotion, motivation (Norman & Shallice, 1986; Luu &Tucker; 2000).

(Source: Rusnáková, Š. & Rektor, I. *The Neurocognitive Networks of the Executive Functions*. In Ajeena, I. M. (2012). *Advances in Clinical Neurophysiology*. Rijeka: InTech, s.161-170, 10 s. ISBN 978-953-51- 0806-1)

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Chapter 1: Introduction

1.1 Research Background

The core of natural healing and natural medicine indicates that beings have a natural ability within to heal, an inherent healing and recuperative power that is the key to all healing. Just as Hippocrates (c.460-377BC), the "Father of Medicine" said, “Natural forces within us are the true healers of disease” and “health is not merely the absence of disease. It is the balance of mind, body and soul.”

The Buddha discovered and discoursed that mindfulness can transform and remove suffering and dis-ease by changing the conditions our minds process and view experiences (Teasdale & Chaskalson, 2011). Mindfulness plays a central role in the teachings and practices of traditional healers (Poulin, 2009). Dr. Edward Bach (1886-1936), the developer of the Bach flower remedies, also put forward that instability of mind leads to various disorders in the body. The prevention and cure of disease starts with discovering the imbalance and disharmony within ourselves, because final and complete healing ultimately comes from within (Bach, 2009).

There is a substantial amount of empirical research and popular literature showing mindfulness is beneficial to a wide range of population both clinically and non-clinically. Harvard Health Publications listed that “Since the early

1980s, mindfulness meditation has increasingly found a place in mainstream health care and medicine because of evidence that it's good for emotional and physical health — for example, helping to reduce anxiety, stress, depression, chronic pain, psoriasis, headache, high blood pressure, and high cholesterol. Some studies suggest that it can improve immune function. Research has also found an association between mindfulness meditation–induced improvements in psychological well-being and increased activity of telomerase, an enzyme important to the long-term health of cells (1 April 2011, online)."

The aim of education is to provide qualitative education *par excellence* not only for academic learning and achievement, but also for personality development, well-being and fulfillment. Mindfulness was praised by the father of American psychology William James and researchers also suggested mindfulness may be just the education *par excellence* that William James sought over a hundred years ago (Lynch, 2013) and an education *par excellence* may require training students in strategies to help them establish a wandering attention in the service of learning (Morrison et al., 2014). In addition to healing, there are increasing amount of studies showing mindfulness can contribute to improved attention, cognition, and academic performance (Keye & Pidgeon, 2013; Chiesa & Malinowski, 2011; Morrison et al., 2014; Tang et al., 2007). A systematic review on effects of meditation techniques (including mindfulness meditations, MBSR and MBCT) on age-related cognitive decline showed that

12 studies reported positive effects on attention, memory, executive function, processing speed and general cognition (Gard et al., 2014).

Mindfulness has not only earned respect as an evidence-based discipline after extensive clinical researches (Burnett, 2009), but also became popular in societies and in education. *Time Magazine* used 'Mindful Revolution' as the cover in the February 2014 issue. The UK parliament has been discussing about introducing mindfulness into public schools to provide benefits to students, teachers and ancillary staff to address health crisis such as mental health, ADHD and stress as well as to bring about excellence in education (Parliamentary Westminster Hall Debate, 10 Dec. 2013).

Mindfulness is in its momentum in Western societies. In contrast and surprisingly, there are few studies giving attention to mindfulness in Taiwan or in Asian countries when compared to the West. In the university the researcher is studying, Nanhua University is starting to promote and introduce mindfulness training for freshman students as a credited course and beginning in the first semester in September 2014. This is the first trial in universities in Taiwan. This new program motivated the researcher to study how mindfulness meditation would affect Taiwanese university students and if the benefits would be same as the findings in Western countries. It is also hoped, from the study, to provide recommendations to teachers and schools in providing opportunities to students in learning and practicing mindfulness. The study is hoped to serve as an

initiative to increase the awareness of mindfulness' learning and healing benefits in Taiwan and hope there will be more research and practice of mindfulness in education in Taiwan to not only improve students' learning effectiveness, but also health, happiness and fulfillment.

1.2 Research Objectives

The aim of the current study is to explore the effects of a mindfulness meditation course on year one freshmen in Nanhua University in Taiwan in terms of learning and cognitive performance. The objectives investigated are:

1. The effects of mindfulness meditation course on students' learning effectiveness;
2. The effects of mindfulness meditation course on students' attention;
3. The effects of mindfulness meditation course on students' memory.

1.3 Original and Distinctive Contribution

The research in this study is aimed to make a distinctive contribution to educational excellence and a scaffolding for mindfulness in universities by exploring the effects of a mindfulness training on students' learning effectiveness and cognition performance.

The research also made an original contribution by adopting the CLEI and computer cognitive tasks for a measurement of the effects of a mindfulness training course. The CLEI and computer cognitive tasks could become a scaffolding for mindfulness in universities and educational excellence. The CLEI and computer cognitive tasks could also be a practice or an activity of the mindfulness training course for students to assess or aware of their own learning

effectiveness and also provide information or give ideas for teachers to design and develop activities for the mindfulness training course in improving students' learning effectiveness in a relaxing and aware way.

There is a lacking of empirical research and evidence in Taiwan. This research resulted in original and unique contributions to the local empirical evidence and research literature on mindfulness in Taiwan. The research also made a distinctive contribution to provide recommendations on implementing and improving mindfulness training course in universities. The research also aimed to make a distinctive contribution in promoting the awareness, research and integration of mindfulness training into education in Taiwan and in Asia.

Chapter 2: Literature Review

2.1 Mindfulness

2.1.1 Defining Mindfulness

Mindfulness can be defined as a meditation or a clinical intervention and also has been variously defined as a set of cognitive functions, psychological factors, traits, attitudes or skills (Whitmarsh, 2013). Behavioral sciences defined mindfulness as a consciousness discipline (Walsh, 1980; cited in Kabat-Zinn, 2003).

One of the most well recognized Western definitions of mindfulness comes from the mindfulness based training pioneer Jon Kabat-Zinn (Black, 2011). He outlined an operational working definition of mindfulness as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment to moment (Kabat-Zinn, 2003, p.145)." Baer (2003) pointed out that mindfulness is related to particular qualities of attention and awareness that can be cultivated and developed through meditation (Kabat-Zinn, 2003). Bishop et al (2004) proposed a two-component model of mindfulness: (1) The maintained self-regulation of attention on immediate experience and that allows for increased recognition of mental events in the present moment; (2) Curiosity, openness, and acceptance toward one's experiences in the present moment is the second component of

mindfulness. They proposed that mindfulness is a mode of awareness and a metacognitive (cognition about one's cognition) skill that is evoked when attention is regulated (Bishop et al, 2004). They hypothesized skills can be learned to regulate attention to evoke mindfulness do not limited to meditation techniques.

There is absence of consensus about an operational definition of mindfulness (Chiesa & Malinowski, 2011). Although, there are also concerns on what exactly practitioners are practicing with modern mindfulness based interventions and what studies are actually measuring mindfulness (Chambers et al., 2009; Rapgay & Bystrisky, 2009; cited in Chiesa & Malinowski, 2011), Chiesa & Malinowski (2011) emphasized that modern psychologically oriented definitions of mindfulness were draw from psychological terminology and were specifically designed to be used within current psychological and medical research settings.

Baer et al. (2006) combined five different mindfulness self-report scales with a psychometric approach and their factor analysis revealed a structural five-factor of mindfulness: observing, describing, non-reactivity, acting with awareness and non-judging (Chiesa & Malinowski, 2011).

2.1.2 The Historical Origin of Mindfulness

The word mindfulness is originally from the Pāli word *sati* and was first translated as ‘mindfulness’ by T.W. Rhys Davids in 1881 (Gethin, 2011).

Mindfulness is a basis of early Buddhism, the key element in meditations and one of the eight elements of the Noble Eightfold Path (Harvey, 1990; cited in Burnett, 2009). The topic of mindfulness was revealed by the Buddha in two discourses, the Anapanasati Sutra (Breath-Mindfulness Discourse) and the Satipathana Sutra (Katat-Zinn, 2003) (or the Maha-Satipatthana Sutra: The Great Discourse on the Establishment of Mindfulness, Bhikshu, 2012). In its origin in Theravada Buddhism from Maha-Satipatthana Sutra, there are “fourfold establishments of mindfulness (also known as ‘The Four Mindful Dwellings’) on the body, feelings, states of mind and phenomena, based on the life structure of body, mind and wisdom according to the Buddha’s teaching. By understanding of our own body, sensation, and mind (including recognition, mental formations, and consciousness), and Dharma, one can develop and settle one’s awareness, mindfulness and appreciation of truth (Dharma) in daily life (Bhikshu, 2012, p.203).”

The Buddha discovered and discoursed that mindfulness can transform and remove suffering and disease by changing the conditions our minds process information and view experiences (Teasdale & Chaskalson, 2011) by enabling insight into:

1. The nature and causes of suffering (dukkha);
2. The impermanence of all phenomena (anicca);
3. The non-existing of what we look for an underlying permanent essence to what we spend our lives thinking of as 'I', 'we' and 'my' (anatta) (Burnett, 2009).

The word *sati* or mindfulness has frequently been described as a state of "presence of mind… which allows the practitioner to see internal and external phenomena as they really are and to distinguish between projections and misunderstandings of the practitioner" (Nyaniponika, 1973; Tsoknyi, 1998; Uchiyama, 2004; cited in Chiesa & Malinowski, 2011, p. 406). Mindfulness facilitates a reveal of what is happening beyond its conceptual and emotional experience. Mindfulness places emphasis on a 'wakefulness awareness' of one's inner and outer worlds including thoughts, sensations, emotions, actions and surroundings in every moment (Chiesa & Malinowski, 2011).

Bhikkhu Bodhi (2011) tried to determine the meaning of mindfulness meditation using the source of inquiry the oldest Buddhist tests, the Pāli Canon. Bodhi described that *sati* (mindfulness) has to be integrated with sampajañña (clear comprehension) and it is only when these two work together that right mindfulness can fulfill its intended purpose. The word *sati* originally meant 'memory' and the Buddha explained it as 'lucid awareness'.

Bodhi (2011) viewed non-traditional applications of mindfulness and

whether mindfulness can legitimately be extracted from its traditional context and employed for secular purposes as acceptable and even admirable on the ground that they help alleviate human suffering.

Kabat-Zinn (2003, p.145) described "Buddha as a born scientist and physician…used his native resources of own mind, body and experience to delve into the nature of suffering and the human condition." Mindfulness is not exclusive to Buddhist, but an inherent human capacity as everyone is all mindful to one degree or another in different time. Kabat-Zinn does acknowledge the Buddhist traditions of cultivating mindfulness capacity and bring it to all aspects of life (Kabat-Zinn, 2003).

2.1.3 Mindfulness and Meditation

Mindfulness is a form of meditation (Anderson et al., 2007) and the historical and conceptual origins of mindfulness are rooted in Buddhist philosophy and practice as well linked to the meditation techniques (Rapgay & Bystrisky, 2009; cited in Chiesa & Malinowski, 2011). It is suggested two main styles of meditation: mindful and concentrative types of meditation with reference to directing attention differently (Golemen, 1988; cited in Chiesa & Malinowski, 2011). Baer (2003) described mindfulness meditation as distinguished from concentrative forms of meditation. Concentrative forms of meditation focus attention on a single point or stimulus such as an object, a word,

an image or a mantra, while mindfulness meditation involves a broader observation and meta-awareness of one's present moment ongoing experience inside and out with an open and non-engagement attitude (Anderson et al., 2007; Chiesa & Malinowski, 2011).

It is hard to distinguish or separate mindfulness and meditation. Sometimes they are used together and referred to each other. One reason is that most meditative techniques lie somewhere in between the two general styles of meditation (Andresen, 2000; Shapiro & Walsh, 1984; Wallace, 1999; cited in Chiesa & Malinowski, 2011). Another reason is that concentrative meditations and mindfulness meditations are no longer described or practice as opposed, instead it is recognized of their shared focused attention which can be directed depending on its practice (Lutz et al., 2008; Rapgay & Bystrisky, 2009; cited in Chiesa & Malinowski, 2011). Mindfulness training and practice involves meditation, and vice versa.

Mindfulness practices have a unique spirit and are different from relaxation strategies, cognitive behavioral interventions and self-monitoring exercises (Kabat-Zinn, 2003). Mindfulness was intended to be westernized and secularized to be applied into clinical and medical contexts to provide benefits for wider populations.

Chambers et al. (2009) and Goleman (1988) (cited in Chiesa & Malinowski, 2011, p.405) suggested that the link between mindfulness meditations practice

and the psychological health could be explained by that "Buddhist philosophy and psychology are mainly devoted to the eradication of latent tendencies and habits associated with the onset and maintenance of the emotions usually described as destructive such as anger and to the increase of 'positive' emotions such as happiness and compassion."

2.1.4 The Contemporary Clinical Application of Mindfulness

The US National Center for Complementary and Integrative Health (NICCIH, formerly NCCAM) categorizes mindfulness and mindfulness meditations as a mind and body complementary health approach and practice. Mindfulness-Based Cognitive Therapy (MBCT) is now a treatment for depression has been endorsed and recommended by The UK National Institute of Clinical Excellence as an effective treatment for prevention of relapse (http://mbct.co.uk/about-mbct/).

Jon Kabat-Zinn, Professor of Medicine Emeritus, was the first person who secularized, simplified and integrated mindfulness with science into clinical context and into the mainstream of medicine and society. In 1979, He founded the Stress Reduction Clinic and the Center for Mindfulness in Medicine with colleagues at the University of Massachusetts Medical Center. Kabat-Zinn introduced the first eight week structured mindfulness skills training programme named Mindfulness-Based Stress Reduction (MBSR) which gave considerable

psychological, and some physical, relief, to patients from a wide range of chronic physical health conditions experiencing intractable severe pain and distress. In his paper in 2003, Kabat-Zinn stated the original vision and rationale for MBSR as a training vehicle for the relief of suffering in patients and as a model for other hospitals and medical centers (Kabatt-Zinn, 2003).

Since then mindfulness interventions and research have proliferated in North America, UK and across the world, and the emerging evidence based empirical studies have confirmed that mindfulness has potential applications and benefits to a wide range of populations (http://mindfulnessinschools.org/mindfulness/).

Kabat-Zinn believes mindfulness brings a whole new meaning and thrust to clinical practice that "has the potential to contribute profoundly to the further development of the field of clinical psychology and its allied disciplines, behavioural medicine, psychosomatic medicine, and health psychology, through both a broadening of research approaches to mind-body interactions and the development of new classes of clinical interventions (p.144)." MBSR has become a template and there are many Mindfulness-Based Interventions (MBIs). There is a growing interest in incorporating mindfulness into clinical interventions in medicine and psychology (Kabat-Zinn, 2003).

The most well-known offshoot of MBSR is MBCT, also an 8-week course, was developed by Zindel Segal, Mark Williams and John Teasdale in the 1990s,

based on Jon Kabat-Zinn's Mindfulness-Based Stress Reduction program for people who have been repeatedly depressed to help them stay well and prevention of relapse in depression (http://mbct.co.uk/about-mbct/).

Mindfulness and acceptance are emphasized and mindfulness based interventions represent a new generation of therapy, or a third wave of cognitive behavioral psychotherapy (Hayes eds., 2006; cited in Smits, 2008; Brown et al., 2011). There are a variety of mindfulness-based approaches as interventions for treating a variety of psychological, psychiatric and physical problems (Chiesa and Malinowski, 2011). MBIs have become a central aspect of other psychological treatment protocols, with positive results from empirical studies. Apart from MBSR and MBCT, the most common mindfulness-based approaches include Dialectical Behavioral Therapy (DPT) was developed for borderline personality disorders patients (people with, a difficult-to-treat condition involving long-term turbulent emotions, impulsive actions, and chaotic relationships); Acceptance and Commitment Therapy (ACT) mixes mindfulness and acceptance strategies with commitment and behavior-change strategies. Contrasted with traditional cognitive behavioral therapy (which teaches people to control their thoughts, feelings, sensations, and memories), ACT teaches them to notice, accept, and embrace their private events. There are many other MBIs, such as the mindfulness-based eating programme (MB-EAT).

2.1.5 Mindfulness-Based Stress Reduction (MBSR)

Jon Kabat-Zinn introduced mindfulness as a resource into clinical practice and research through the 8-week sessions of Mindfulness-Based Stress Reduction (MBSR) (Zenner, 2014). The program consists of 2.5 hours for each session for 8 weeks and a full day of mindfulness retreat. The practice of mindfulness includes in class learning and practice and recommended approximately 45 minutes of daily home practice. The exercises or practice include sitting meditation (breathing and body-scan), movements such as yoga, in daily activities such as eating. In addition, mindfulness attitudes of a beginner's mind, non-judging, patience, acceptance, trust, letting go, non-striving are encompassed in the practice (Kabat-Zinn, 2003). MBSR is a highly structured program to help participants to increase their observation power and enhances patients' own abilities to cope with their health conditions and life more productively (Hamilton et al.; Kabat-Zinn, n.d.; cited in Praissman, 2008). Participants are encouraged to incorporate their learning into their daily lives so that routine activities become a meditative practice.

For example, by observing thoughts and emotions from a detached perspective, one can obtain clarity of mental perception (Black et al., 2009). Fernandez et al (2010) conducted a study on 316 college-aged and found that one acceptance-based factor (non-judging of thoughts and feelings) was negatively related to alcohol-related consequences, and one awareness-based

factor was positively related to consequences (all $p<.05$). Effect sizes were medium-small. The results reported mindfulness reduces alcohol consumption and consequences in college students. There is growing development of mindfulness-based addiction treatment driven by its effectiveness.

The MBSR program became the parent to later mindfulness based variations (Zenner, 2014). As Michael Chaskalson said in an interview by Burnett (2009): “mindfulness has been so successful in the clinical world is to with the fact that it is so targeted, because of its very clear problem formulation.” MBSR and MBCT are taught well because they are focused and well constructed within a framework of understanding which often nesting within the context of the pathology addressed.

The United States has now more than two hundred medical institutions and relevant agencies to provide mindfulness courses to help patients learn to use their own inner resources for a variety of physical and mental disorders and to live a happier, fulfilled life (Kabat-Zinn, 2011).

MBSR is sometimes compared to cognitive-behavioral therapy (CBT). While CBT assumes an underlying pathology such as depression, addition and eating disorders, MBSR does not assume an underlying pathology. Instead, MBSR is considered more a preventative way and to improve the overall well-being as it provides a new way of thinking and functioning in addition to as a treating method (Hamilton et al., 2006; cited in Praissman, 2008).

2.1.6 Some Research Highlights

"The experts lay out how the mind's powerful healing effects can be harnessed in ways that are becoming increasingly illuminated by scientific discoveries." Stuart J. Eisendrath, MD, professor of psychiatry at the University of California, San Francisco and director of its depression center

A growing body of research has demonstrated mindfulness based interventions are clinically effective (Baer, 2003; Grossman et al., 2004; cited in Anderson et al., 2007). The focus of the large majority of studies on mindfulness is on modern mindfulness based interventions and the reason may be those interventions are standardized and manualized in operation and facilitating empirical research as well as comparability across the studies (Chiesa & Malinowski, 2011). Grossan et al. (2004) conducted a meta-analysis of 20 studies showed that MBSR to be an effective method of stress reduction and improving quality of life for people with various diagnoses such as cancer, psychiatric diagnosis, chronic pain, cardiovascular diseases and so on (Praissman, 2008). Praissman concluded that MBSR is also beneficial to healthcare providers by enhancing clinicians' own well-being and their interactions with patients. MBSR is a safe, effective and integrative approach for both patients and healthcare providers.

As Black (2011) stated that "mindfulness is now widely considered to be an inherent quality of human consciousness. That is, a capacity of attention and

awareness oriented to the present moment that varies in degree within and between individuals, and can be assessed empirically and independent of religious, spiritual, or cultural beliefs (p.2).” This can be seen in the rapid growth in the last 20 years in mindfulness research (Figure 1).

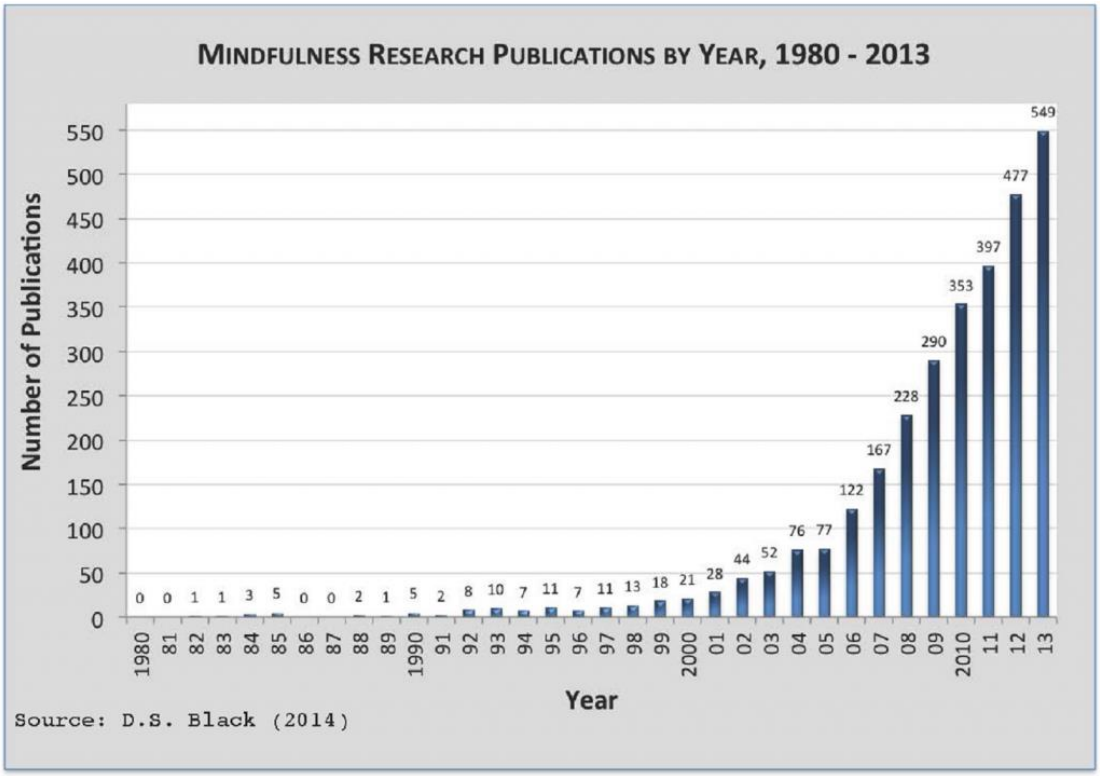


Figure 1 The growth in mindfulness research literature from 1980-2013. Source: The Mindfulness Research Guide, a website launched in 2009.

PubMed is the primarily database of references and abstracts on life sciences and biomedical topics and maintained by The United States National Library of Medicine (NLM) at the National Institutes of Health. When typed ‘mindfulness’ with filters ‘review’ and ‘free full text’ on 2015-2-3, there are 80 results and if removed filters would be 2381 items on mindfulness related

empirical studies and research. The 80 results showed the following topics of research of mindfulness in:

Anxiety in bipolar spectrum disorders, Addiction, Substance use, Relapse prevention, Attention and craving, Affective dysregulation, Borderline personality disorder, Cancer, Cardiovascular disease, Chronic physical illness, Depression, Burnout, Stress, Mood disorders, Emotional dysfunction and regulation, Aging brain, Cognitive decline, Functional gastrointestinal disorders, Multiple sclerosis, Neural mechanisms, Adolescent brain development, Executive function development, Pain, Chronic pain, Parent and children relationship, Psychotherapy, Psychological problems and health, Polycystic ovary syndrome, Positive reappraisal, Posttraumatic stress disorder (PTSD) and alcohol use disorders (AUD), Rheumatologists, Sleep disturbance, Insomnia, Schizophrenia, Smoking cessation, Somatization disorders, Vascular disease

The effectiveness of mindfulness-based interventions has been studied in a variety of populations and clinical settings (Praissman, 2008). There is a growing body of literature suggesting mindfulness training provides a number of benefits for a wide range of populations. There are now hundreds of published empirical studies suggesting that MBSR can lead to significant reductions in stress, anxiety and depression in clinical and healthy populations (Hölzel et al., 2011; Fjorback et al., 2011). A systematic review of randomized control trials on

21 studies, Fjorback et al. (2011) concluded that evidence supports MBSR improves mental health and MBCT prevents depressive relapse. In relation to how cognitive and behavior changes may be benefited from mindfulness training, Anderson et al. (2007) provided a few examples: (1) Williams et al. (2000) found mindfulness improved autobiographical memory without judging or avoiding aspects in depressed patients when compare to treatment as usual group; (2) Teasdale et al. (2002) demonstrated that MBCT improved patients' metacognitive awareness compared to treatment as usual that prevents depressive relapse; (3) Breslin et al. (2002) suggested mindfulness may increase participants' conscious awareness and controlled processing of relapse triggers that help to reduce substance abuse relapse.

Dryden and Still (2006) commented that the clinical applications of mindfulness has tackled in the adult world with 'spectacular success' (cited in Burnett, 2009).

A major criticism concerns the mindfulness studies is the shortcomings and limitations of methodology such as small sample size, no control groups, non-randomized and relying on self-report measurements (Chiesa & Malinowski, 2011; Praissman, 2008). Higher quality randomized control studies with larger samples are in demand.

2.2 Mindfulness in Education

Mindfulness training may be just the education *par excellence* that the father of American psychology William James sought over a hundred years ago (Burnett, 2009; Lynch, 2013):

"The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will... An education which should improve this faculty would be the education par excellence." - William James

Mindfulness in schools is a growing movement and trend, especially in the USA and UK. Mindfulness training for university students is also gaining international interest, with research into the benefits being conducted in the USA, UK, Australia, and Singapore (Lynch, 2013).

In the U.K., there is .b (http://mindfulnessinschools.org/what-is-b/), a mindfulness in schools project, provides a nine lesson course for schools and its objectives are to give students mindfulness as a life-skill:

- To feel happier, calmer and more fulfilled
- To get on better with others
- To help them concentrate and learn better
- To help cope with stress and anxiety
- To perform better in music and sport

It has been extended into 3 programs: .b is for 11 to 18 years old, paws .b

for 7 to 11 and .b Foundations for adults including teachers, staff and parents. The program received a positive evaluation by the Universities of Cambridge and Oxford Brookes.

On the other side of the Globe, in the USA, a non-profit agency Garrison Institute found there are nearly 20 school or community based organisations providing mindfulness programs or others using elements of mindfulness (Black et al, 2009). Two of organizations promote mindfulness and meditative interventions among youth in school, community and clinical settings (Black et al, 2009):

1. The US Committee for Stress-Free Schools (www.tmeducation.org): "established in 2005, provided TM programs to students and teachers in public, charter, and probate schools throughout the United States and evaluated the effects of TM on intelligence, learning, academic performance, ADHD and learning disorders, anxiety, depression, substance use, eating disorders, and other outcomes. (p.2)"

2. David Lynch Foundation: funds school-based programs to treat attention-deficit hyperactivity disorder (ADHD), emotional problems and enhance learning. One of the programs is a Quiet Time program (http://www.davidlynchfoundation.org/schools.html) which provides students with two 15-minute periods of Transcendental Meditation each day to help balance their lives and improve their readiness to learn. It started in the San

Francisco area and currently in San Francisco middle, high schools, and in scattered schools around the Bay Area. Although the Quiet Time involves Transcendental Meditation instead of mindfulness meditation, it is worth of looking at its research outcomes and benefits to education and students (Table 1).

An independent non-profit organization in US, Mindful Schools claimed that their program has benefited tens of thousands of children and their teachers. They claim over 200,000 children and adolescents in 48 U.S. states and 43 countries have been impacted as a result of their program. The mission of Mindful Schools is to integrate mindfulness into education (http://www.mindfulschools.org/about/our-story/).

Given the diverse efficacy and beneficial record and development of MBIs for adults, researchers and clinicians are also striving to develop adaptations for children and youths (Zenner et al, 2014). When typed ‘mindfulness in schools’ on PubMed on 2015-2-3, there are 48 results. A summary of the majority of this literature evaluating the effects of mindfulness in education and in young population is listed in Appendix 1.

Table 1 The result from the groundbreaking research on schools with a Quiet Time program in the US.

- 10% improvement in test scores and a narrowing of the achievement gap
- Highly effective for increasing intelligence and creativity
- Improved teacher retention and reduced teacher burnout
- Greater happiness, focus and self confidence
- Reduced ADHD symptoms and symptoms of other learning disorders
- 86% reduction in suspensions over two years
- 40% reduction in psychological distress, including stress, anxiety and depression
- 65% decrease in violent conflict over two years
- 21% increase in high school graduation rate
- 10% improvement in test scores and GPA
- Increased attendance and decreased suspensions for high school students

Source: http://www.davidlynchfoundation.org/schools.html

A review of treatment efficacy on sitting-meditation interventions among youth on 16 empirical studies by Black et al (2009) found meditation to have beneficial effects across physiologic, psychosocial, and behavioral outcomes. The majority of studies used mindfulness-based interventions. The review suggested sitting meditation may be an effective intervention in the treatment of physiologic, psychosocial and behavioral conditions among youth.

Black et al (2012) conducted a study on 5,287 Chinese adolescents in 24 schools and found trait mindfulness possibly shields against decision-making processes that place adolescents at risk for smoking. Results from baseline cross-sectional data indicated that trait mindfulness had a significant indirect effect on past 30-day smoking frequency through depressive affect, anger affect and perceived stress mediators. Results from 13-month longitudinal data indicated that these indirect effects remained significant for depressive affect and perceived stress but not for anger affect. Findings suggest that increasing mindfulness that improves affect regulation competencies among adolescents may indirectly reduce cigarette smoking.

Wall (2005) studied a clinical project that combined Tai Chi and mindfulness-based stress reduction as an educational program. Participants suggested that they experienced well-being, calmness, relaxation, improved sleep, less reactivity, increased self-care, self-awareness, and a sense of interconnection or interdependence with nature. This project infers that Tai Chi

and mindfulness-based stress reduction may be transformational tools that can be used in educational programs appropriate for middle school-aged children.

A systematic review and meta-analysis on 24 studies on mindfulness-based interventions in schools done by Zenner et al (2014) concluded that mindfulness-based interventions provide promising effects especially in relation to improving cognitive performance, coping and resilience to stress. Their analysis suggests that mindfulness-based interventions for children and youths are able to increase cognitive capacity for attending and learning. Zenner et al proposed the allocation and justification of such allocation of resources to implementations and evaluations of MBIs.

Mindfulness training are reported as promising interventions to guide self-awareness, reduce psychological distress, depression and burnout in medical students and recommended it for a self-care curriculum, as well as to better prepare medical students to cope with the demand of clinical practice (Outram & Kelly, 2014). Another study also demonstrated similar results on required resilience-mindfulness experiences were associated with significantly lower levels of depression symptoms, anxiety symptoms, and stress, and significantly higher levels of community cohesion, in medical students (Slavin et al, 2014). Dobkin and Hutcinson (2013) suggested that teaching mindfulness in medical school is gaining momentum. Their literature search revealed that there are 14 medical schools teach mindfulness to medical and dental students and residents.

Their findings show that students who follow these programmes experience decreased psychological distress and an improved quality of life. Dobkin and Hutcinson raised the question whether mindfulness training should be integrated into the medical school core curriculum. The University of Rochester School of Medicine and Dentistry (USA) and Monash Medical School (Australia) have integrated mindfulness into their curricula. Moreover, an exploratory study by Black et al (2011) found that self-control is positively related to mindfulness and working memory, and mental health and coping responses that leads to less alcohol use and hazardous or harmful alcohol use in medical students.

Lynch (2013) developed a tailored mindfulness-based coping with university life (MBCUL) for university students at the University of Northampton (UK) and evaluated its benefits between 2007-2010. The results showed that students attended MBCUL showed significant reductions in measures of perceived stress and anxiety, compared to wait-list controls. The scores of those in the control groups were actually increasing while there were significant decreases in scores of stress and anxiety in those attending MBCUL. Lynch suggested mindfulness in higher education is a ‘win-win situation’ for not only the students, but also for staff, teachers and academic success.

Kass et al. (2011) examined mindfulness training in relation to driving safety on university students. The study suggested that mindfulness training may greatly impact actual driving performance over time by improving drivers'

situation awareness and enabling them to block out distractions and to quickly identify hazards.

Studies also showed mindfulness meditation is effective at enhancing cognitive processes and self-regulated emotions, improving mood, and reducing anxiety (Arch & Craske, 2006; Broderick, 2005; Zeidan et al., 2009; Austin, 1998; Moore & Malinowski, 2009; cited in Ding et al., 2014).

2.3 Mindfulness and Learning Effectiveness and Cognition

The ability to focus with selectively process information (attention) and to retain information for accessibility (working memory) are critical aspects of our cognitive capacities (Fougnie, 2008) and attention and memory cannot operate without each other (Chun and Turk-Browne, 2007). There is a general agreement regarding the benefits of mindfulness on sustained attention and attentional control, reduced mind wandering and habitual tendency, and so improve participants' learning, performance, cognition and memory. On the other hand, the lower emotional reactivity, reduced rumination and better mood also lead to mental stability, well-being and academic performance (Chiesa & Malinowski, 2011; Malinowski, 2013).

However, mindfulness is not just and different than self-related attention. A study by Farb et al. (2007) and their result showed that MBSR participants' medial prefrontal cortex activity reduced more significantly compared to the active control group with self-related attention.

Bishop et al (2004) proposed that mindfulness is closely related to attention (a self-regulated attention) and mindfulness is therefore similar to a skill that can be developed with practice and as long as attention is purposely brought to experience, mindfulness will be maintained, and when attention is no longer regulated in this manner, mindfulness will cease. Bishop et al suggested that once the skills are learned, attention can be regulated to evoke mindfulness in

many situations, thus allowing the student to respond skillfully to situations that provoke emotional reactions. Chambers et al., (2009; cited in Chiesa & Malinowski, 2011) suggested that the awareness and non-reactivity retraining in mindfulness and MBIs allow participants to choose thoughts, emotions, and sensations more consciously rather than habitually reaction.

Jha et al (2007) conducted a study on 8-week mindfulness-based stress reduction (MBSR) course and the results suggested that mindfulness training may improve attention-related behavioral responses by enhancing functioning of specific subcomponents of attention, 'the endogenously orient attention'.

In a blinded study of 48 young, healthy meditation novices were randomly assigned to a mindfulness-based stress reduction (MBSR), non-mindfulness stress reduction (NMSR), or inactive control group, selective attention in the MBSR group improved significantly more than the other groups. The study result showed that only the MBSR intervention improved the threshold for conscious perception and visual working memory capacity. The study suggested that MBSR may contribute uniquely to attentional improvements (Jensen et al, 2012).

Although the study by MacCoon et al (2014) found no sustained attention differences in a longitudinal randomized trial comparing mindfulness based stress reduction versus active control, they also suggested it is unclear whether mindfulness might positively affect another aspect of attention, vigilance.

Another potential mechanism of mindfulness researchers suggested is the reduction of mind wandering. Mindfulness is suggested to be the opposite of mind wandering. Mind wandering is that the areas of the brain is still active when the cognitive system remains idle and is called default-mode network (DMN). It is suggested that a higher activity of DMN is related to increased rate of mistakes in attentional tasks and other tasks. It is also suggested that reducing mind wandering could lead to improved attentional capacities that could be beneficial in many respects (Smallwood and Schooler, 2006; Raichle et al., 2001; Carmody, 2009; cited in Zenner, 2014).

In relation to working memory, Cowan (1995) suggested that working memory "is a system that operates via a dynamic interaction between memory and executive attention processes (cited in Shelton et al., 2010, p.1)". Zeidan et al (2010) found that brief mindfulness training (4 sessions in 4 weeks) significantly improved the visuo-spatial processing, working memory, and executive functioning. The findings suggest that four days of meditation training can enhance the ability to sustain attention and improves cognition. Brief mindfulness training can also provide benefits that have previously been reported with long-term meditators. In a randomized controlled study, Mrazek et al (2013) found mindfulness training reduces mind wandering and improves working memory capacity and cognitive reading and comprehension performance.

A systematic review on whether mindfulness training improve cognitive abilities by Chiesa et al (2011), reviewed 23 studies and suggested that mindfulness meditation practices could enhance cognitive functions such as working memory capacity and some executive functions. They also suggested that early phases of mindfulness training (more concerned with the development of focused attention) could be associated with significant improvements in selective and executive attention, while the following phases (by an open monitoring of internal and external stimuli) could be mainly associated with improved unfocused sustained attention abilities.

From neuroscience findings, the results of a study on mindfulness practice leads to increases in regional brain gray matter density (Hölzel et al., 2011) suggest that participation in MBSR is associated with changes in gray matter concentration in brain regions involved in learning and memory processes, emotion regulation, self-referential processing, and perspective taking.

2.4 Teaching Mindfulness in Education

Mindfulness is considered an appropriate intervention to provide benefits to students to address their needs, and also can be a preventive approach at little cost, given the diverse usefulness and beneficial record of MBIs for adults (Weare and Nind, 2011; cited in Zenner et al., 2014).

Due to different audience, time-frame and place, Burnett (2009) suggested there are practical differences between the teaching of mindfulness in the adult world and in schools. For example, as Kabat-Zinn said “no one was in the classroom under duress. You have to want to be there to be allowed in”, Burnett commented that this could not be said of all students in a school. Among students, attention spans are limited and demands a very clear rationale for motiving them to participate into mindfulness meditation or to do certain tasks. Adult techniques need to be adapted for a younger audience. There is a greater need for variety consistency in order to sustain and engage younger people’s interest but also need to balance repetitions practices so that skills can be developed (Thompson and Gauntlett-Gilbert, 2008; cited in Burnett, 2009).

Burnett (2009) also suggested that it’s very important to have a clear and well-defined framework of understanding or context for teaching mindfulness to suit the school environment and students. Burnett suggested the objectives for mindfulness to adolescents could be:

- To concentrate better and improve their exam results;

- To address attention deficits and improve their behavior;
- To decrease the risk of depression in later life;
- To open a door to greater self-understanding;
- To encourage students to see the world through a different lens;
- To cultivate value-like patience, tolerance and equanimity.

It's generally expected instructors for mindfulness to be well trained and have extended personal practice as instructors play a very significant role on the way mindfulness is presented depending on the training and background of instructors (Gilpin, 1998; cited in Burnett, 2009). In the context of timetabled classrooms, Burnett (2009) suggested that not the same level of training as an instructor of an eight-week course is acceptable because it's less likely for the instructor to be able to teach the kind of depth in a 40 minutes lesson as common in eight-week courses. He suggested that the mindfulness teacher's role is to nurture a culture of trust so that students are comfortable to share their experiences. Burnett also suggested that the ability to teach mindfulness successfully to a class of teenagers not only depends on mindfulness teachers' understanding of mindfulness, but also their classroom management and their relationship with the students.

Burnett (2009) proposed that "if the ambition is for mindfulness to be accepted as a well-being discipline of real value to young people, then one thing

the scaffolding almost certainly shouldn’t be is a ‘Buddhist’ one (p.31)” due to may potentially exclude people who could benefit from it.

Chapter 3: Methodologies

3.1 Research Framework and Flow Chart

The study was carried out in accordance with the protocol approved by the Committee for Research Involving Human Subjects under the Research Ethics Committee at Buddhist Dalin Tzuchi General Hospital. The letter of approval is included Appendix 2.

The design of the study used a quasi-experimental pre-post test to measure the effects of Mindfulness Meditation course on students. The design was quasi-experimental because in the context in this study, it was not possible to randomize participants to groups and this is one of the limitations of the study. However, the use of a control group allowed the study to control for effects such as learning, maturation and time of the year (e.g., beginning of the semester or examination period).

This study used quantitative research method to allow comparing the effectiveness of the intervention between Mindfulness Meditation course participants' scores to those of control participants. Figure 2 and Figure 3 show the research framework and flow chart.

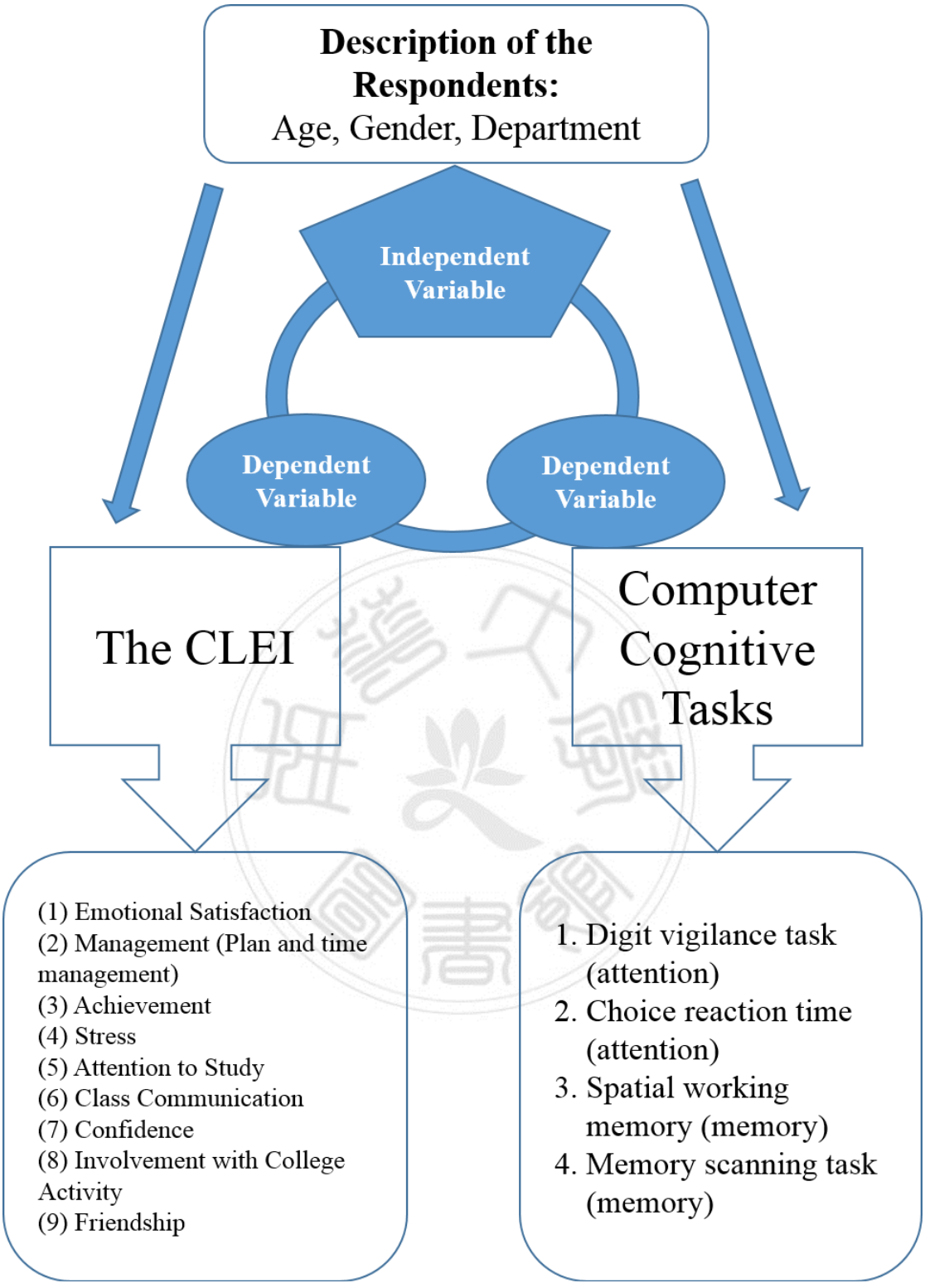


Figure 2 Research Framework

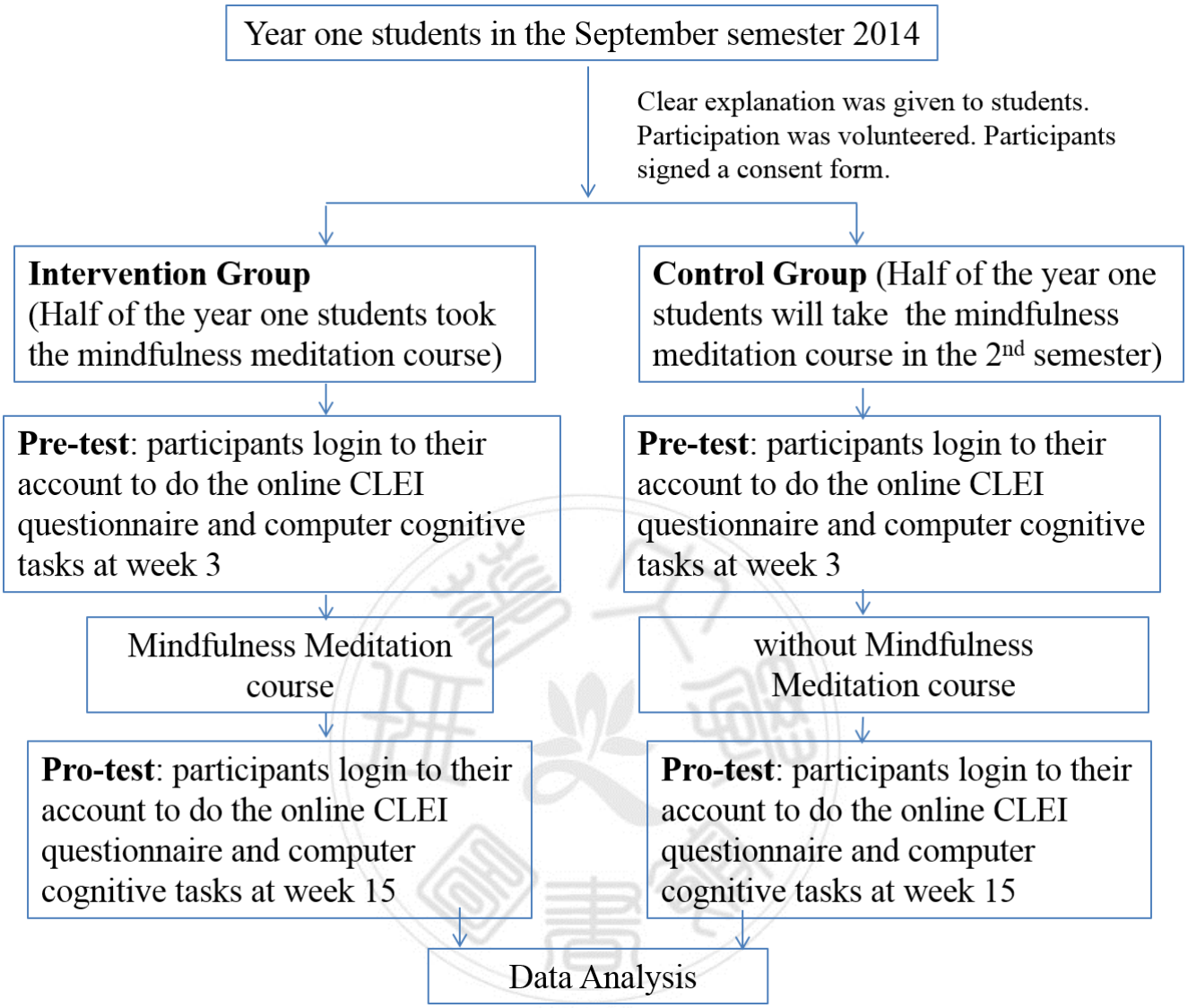


Figure 3 Research Flow Chart

3.2 Intervention

The Mindfulness Meditation course in this current study involved 18 weekly 50-minute classes (total 15 hours) over a semester for freshmen students in the school year starting in September in 2014. Half of the students enrolled in the course in the first semester and half of the students had normal course and will take the Mindfulness Meditation course in the second semester served as the control group.

The outline of the Mindfulness Meditation course covers secular and Buddhist context and contains a rich content. Students in the Mindfulness Meditation course engaged in mindfulness practices such as mindful breathing, body-scan, mindful eating, sitting and walking meditation. In classes, the focus was on practice and experience of mindfulness through participation in different methods or different kinds of activities. Students were encouraged to extend their experience and apply mindfulness skills in everyday life. Students are required to attend classes and submit homework with a practice diary and watch online course material for further explanations and practice instructions outside the course as part of their assessment. Appendix 3 contains the course outline.

3.3 Participants

3.3.1 The Sampling Method

The inclusion criteria for this study required participants to be freshmen students in the September semester of 2014. The sampling method consisted of asking all year one freshmen students in the September semester 2014 at Nanhua University in Taiwan to participate in this research study. Twelve classes of freshmen students were in the mindfulness meditation course and another 12 classes were in the wait-list group who will take the mindfulness meditation course in the 2nd semester served as the control group. The researcher obtained the approval to go to each class, when the freshmen students were in the Mindfulness Meditation classes (intervention group) or in the Physical Exercise classes (control group), to do a short presentation to explain the research and how to participate. Presentations were made to 24 different classes.

The intent was to obtain a sample of freshman students from the mindfulness meditation course and from the wait-list control group. The goal was to approach all freshmen students to invite them to participate in the research. It was intended to recruit approximately 300 students (150 from the intervention group and 150 from the control group) to participate. However, participation was lower than expectation and may due to a lack of incentive and motivation for new students to participate. The reason may be lack of motivation or the intensive was not strong enough to motive students to take the time and

effort to participate.

3.3.2 Recruitment

In the presentation to the targeted population, students were given basic information of the research to fully inform them about what was expected of them.

First, they were told about the study was to assess the effects of mindfulness meditation course on students' learning effectiveness. They were told that the IRB approval and participation was volunteered. Second, they were told that there were two parts to the research, or two separate online instruments to complete: one containing the Chinese version of the CLEI, and the other containing the computer cognitive tasks. They were explained that they would have to sign the consent form themselves and also explain to their parents to sign since they were under 20 years old that the IRB required parents' or legal guardian's signature as well. They were explained when and how to participate that the participants need to logon to their student account to do the online CLEI, after completed it they then can follow the instruction to do the online computer cognitive tasks. Third, students were told that they could personally benefit from completing the CLEI and computer cognitive tasks because they would gain information on their learning effectiveness, attention and memory that could help them identify their strengths and weaknesses. Next, they were told the

purpose of the survey was to measure mindfulness effectiveness, not to gather personal or private information about them for analysis. They were assured that their responses to the study would be confidential and that they would not be identified in reporting the results. Finally, they were told that a small gift would be given to those completed both pre and post tests (as well as returning required consent forms). In order to encourage students to participate, some teachers of the mindfulness classes and the Physical Exercise classes told students they would be given extra credit points for participating in the study.

3.4 Research Tools

This study used the Chinese version of the College Learning Effectiveness Inventory (CLEI) and computer cognitive tasks for measures of the effects of mindfulness meditation course on students' learning and cognition (attention and working memory).

3.4.1 The Original CLEI

The College Learning Effectiveness Inventory (CLEI) is a valid and reliable assessment tool identifying variables important to individual student academic success. It is a college-specific construct measures instrument designed to measure college students' attitudes and behaviors that may impact learning and academic performance (Newton et al., 2008). The CLEI was developed over ten years. The present edition of the CLEI (2008 Edition) is comprised of six scales with 50 questions to measure learning effectiveness impact factors (Appendix 4). The six scales include academic self-efficacy (ASE), organization and attention to study (OAS), stress and time press (STP), involvement with college activity (ICA), emotional satisfaction (ES), and class communication (CC). Participants are asked to rate their own learning approach and attitude on a five-point scale, from 1 (Never) to 5 (Always).

The CLEI contains clearly definable and operational items to measure psychosocial factors including thoughts, feelings, or behaviors related to

academic outcomes (Newton et al., 2008). Students can use the CLEI as a tool to increase their awareness of personal strengths and weaknesses of their learning effectiveness and to make changes that may improve their academic performance. Teachers, counselors and advisors can also use the CLEI to understand students' personal and social influences that impacted learning performance and to develop interventions as well as to help students develop plans to improve their learning.

The objective of CLEI is also as a research tool to measure changes and describe relationships between variables and outcomes. It is appropriate to use in pre-post measure to determine the effectiveness of specific interventions (Newton et al., 2008).

The interpretation of the six scales is listed below (Newton et al., 2008):

1. **Academic Self-Efficacy (ASE Scale)**: This scale measures an expression of confidence in academic ability, awareness of effort toward study, and expectations of success in college attainment. Those who score high have expectations to succeed and accomplish important outcome goals. Those who score low are more likely to feel uncertain about possible achievement and what the future may hold.
2. **Organization and Attention to Study (OAS Scale):** This scale measures the organization of tasks and structuring of time to set goals, plan, and carry out necessary academic activity. Those who score high are likely to use

effective organizational planning and time management skills to achieve academic success. Those who score low are more likely to avoid planning strategies and lack focus of attention in providing self-direction.

3. **Stress and Time Press (STP Scale)**: This scale measures how student deals with the pressures of time, environmental concerns, and the academic demand that impacts academic study. Those who score high manage the pressures of academics without reactions such as being overwhelmed, procrastination, or avoidance. Those who score low may experience symptoms of stress and do not believe they can handle the academic demands they experience.
4. **Involvement with College Activity (ICA Scale):** The ICA Scale measures active in student activities and membership in university organizations. Those who score high are members of many organizations and often participate in formal and/or informal campus activities. Those who score low are more socially isolated and are less likely to participate or engage in campus activities.
5. **Emotional Satisfaction (ES Scale):** This scale measures the degree of interest and emotional response in academic life including people and the campus educational environment. Those who score high express encouragement, interest, and positive anticipation for academic life, whereas those who score low are more likely to express discouragement, negative

reactions, and a sense of being overwhelmed with academic life.

6. **Class Communication (CC Scale)**: Communication in the CC Scale includes both verbal and non-verbal effort to engage in class activity. Those who score high scorers are assertive and active with written and oral communication in-class and with their instructors. Those who score low may experience uncertainty and reluctance in expressing and asserting their ideas in-class and with their instructors.

Newton et al., (2008) conducted three separate studies with samples of university students: (a) a derivation sample for an exploratory factor analysis (N=587), (b) a replication sample for a confirmatory study (N=282), and (c) a validation sample for a cross-validation study (N=160). Participants were university undergraduate students who were enrolled in a large public university (enrollment greater than 20,000 students) in the US Midwest.

Scores for the six scales had reliability coefficients of internal consistency (ranging from .68 to .87). Table 2 presents scale statistics including means, standard deviations, inter-correlations, and reliability coefficients with 95% confidence intervals for the six scales of the CLEI. Table 3 shows that, for confirmatory factor analysis (CFA), when applied to the replication sample, overall fit indices indicated that the CFA for the six CLEI scales resulted in a generally acceptable fit. Correlations between the validation instruments and the

CLEI scales are shown in Table 4 with overall moderate positive correlation.

Table 2 Reliability coefficients of internal consistency of original CLEI

Scale Statistics: Means, Standard Deviations, Intercorrelations, and Reliability Coefficients with 95% Confidence Intervals for the Six Scales of the CLEI

Factor	N of Items	M	SD	Intercorrelation Coefficient						Reliability Coefficient (95% CI)
				1. ASE	2.OSA	3. STP	4.ICA	5.ES	6.CC	
1. ASE	14	4.40	0.51	---						.87[a] (.855, .885)
2. OSA	8	3.06	0.60	.45**	---					.81[a] (.784, .831)
3. STP	6	3.04	0.73	.26**	.41**	---				.77[a] (.738, .796)
4. ICA	9	3.40	0.69	.43**	.35**	.18**	---			.81[a] (.782, .829)
5. ES	7	3.62	0.58	.56**	.51**	.38**	.38**	---		.72 (.689, .757)
6. CC	6	3.34	0.64	.39**	.36**	.32**	.35**	.47**	---	.68 (.637, .717)

Note. N=597.
ASE=Academic Self-Efficacy, OSA=Organization and Attention to Study, STP=Stress and Time Press,
ICA=Involvement with College Activity, ES=Emotional Satisfaction, CC=Class Communication.
[a] Cronbach's alpha was significantly greater than hypothesized value of .70 ($p<.05$).
**$p<.01$.

(Source: Newton et al., 2008)

Table 3 Confirmatory factor analysis of original CLEI

Table 11

Overall Fit Indices of the Confirmatory Factor Analysis on the Six Scales of the CLEI

	χ^2	df	NFI	GFI	AGFI	RMSR	RMSEA	CFI
Independence Model	22,447.46**	1,225						
Fit Statistics	1.898.62**	1,118	.92	.92	.90	.08	.05	.96

Note. N=292.
Fit indices include chi-square (Satorra-Bentler Scaled Chi-Square), NFI=normed fit index, GFI=goodness-of-fit index, AGFI= adjusted goodness-of-fit index, RMSR=root mean square residual , RMSEA=root mean square error of approximation residual, and CFI=comparative fit index.
**p<.01.

Table 4 Correlations between the validation instruments and the CLEI scales of original CLEI

Relationship between the CLEI and Validation Instruments

CLEI Scales	Validation Instruments	Pearson *r*
1. Academic Self-Efficacy	LASSI (Motivation Scale)	.46**
	Rosenberg Self-Esteem Scale	.45**
2. Organization and Attention to Study	LASSI (Concentration Scale)	.71**
	LASSI (Self-Testing Scale)	.46**
3. Stress and Time Press	LASSI (Time Management Scale)	.44**
4. Involvement with College Activity	Crombag College Adaptation Questionnaire	.31**
5. Emotional Satisfaction	LASSI (Attitude Scale)	.50**
6. Class Communication	Student Propensity to Ask Questions	.53**

Note. N=160.
LASSI=Learning and Study Strategies Inventory
**p<.01.

(Source: Newton et al., 2008)

Scoring Procedures

According to the CLEI Manual (Newton et al., 2008), items are on a five point Likert scale (a score of "1" equals a high negative behavior and "5" represents a high positive behavior. Items in negative continuum are transformed to reverse scores (i.e., a score of 1 is transformed to a score of 5, score 2 to 4, score 4 to 2, score 5 to 1).

The scoring includes raw mean and T-scores for each of the six scales. The purpose of providing an individual raw mean score for each of the six scales is to provide an interpretation that demonstrates an individual's profile of high and low scores indicating strengths and weaknesses from an intrapersonal perspective.

The scoring system of T-Scores is based on normative scores that an individual student's mean raw score for each scale is compared with average scale scores generated by a normative sample. T-Scores could provide better interpretation of the individual profile of the scales (Newton et al., 2008).

3.4.2 The Chinese Version of the CLEI

Chen (2010) translated and revised the CLEI to suit Taiwan college students. Chinese version of CLEI has good construct validity and criterion-related validity, at the same time, has good stability, and the internal consistency reliability is in the acceptable range (Chen, 2010).

1. Validity

In order to examine the construct validity by exploring the underlying variance structure of a set of correlation coefficients, Chen conduced item analysis, factor analysis and principal components analysis, the Chinese version of CLEI reduced to 38 questions and come up with 9 factors and Chen named them with reference to the CLEI: Emotional Satisfaction, Management, Achievement, Stress, Attention to Study, Class Communication, Confidence, Involvement with College Activity, Friendship (Appendix 5). Chen analyzed that the change may due to the difference between English and Chinese and cultures.

The nine factors eigenvalue were 4.854, 3.942, 4.721, 3.238, 3.084, 3.699, 4.274, 2.307, 3.037 respectively and explain 58.71% of the total variance.

Chen (2010) used comparative-fit index (CFI), root-mean-square error of approximation (RMSEA) and standardized root-mean-square residual (SRMR) for confirmatory factor analysis. To confirm the structural model adaptation index of the 9 factors Chinese version of the CLEI, model fitness test was

conducted with the formal data of the sample, the results were significant statistically: $\chi 2$ value of 1824.58 ($p < .001$), although achieve significant level, but RMSEA value of .06, CFI value is .92, SRMR value .08, showing fitness model is still good. And calculate the correlation of each subscale coefficient as shown in Table 5.

Table 5 The correlation coefficient for the Chinese version of CLEI of each subscale (N=420)

	1	2	3	4	5	6	7	8	9
Total Scale	0.74	0.61	0.77	0.58	0.73	0.61	0.68	0.60	0.53
Emotional Satisfaction		0.28	0.58	0.29	0.38	0.35	0.50	0.47	0.44
Management			0.49	0.31	0.44	0.20	0.36	0.24	0.26
Achievement				0.24	0.41	0.36	0.64	0.39	0.34
Stress					0.57	0.32	0.22	0.19	0.19
Attention to Study						0.38	0.42	0.25	0.25
Class Communication							0.38	0.45	0.22
Confidence								0.29	0.26
Involvement with College Activity									0.32
Friendship									

Note: Table 4-5 All correlation coefficients are reached significant level $p<.01$

(Source: Chen, 2010)

For the criterion-related validity, Chen (2010) used Lee's (2007) college student efficacy scale and Tseng's (2007) college student problem scale and the relevant subscales ranged .16 ~ .69 and correlation between subscales -.18 ~ -.72 respectively. The results of moderate correlation coefficients showed that the Chinese version of the CLEI has good criterion-related validity.

2. Reliability and Coefficient of Stability

The repeated surveying (N=110) after three weeks, full-scale test-retest reliability was .89, while the subscale between.70 ~ .82 (see Table 6), show the Chinese version CLEI has good stability.

Table 6 The internal consistency coefficient and stability coefficient for the Chinese version of the CLEI

	Internal consistency coefficient α	Test-retest reliability (Interval of three weeks)
Total Scale	0.90	.89**
Emotional Satisfaction	0.72	.80**
Management	0.77	.70**
Achievement	0.76	.73**
Stress	0.65	.74**
Attention to Study	0.77	.79**
Class Communication	0.62	.80**
Confidence	0.71	.82**
Involvement with College Activity	0.56	.79**
Friendship	0.66	.74**

**p<.01

(Source: Chen, 2010)

For Internal Consistency coefficient alpha, the researcher used the formal survey sample data to calculate Cronbach's α coefficients and get the full scale .90 coefficient α, and the subscales between .56 ~ .77, except a slightly low with the subscale " Involvement with College Activity," the remaining coefficients α subscales mostly about .70, show that the Chinese version of CLEI has a certain internal consistency of the scale.

In summary, the Chinese CLEI has good construct validity, criterion-related validity and stability, as well as acceptable internal consistency.

3. Administration and Scoring

The Chinese version of the CLEI is administered on-line via Moodle Teaching System. Students logon to their account to access and take the CLEI. The inventory can usually be completed in 10 to 15 minutes.

The Chinese version of the CLEI has 38 questions and adopted five-level Likert item: (1) means never; (2) seldom; (3) sometimes; (4) often; (5) always. One score for answer 1, 2 scores for answer 2 and so on. Items in negative continuum are transformed to reverse scores (i.e., a score of 1 is transformed to a score of 5, score 2 to 4, score 4 to 2, score 5 to 1). All added up will be the total scores of the Chinese version of the CLEI. The total scores range from 38-190, the higher the better of the learning effectiveness. Raw item scores, mean scores, and T-Scores are same as the original English CLEI. A normative

score for the Chinese version of the CLEI is not yet developed.

The researcher has obtained consent from Chen to use the Chinese version of the CLEI in this study (Appendix 6).

4. The nine scales of the Chinese version of the CLEI

The interpretation of the nine scales is listed below (Chen, 2010):

(1) Emotional Satisfaction

This scale reflects the extent of students' interest in university life and emotional reactions, including towards to people and the environment on campus. Higher scores exhibit encouragement and interest in things and there is a positive response to expectations. Lower scores may be more likely to experience frustration, negative emotions, and overwhelmed feelings.

(2) Management (Plan and time management)

This subscale revealed the ability to organize and time management when set goals and make plans to carry out the necessary academic activities among college students. Higher scores are likely to use effective and organized planning and time management skills in order to achieve academic goals. Relatively lower score may avoid making plans or using strategies.

(3) Achievement

The questions in this subscale reflect the degree of students in actively

setting goals for themselves and trying to pursue success, but also reflect students' own expectations for success. Higher scores have expectations for the successful completion of important academic achievement. Lower scores feel uncertain about his ability to get on academic achievement, as well as their future direction.

(4) Stress

This subscale reflects college students perceived pressure from schoolwork and time, and whether can properly handle in the face of stress from the environment and the academic needs. High scorers are less likely to be at a loss, delay and escape reactions in the face of academic stress. Low scorers are more likely to experience symptoms of stress and believe they can’t cope.

(5) Attention to Study

This subscale revealed the extent of university students for learning and academic focus. Higher scores exhibited higher level of learning attention and students with low scores may not be able to focus on his studies or aims.

(6) Class Communication

This includes communications between teachers and students in classroom activities, including verbal and non-verbal part. Higher scores indicated more assertive and actively interact with the teacher in the classroom whether through text or spoken. Low scorers are more likely to exhibit reluctance, or when the expression of ideas with showing no confidence.

(7) Confidence

This topic subscale reflects the faith and confidence demonstrated by college students for their academic ability. High scorers have expectations and confidence for the successful completion of important academic achievement. For those students who get low scores did not feel confident on academic achievement, as well as their future direction.

(8) Involvement with College Activity

Involvement defined by this subscale, refers to belonging to certain organizations or participating in some activities within the campus environment, including social and academic activities. Students with higher scores are more actively involved in student societies or school activities. Low scorers have “loner tendencies”, and participate less in social and campus activities. It should be noted is that this subscale refers to campus activities and does not include distance-learning courses.

(9) Friendship

This refers to the interaction and friendship with friends, classmates or other students when participating the campus community or activities, such as group assignments or studying together. High scorers were more often attend formal and informal parties with friends or peers. Low scorers are more solitary, and have less interaction or communication with peers.

3.4.2 Computer Cognitive Tasks

The CLEI is based on self-report data. The study would like to also include more objective data to measure the two important aspects of cognition and learning: attention and working memory.

This study employed the cognitive software E-prime and designed online tasks based on Moss et al., (2008)'s cognitive tasks to evaluate cognitive performance of attention and working memory. The tasks were online so that students can do it after completed the CLEI survey.

The cognitive tasks used include: digit vigilance tasks, choice reaction times, spatial working memory and memory scanning tasks. The first two tasks were used to measure attention and the last two were used to measure memory.

1. Digit vigilance task: A number (from 1 to 9 and 0) is displayed constantly on different places of the screen. If the appeared number matches with the number in the middle, the participant has to press the "1" button as quickly as possible every time the digit in the center matches the one constantly displayed. If the appeared number does not match with the number in the middle, the participant has to press the "0" button. Accuracy of response (%) and reaction time (ms) are recorded (Moss et al., 2008). This task is to measure sustained attention.

Figure 4 Digit vigilance task

2. Choice reaction time: Either the letter X or the letter Y is presented on different part of the screen. The participant has to press the "1" for X or "0" button for Y as appropriate and as quickly as possible. There are 50 trials and the interval varies randomly between 1 and 2.5 s. Accuracy (%) and reaction time (ms) are recorded (Moss et al., 2008). This task was to measure attention and vigilance. In the post-test, the X and Y changed to U and V to provide some differentiation and reduce the learning effect.

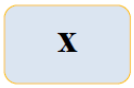


Figure 5 Choice reaction time task

3. Spatial working memory: A schematic picture of a house is presented for 5 s. The house has nine windows in a 3 × 3 pattern, 4 of which are illuminated. A series of 50 presentations of the same house in which just one window is illuminated follow, and the participant has to respond "1" if the window was one of the four lit in the original presentation, or "0" if it was not. Reaction time and accuracy are recorded (Moss et al., 2008). This task is to measure memory. In the pre-test, the colour of the box was yellow and it changed to red in the post-test.

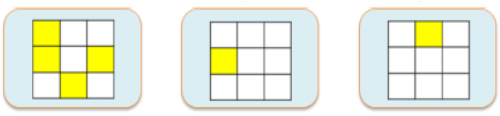
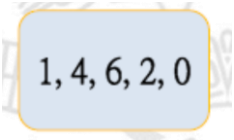


Figure 6 Spatial working memory task

4. Memory scanning task: Five digits are presented singly at the rate of one every second for the participant to remember. A series of thirty digits is then presented. For each, the participant must press 1 or 0 according to whether the digit is thought to be one of the five presented initially. This is repeated three times using a different 5 digits on each occasion. Reaction time and accuracy are recorded. This task is to measure memory. (Moss et al., 2008).

Moss et al. (2008) suggested that the working memory and secondary memory are two factors account for the quality of memory. Theory-based research has revealed that working memory is a system that operates via a dynamic interaction between memory and executive attention processes (Cowan 1995, cited Shelton et al., 2010). Shelton et al. (2010) suggested that the combined need for maintenance and retrieval processes present in working memory tests makes them reliable in their prediction of higher-order cognition.

Figure 7 Memory scanning task



3.5 Data Collection Process

Data was captured online and downloaded to Excel and SPSS for analysis. Two separate instruments were created to gather data. The first instrument contained the CLEI and demographic questions. The second instrument contained the computer cognitive tasks. Results were combined into a single data set using student identification numbers to match responses from the survey instruments. Incomplete responses were not included in the analysis.

3.6 Statistics

A variety of statistical analyses were used in this study. All analyses were done using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics (means and standard deviations) and percentages were used to describe the sample demographic data. Also, descriptive statistics were used to describe responses to the CLEI and to the computer cognitive tasks. Independent t-test was used to compare the Mindfulness Meditation group to the control group and paired-test was used to compare the pre-post test within the same group. The total scale score and subscale scores of the CLEI and reaction times and correct responses of the cognitive tasks were analyzed.

Chapter 4: Results

4.1 Participants

Two hundred and eighty-two freshmen students volunteered to take part in this study. The composition of the experimental (mindfulness meditation) group and control group was: the mindfulness group n=152 (males 44; females 108); control group n=130 (males 66; females 64) (Figure 8). All participants were between 18 and 19 years of age. The mindfulness meditation courses included students from the departments of business administration (BA), tourism management (TM), finance, literature, foreign languages & literature (FLL), early childhood education (ECE), life-and-death studies (LS), culture & creative enterprise management (CCEM), and technology. The control group comprised of students from international & China studies (ICS), communication, applied sociology (AS), biotechnology (BT), computer science & information engineering (CSIE), information management (IM), ethnomusicology (EM), architecture & landscape design (ALD), creative product design (CPD), and visual and media arts (VMA) departments (Figure 9).

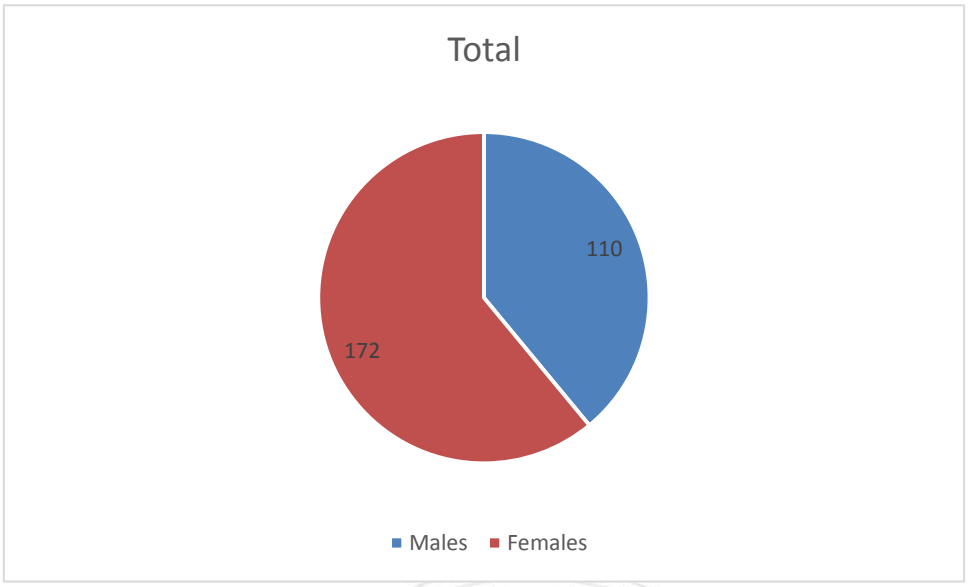


Figure 8 The gender distribution of total participants

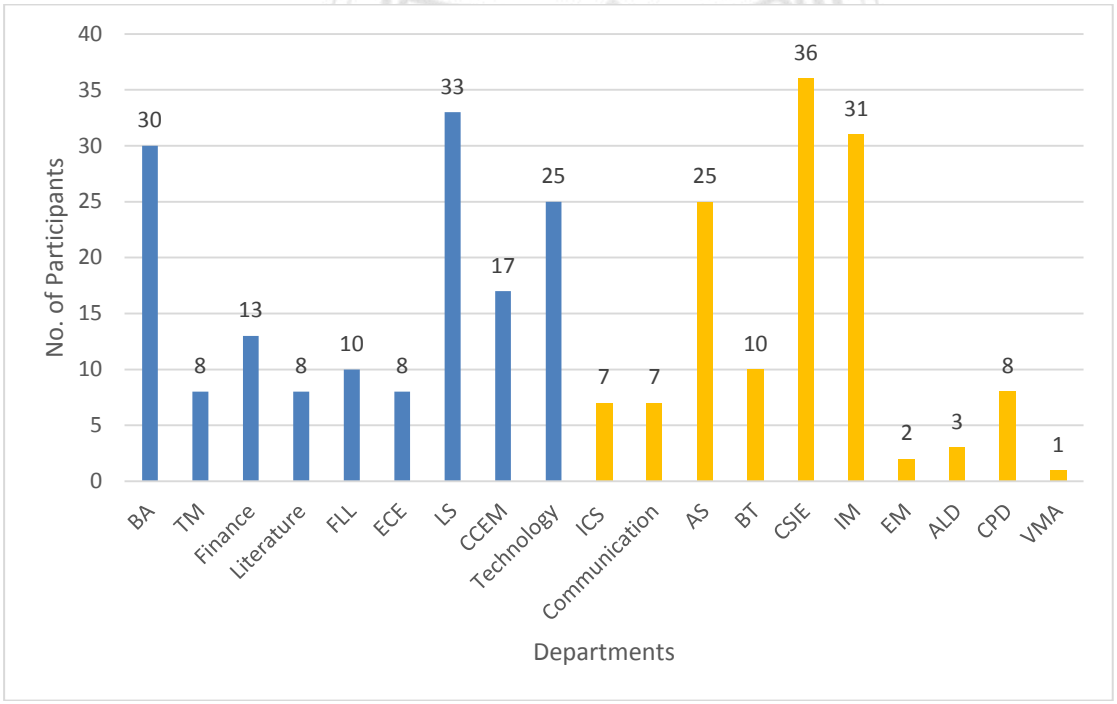


Figure 9 The number of distribution between mindfulness and control groups in faculties and departments.

4.2 Self-report Measures

4.2.1 Total Scale of the Chinese CLEI

The independent t-test was used to see whether there is a statistically significant difference between the means in the unrelated groups: mindfulness and control groups for both pre and pro-test. The results showed that both pre and pro-test between two groups have no significant difference: pre-test (mindfulness group 127.25, control 127.40, $p = 0.95$) and pro-test (mindfulness group 129.77, control 127.87, $p=0.38$). Although there was no significant difference between the two groups after the intervention, the mindfulness group's total scores of the CLEI increased slightly from 127.25 to 129.77 while control remained stable (Table 7).

4.2.2 Sub-scales of the Chinese CLEI

There were significant differences between the two groups on subscales on management ($p=0.009$), stress ($p=0.034$) and communication ($p=0.010$) (Table 8).

4.3 Cognitive Tasks

4.3.1 Pre-test

In order to understand whether there are differences before the intervention between the two groups of subjects, an independent sample t-test was used and the results showed the difference between two groups did not reach statistical significance among the various cognitive computer tests for pretest. This showed that the two groups did not differ at baseline on any of the cognitive tasks (Table 9).

4.3.2 Post-test

An independent sample t-test was used to measures the difference between the two groups at post-test to see whether there is an effect of mindfulness on students' cognitive performance. The results showed that there were significant difference between the two groups for cognitive tests measuring attention: digit vigilance task for both accuracy ($p=0.036$) and reaction time ($p=0.018$), as well as accuracy for the choice reaction time task ($p=0.015$) but not reaction time. There was no significant difference for memory tasks between the two groups (Table 10).

Table 7 The independent samples t-test results of the total scale score of the Chinese version of the CLEI between the two groups.

Group	***Pre-test*** **(**Mean ±SD)	*p*	***Pro-test*** **(**Mean ±SD)	*p*
Mindfulness (n=152)	127.25 ± 17.53	0.95	129.77 ± 17.48	0.38
Control (n=130)	127.40 ± 19.14		127.87 ± 19.02	

Independent Samples t- test

p <0.05 The difference was statistically significant.

Table 8 The independent samples t-test results of the subscale score of the Chinese version of the CLEI between the two groups.

Group		***Pre-test*** (Mean ±SD)	*p*	***Pro-test*** (Mean ±SD)	*p*
Emotional Satisfaction	Mindfulness (n=152)	17.70 ± 3.35	0.904	17.42 ± 3.28	0.830
	Control (n=130)	17.65 ± 3.59		17.51 ± 3.47	
Management	Mindfulness (n=152)	13.79 ± 2.72	0.074	13.95 ± 2.77	0.009*
	Control (n=130)	13.18 ± 2.94		13.08 ± 2.80	
Achievement	Mindfulness (n=152)	17.01 ± 2.95	0.785	17.11 ± 3.13	0.927
	Control (n=130)	17.11 ± 3.28		17.08 ± 3.27	
Stress	Mindfulness (n=152)	17.01 ± 2.53	0.086	17.22 ± 2.74	0.034*
	Control (n=130)	16.38 ± 3.38		16.48 ± 3.10	
Attention to Study	Mindfulness (n=152)	16.57 ± 3.34	0.425	16.48 ± 3.21	0.864
	Control (n=130)	16.25 ± 3.36		16.42 ± 3.12	
Communication	Mindfulness (n=152)	12.52 ± 2.41	0.094	12.59 ± 2.48	0.010*
	Control (n=130)	12.01 ± 2.68		11.82 ± 2.48	
Confidence	Mindfulness (n=152)	10.82 ± 2.07	0.464	10.74 ± 2.11	0.904
	Control (n=130)	10.62 ± 2.59		10.78 ± 2.48	
Involvement	Mindfulness (n=152)	12.74 ± 2.12	0.295	12.78 ± 2.07	0.454
	Control (n=130)	13.04 ± 2.60		12.98 ± 2.45	
Friendship	Mindfulness (n=152)	10.94 ± 2.02	0.251	10.63 ± 2.14	0.654
	Control (n=130)	10.65 ± 2.28		10.75 ± 2.14	

Independent Samples t- test
* $p < 0.05$ The difference was statistically significant.

Table 9 The independent sample t-test pre-test results of the accuracy and reaction time of the cognitive tasks between the two groups.

Tasks	***Groups***	***Pre-test*** (Mean ±SD)	*p*
Digit vigilance task			
Accuracy (%)	Mindfulness (n=109)	81.80 ± 16.06	0.487
	Control (n=64)	80.12 ±14.54	
Reaction time (ms)	Mindfulness (n=109)	32.77 ± 6.24	0.335
	Control (n=64)	33.69 ± 6.04	
Choice reaction time			
Accuracy (%)	Mindfulness (n=109)	72.63 ± 13.40	0.077
	Control (n=64)	68.57 ± 14.95	
Reaction time (ms)	Mindfulness (n=109)	39.25 ± 6.61	0.882
	Control (n=64)	39.40 ± 6.36	
Spatial working memory			
Accuracy (%)	Mindfulness (n=109)	83.60 ± 12.03	0.252
	Control (n=64)	81.40 ± 12.88	
Reaction time (ms)	Mindfulness (n=109)	21.73 ± 5.46	0.598
	Control (n=64)	21.24 ± 6.72	
Memory scanning task			
Accuracy (%)	Mindfulness (n=109)	83.70 ± 14.68	0.534
	Control (n=64)	82.33 ± 12.57	
Reaction time (ms)	Mindfulness (n=109)	33.70 ± 6.53	0.967
	Control (n=64)	33.66 ± 5.21	

Independent Samples t- test
** p <0.05* The difference was statistically significant.

Table 10 The independent samples t-test post-test results of the accuracy and reaction time of the cognitive tasks between the two groups.

Tasks	**Groups**	***Pro-test (***Mean ±SD)	*p*
Digit vigilance task			
Accuracy (%)	Mindfulness (n=109)	86.35 ± 11.78	0.036*
	Control (n=64)	81.61 ± 15.68	
Reaction time (ms)	Mindfulness (n=109)	30.70 ± 4.59	0.018*
	Control (n=64)	33.26 ± 7.88	
Choice reaction time			
Accuracy (%)	Mindfulness (n=109)	74.94 ± 13.26	0.015*
	Control (n=64)	68.98 ± 18.91	
Reaction time (ms)	Mindfulness (n=109)	38.36 ± 6.40	0.518
	Control (n=64)	39.07 ± 7.91	
Spatial working memory			
Accuracy (%)	Mindfulness (n=109)	84.63 ± 6.53	0.055
	Control (n=64)	81.25 ± 13.16	
Reaction time (ms)	Mindfulness (n=109)	20.90 ± 4.11	0.218
	Control (n=64)	22.02 ± 7.91	
Memory scanning task			
Accuracy (%)	Mindfulness (n=109)	84.56 ± 9.35	0.230
	Control (n=64)	82.55 ± 12.88	
Reaction time (ms)	Mindfulness (n=109)	31.98 ± 4.83	0.295
	Control (n=64)	32.81 ± 5.51	

Independent Samples t- test
* *p <0.05* The difference was statistically significant.

Chapter 5: Discussion

5.1 Learning Effectiveness

There was no significant difference between the mindfulness group and the control group for the total score of the CLEI. However, the mindfulness meditation course group's total score on learning effectiveness increased slightly from pre-test to post-test after the intervention, when compared to the controls. When interpreting this, since the total score did not reach statistically significant levels, we are hesitant to suggest that students with mindfulness training may have improved their overall learning effectiveness when compared to students with standard curriculum.

There was no statistically difference in the total scale may be explained that subscales are better scoring option than the total scale. As indicated in a study on total score or subscales in scoring the acromegaly quality of life (AcroQoL) questionnaire pointed out that the total score does not capture all of the aspects of quality of life (QoL). The study concluded that model fit and comparison statistics indicate that the three-subscale model is a better scoring method than the total score and two-subscale versions of the AcroQoL. The three-subscale version also better reflected the World Health Organisation's recommendation of using a multidimensional measure of QoL than the total score and two-subscale methods (Felt et al., 2015).

There were significant differences for the subscales of management, stress and class communication in students in the mindfulness course, but not in the control group. These results support Lynch (2013)'s study on university students who attended an 8-week mindfulness-based coping with university life (MBCUL) programme, students felt that they were able to pay more focused attention to reading or listening in lectures. In addition, the initial evidence suggests mindfulness training may lead to improved memory in university students. Many students reported not only just remember more but also become more aware of the way they approach and complete, academic tasks and reported changes in the way they approached their work such as became aware of the need to take breaks or plan their time more effectively. These findings suggest that mindfulness training may lead students to pay greater attention to texts, change their approach to studying and possibly even remember more.

A study by Tan et al. (2014) suggested mindfulness meditation may improve communication and social-cognitive functioning. Their results revealed that brief mindfulness meditation enhanced both mental state and empathic attribution (mindreading skills and empathic understanding) when comparing to the control group.

Research found evidence on mindfulness were significant predictors of resilience and academic self-efficacy (Keye & Pidgeon, 2013). Monash University in Australia provides a guide book for students and stated that

mindfulness is suggested can help students to function better under stress, utilize their time better, focus and foster a mindset more conducive to learning (Hassed, n.d.).

A study by Black and Fernando (2014) showed improved classroom behavior such as paying attention, self-control, participation in activities and caring and respect for others and the effects lasted up to 7 weeks after intervention. Their findings suggested that mindfulness training might benefit teacher perceived of improved classroom behavior and improving classroom learning environment for students. Another study also suggested mindfulness has a positive effect in school learning and achievement alone with reduced stress, improvements in interpersonal relationships and physical health.

A study presented in EDULEARN14, the 6th annual International Conference on Education and New Learning Technologies in 2014, Barcelona, Spain by De Simone and Strollo (2014) suggested that the techniques of mindfulness can be used "beyond the clinical setting, being them of valuable tools for growth and development and above all within the context of learning (p.4724)". Some students expressed that mindfulness as a tool for transformative learning. The study recruited 40 students from university students who took part in a laboratory on the mindfulness practices performed in the context of the activities of LEPE, Laboratory Educational Practices Epistemological of the University Naples “Federico II”. The workshop was structured with the protocol

of the mindfulness-based Acceptance and Commitment Therapy in 6 two-hour class within the course in pedagogy of the learning process of the course Bachelor in Psychology.

5.2 Cognitive Tasks

5.2.1 Attention

The findings of this study showed that mindfulness meditation course promoted significant effects on cognitive tasks that require sustained attention in the mindfulness group. The groups did not differ at baseline for the cognitive tasks and most students had no prior mindfulness meditation training or practice.

These findings of improved attention are paralleled with other mindfulness research. Mindfulness is defined as a set of basic cognitive functions related to attention (Bishop and et al., 2004). Leonard et al (2013) conducted a study in incarcerated youth and found that mindfulness training improved their attentional task performance. The results of a study by Moore et al (2012) also suggested that mindfulness meditation leads to improved self-regulation of attention by cognitive resources allocation more efficiently.

The process of mindfulness training can promote attentional stability by a relaxed and vigilant state of mind and self-regulated emotions, and so enhancing cognition (Epel et al., 2009; Wallace, 2006; Austin, 1998; Moore & Malinowski, 2009; cited in Zeidan et al., 2010). In additional to improved attentional control after mindfulness course, mindfulness training may have improved participants' mood and mind wandering and so leaded to increased cognitive performance as demonstrated in the study of Morrison et al. (2014). Both mind wandering and mood disturbances were found to negatively impact learning and memory.

Another study may also explain the results of accuracy for the two attentional tasks, a brief 5 days of Integrative Body Mind Training showed effectively increased neural activity in the executive attention network which was correlated with better performance on attentional tasks (Tang et al., 2007) and twenty minutes of MM practice reduced habitual responding on the Stroop task (Wenk-Sormaz, 2005; Zeidan & Faust, 2008 cited in Zeidan et al., 2010). That the participants in the mindfulness group may be more readily focus on the present task that leads to better performance when compared to the controls.

This study is also supported by neuroscience studies, which showed that mindfulness training activates the prefrontal cortex (PFC), the anterior cingulate cortex (ACC) and enhances the cerebral areas related to attention, cognitive control and performance monitoring (Larson et al., 2013; Allen et al., 2012; Tang et al., 2012). It is also suggested that mindfulness allows higher executive control processing by affecting the cognitive system to be more readily available and more focus when processing information (Slagter et al., 2009; cited in Chiesa & Malinowski, 2011). A review literature on neuroimaging by Marchand (2014) revealed compelling evidence that mindfulness impacts the function of the medial cortex and associated default mode network as well as insula and amygdala. The review also suggested mindfulness practice appears to affect lateral frontal regions and basal ganglia in some cases.

The reaction time for the choice reaction time task is not significant

(p=0.518). Van Vugt & Jha (2011) explains that greater attentional control could improve accuracy but decision-making may require a longer time.

5.2.2 Working Memory

On the other hand, there is no difference found for the memory cognitive tasks in this study. It is suggested there is a link between memory and mindfulness (once there is mindfulness, memory will function well [Chiesa & Malinowski, 2011]). Research showed that both long and short forms of mindfulness training may improve working memory (Mrazek et al, 2013; Brewer et al., 2011; cited in Morrison et al., 2014). Van Vugt and Jha (2011) demonstrated that intensive mindfulness training can benefit performance in a visual working memory task via attentional improvements. A study by Zeidan et al. (2010) finds that brief states of mindfulness meditation over a 4 day period can enhance sustained attention and improve visuo-spatial processing, working memory and executive functioning. This study found no effects on working memory cognitive tasks. This may due to the mindfulness meditation course structure, contact time and practice difficulties. Zeidan et al. (2010) also found no effects from mindfulness meditation training on the forward and backward digit san (to measure immediate memory span) or speed on the n-back task (to measure information processing speed and working memory). Studies found that fatigue adversely affects complex visual tracking speed and attention

(Andreasen et al., 2009; Diamond et al., 2008; Schwid et al., 2003; cited in Zeidan et al., 2010). The memory tasks were at the end after the CLEI questionnaire and attentional tasks, participants may have started to have fatigue that may have compromised their performance on these tasks. Future study is recommended to test task order effect and fatigue.

Anderson et al. (2007) suggested that mindfulness may be more closely associated with changes in present moment awareness and experience. A study by Morrison et al. (2014) on mindfulness taming a wondering attention over the course of an academic semester in university students also showed the mindfulness group had higher accuracy for the sustained attention to response task (SART) after 7-week training, but for the working memory tasks. Morrison et al. also suggested that mindfulness training may be able to strengthen a more specialized set of cognitive processes related to the control over mind wandering and sustained attention. Morrison et al. explained the reasons for their findings do not replicate the increases in working memory task performance reported in other studies: (1) attention is easier to shift back from mind wandering and sustain; (2) the transferred benefits to working memory from mindfulness training may be slower due to the added cognitive processes and task components in the working memory tasks; (3) the course time may be insufficient or the dose may be too low for changes in working memory; (4) mindfulness training may have benefited attention performance and not working

memory tasks;

Another reason for no reported effects on working memory may be because it was not in a control environment, there may be disturbance from other students, other commitments, network problems or participants did the tasks in a hurry.

5.3 Mindfulness and Education *par Excellence*

Effective learning, sustained attention and memory are particularly important to success and well-being in academic contexts. An education par excellence may require strategies to help students to enhance mental stability and sustained attention. Offering mindfulness training to students has been suggested as an effective strategy and practical route for improving classroom learning and so warranted should be considered in the educational context (Morrison et al., 2014).

Medical schools have started adding mindfulness into their curriculum to enhance both the well-being of medical students and the informal curriculum of a medical school as well as to improve medical students' future clinical practice (Cottingham et al., 2008; Hassed et al., 2008).

Schools are considered one of the primary settings in which prevention and intervention initiatives can be implemented successfully, reaching a large number of young people. Especially when promoting social and emotional learning (SEL), many adolescents benefit from universal programs implemented in the school context (Lawlor, 2014).

Broderick and Frank (2014) Mindfulness, if taught in a developmentally appropriate way, has the potential to be an asset in adolescents' lives.

Conley et al (2013) review examined 83 controlled interventions involving college, graduate, and professional students, with a focus on 3 main outcomes:

social and emotional skills, self-perceptions, and emotional distress. In comparing different intervention strategies, mindfulness training and cognitive-behavioral techniques appear to be the most effective. Furthermore, interventions conducted as a class appear to be effective, suggesting the potential for exposing higher education students to skill training through routine curricula offerings.

A systematic review of the literature and meta-analysis was conducted to examine the effectiveness of interventions aimed at reducing stress in university students (Regehr et al, 2013). Cognitive, behavioral and mindfulness interventions were associated with decreased symptoms of anxiety. Secondary outcomes included lower levels of depression and cortisol. This review provides evidence that cognitive, behavioral, and mindfulness interventions are effective in reducing stress in university students. Universities are encouraged to make such programs widely available to students.

There is evidence found that mindfulness is associated with academic self-efficacy and academic self-efficacy has been also found to directly affect students' university grades, motivation and persistence to succeed in future situations (Pajares, 1996; Hudson, 2007; Bouffard-Bouchard et al, 1991; cited in Keye & Pidgeon, 2013).

Mark Williams: "What we're doing is cultivating a sense that there is more well-being to be had than we had ever imagined if we just make a little bit more

use of this other mode of mind because we've got it here, but most of us haven't cultivated it (interviewed by Burnett, 2009)."

John Teasdale: "we're not just fixing pathology here, we're actually learning to recognize patterns of mind that both contribute to the way in which we convert sadness into depression, mild fear into chronic anxiety but also stand between us and our inherent potential for another way of being, greater wisdom and compassion (interviewed by Burnett, 2009)."

Given the wide range of research and potential benefits of mindfulness, it is warranted further attention and research in education context as Albert Einstein and Margaret Thatcher said:

Albert Einstein: "*Problems cannot be solved with the same mind set that created them.*"

Margaret Thatcher:

"Watch your thoughts for they become words.

Watch your words for they become actions.

Watch your actions for they become habits.

Watch your habits for they become your character.

And watch your character for it becomes your destiny."

Last, but not least, a rare and important mindfulness scholar in Taiwan also supports the benefits and suggests integrating mindfulness training into education in Taiwan (Wen, 2014, 2013a, 2013b, 2006).

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

The findings from this study show mindfulness meditation provides positive effects on learning effectiveness and cognitive performance on attentional tasks. It is well documented in an increasing number of researches that consistent and extensive mindfulness meditation promotes not only better learning and cognition performance but also improved overall wellness. It has also been suggested by researchers and educators that mindfulness is suitable for schools and colleges (matching with educational objectives). This study is consistent with the idea that attention, sustained attention, and attentional control can be trained in order to improve student learning and cognitive effectiveness. This study also supports mindfulness as *par excellence* in education.

6.2 Limitations

Since the study is not a randomized controlled design in a controlled environment, the interpretation of the results and the comparison with other studies should be considered with caution and a number of limitations of this research should be noted.

First, the data collection was not conducted in an experimental environment that tasks were done in participants' own time and the self-report CLEI may provide bias for the measurement of the learning effectiveness. Second, the mindfulness meditation was part of their study course, it is hard to know their motivation in participation of this research.

This study did not assess the relationship between the measures and frequency of mindfulness home practice or other factors during the whole span of the test period in order to be able to conclude on the data. There were fewer participants for the cognitive tasks due to the problems with the server and network. On the other hand, there were also more female participants in the study, which may have limited the ability to generalize the results.

Another limitation concerns the construct of the mindfulness meditation courses, which were taught by 10 different teachers. In addition, inherent differences between the classes, department differences and school environments may have reduced the homogeneity of course delivery. Further

studies should find other means of measuring the relationship between the measures and frequency of mindfulness home practice as well as the homogeneity of course delivery.

This study also has same limitation of other studies is the difficulty in distinguishing and measuring if the changes were from specific or nonspecific effects of the mindfulness practice (Chiesa & Malinowski, 2011). The researcher also acknowledges that there may have been other variables which may have influenced the results. It is also not possible to distinguish whether results are the effect of mindfulness training or meditation.

This study was presented with these limitations which affected the quality and expectations of the study. The study would have a better quality and more participants without these limitations. Future research is encouraged to consider these limitations.

6.3 Recommendations

The results of this study indicate that mindfulness meditation course may be a feasible and effective course for intervention for university students in improving their learning effectiveness and cognition performance. It is recommended the University and other universities to adopt mindfulness training into their education context to improve students' academic learning and performance as well as well-being.

It is recommended universities to utilize the Chinese version of the College Learning Effectiveness Inventory (CLEI) as a screening and diagnostic tool to provide assistance for students. Universities and teachers can use CLEI subscales representing the students' individual profiles of strengths and weaknesses to design strategies for courses. The academic counselor can use the CLEI results to guide the structure of the course and work with students on an individual basis. It is recommended to incorporate the CLEI into courses such as the academic skills class or mindfulness course setting for students to gain information on their own learning strengths and weaknesses. It is also recommended to use the well-designed cognitive tasks for both as a measurement tool and as a training tool for attention, memory and mindfulness.

The CLEI and cognitive tasks could be a scaffolding, a model, a practice activity, and a measure tool for mindfulness in universities and for educational excellence.

For future research, it is recommended to use tools to measure mindfulness scales so as to distinguish the effects of mindfulness and other factors such as meditation.

It is hoped this study will make a positive contribution to the research, application and improvement of mindfulness in education. Based on research in this study, the following are recommendations for the University and other education providers who wish to introduce mindfulness training into the academic setting:

1. Provide a supportive environment so students can feel more comfortable participating and be less sensitive to adverse factors such as heat or cold temperature.
2. Participation, practice and willingness are the keys. It is important for students to relax and remain calm in order to experience mindfulness. Mindfulness training is different than general education classes. In mindfulness training classes, it is better to let students understand and experience the benefits, usefulness and fun of mindfulness, instead of trying to achieve certain requirements or aims of the educational system. Students should not feel stressed, but relaxed and calm in order to induce and cultivate mindfulness.
3. Student-centered: Since mindfulness training is not intended to add more intellectual material or learning to students but as a chance for students to

experience a new skill within their own resources. Hence, teachers in the mindfulness training classes play a role as a facilitator rather than as an authority that may be different than as a “teacher” in normal classes.

4. Non-religious: Since the heterogeneity in education and schools, it is more courtesy to deliver mindfulness training in a non-religious framework so that not to exclude some people, especially in the elementary or foundation level. There is a unique resource in Nanhua University where scholars with different dimensional levels of mindfulness are presented. There are four years of study for undergraduate students. Mindfulness training with more information could be spread out into different years for students to continue their practice if they like that may be more effective than condensed everything in an elementary 50 minutes class for freshmen students. Zenner et al (2014) suggested a good model to train teachers in mindfulness that teachers are the agents and ambassadors of change so that mindfulness training can be established in a school-based framework. This provides two benefits: one is that students have extended chance to practice and experience mindfulness; second is that it is also a good resource for teachers’ own resilience, well-being and prevention of burnout.

Mindfulness is a life skill and is a practice moment-to-moment. If delivered correctly, mindfulness could be the most valuable life-skill learned by students to be used by individuals for many years after graduation.

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Appendix 1 A summary of the majority of this literature evaluating the effects of mindfulness in education and in young population.

Study	Sample	Study Design	Intervention	Measures	Findings
Black & Fernando (2014)	17 teachers reported on the classroom behaviors of 409 children in kindergarten through 6th grade	pre-intervention, immediate post-intervention, and 7 weeks post-intervention.	5-week mindfulness-based curriculum	teacher-ratings of student classroom behavior	Reported improved classroom behavior of their students (i.e., paying attention, self-control, participation in activities, and caring/respect for others) that lasted up to 7 weeks post-intervention. Findings suggest that mindfulness training might benefit teacher-based perceptions of improved classroom behavior in a public elementary school, improving the classroom learning environment for lower-income and ethnically-diverse children.
Dvorak et al (2014)	1758 college students	online questionnaires assessing demographics, alcohol use and problems, and emotion regulation difficulties.		The Difficulties in Emotion Regulation Scale (DERS)	Emotion-regulation difficulties are associated with alcohol-related consequences. Results suggest exposure and/or mindfulness based prevention/interventions with emotion focused psychoeducation may offer one path to reducing alcohol-related consequences among college students.
Bodenlos, Noonan & Wells (2013)	310 students from a small, private college in the Northeast	To examine the relationship between mindfulness and alcohol problems in college students, as well as the role of stress as a mediator in this relationship.		Students completed self-report measures, including the Perceived Stress Scale, the Five Facet Mindfulness Questionnaire, and the Rutgers Alcohol Problems Index.	Mindfulness was negatively correlated with alcohol problems and stress, whereas stress positively correlated with alcohol problems. Stress as fully mediating the relationship between mindfulness and alcohol problems. Alcohol problems were negatively correlated with the Acting With Awareness and Describing Experience facets of mindfulness. Mindfulness-based stress reduction or other mindfulness programs may be useful in decreasing alcohol problems on college campuses via the effects on stress.
Kuyken et al (2013) RCT	522 young people aged 12-16 in 12 secondary schools	To assess the acceptability and efficacy of a schools-based universal mindfulness intervention to enhance mental health and well-being.	Mindfulness in Schools Programme; Control: usual school curriculum		The findings provide promising evidence of the programme's acceptability and efficacy. Children who participated in the intervention reported fewer depressive symptoms post-treatment (P = 0.004) and at follow-up (P = 0.005) and lower stress (P = 0.05) and greater well-being (P = 0.05) at follow-up. The intervention group practised the mindfulness skills was associated with better well-being (P<0.001) and less stress (P = 0.03) at 3-month follow-up.

Bei et al (2013)	10 participants (aged 13-15) at a girls' school with self-reported poor sleep	enrolled into a six-session program based on Bootzin & Stevens, with added stress/anxiety-specific components.	Sessions covered key aspects of basic mindfulness concepts and practice, sleep hygiene, sleep scheduling, evening/daytime habits, stimulus control, skills for bedtime worries and healthy attitudes to sleep.	Treatment changes were measured by pre-post scores on the PSQI, SCAS and 7-day actigraphy-measured sleep.	The program demonstrated high acceptability, with a completion rate of 90%. Participants showed significant improvement on objective sleep onset latency (SOL), sleep efficiency and total sleep time; actigraphy data also showed significantly earlier bedtime, rise time and smaller day-to-day bedtime variation. Post-intervention global PSQI scores were significantly lower than that of pre-intervention, with significant improvement in subjective SOL, sleep quality and sleep-related daytime dysfunction. A mindfulness-based, multi-component, in-school group sleep intervention is feasible, and has the potential to improve sleep and impact on anxiety.
Murphy et al (2012)	441 college women	completed self-report surveys at the beginning and end of a 10-week academic quarter. The study was conducted over 5 academic quarters from fall 2008 to fall 2010.			Findings indicated that higher levels of dispositional mindfulness were related to healthier eating practices, better quality of sleep, and better physical health. Dispositional mindfulness contributed to better physical health even after controlling for traditional health habits. Finally, bidirectional mediational relationships were found between healthy eating and dispositional mindfulness as well as between sleep quality and dispositional mindfulness when physical health was the outcome variable. Findings suggest that incorporating mindfulness training into programming on college campuses may be beneficial, as results indicate that dispositional mindfulness is related to positive physical health among college students.
Wendell, Masuda & Le (2012)	Ethnically diverse non-clinical college undergraduates (Study 1 N=208; Study 2 N=178)	completed an anonymous online survey.			Findings suggest that the link between disorders eating cognitions (DE) and overall DE pathology is established in part through an inflexible and avoidant coping style specific to negative body image. Clinical implications include targeting body image flexibility as a mechanism of change and treating DE pathology with acceptance- and mindfulness-based behavioral interventions.
White (2012)	4th- and 5th-grade girls were	to investigate the efficacy of mindfulness training	The intervention group met 1		Self-esteem and self-regulation increased in both groups. The intervention group was more likely to report greater appraisal of

RCT	recruited from two public schools	through yoga with school-age girls to reduce perceived stress, enhance coping abilities, self-esteem, and self-regulation, and explore the relationship between the dose of the intervention and outcomes.	hour a week for 8 weeks and completed 10 minutes of daily homework. Control: wait-list groups.		stress ($p < .01$) and greater frequency of coping ($p < .05$). Homework accounted for 7% of the variance in reported stress. Consistent with reports of mindfulness training, greater awareness of the feelings associated with stress may enhance coping abilities. However, it is possible that the increasing awareness of stressors in itself increased stress, possibly as part of the process of developing mindfulness or related to cognitive, emotional, or social development. Mindfulness in children may differ from mindfulness in adults and warrants further investigation.
Grinnell et al (2011)	Male and female first year college students (n = 75)			Height, weight, waist circumference (WC), and blood pressure were assessed and online questionnaires were completed.	The less mindful group had a higher WC than the more mindful group. Correlations were seen between mindfulness and weight-related behaviors. Mindfulness can impact health status of first year college students, particularly with behavioral measures that have been found to effect weight status. However, additional research is needed focusing on mindfulness as a potential weight gain prevention technique for first year college students in order to decrease chronic disease prevalence.
Warnecke et al (2011) RCT	66 medical students in their final 2 years of study	block-randomised to either an intervention or a usual care control group. two self-report questionnaires, at baseline and at 8 weeks, respectively. The intervention group also completed a questionnaire at 16 weeks to provide follow-up data.	used an audio CD of guided mindfulness practice designed and produced for this trial. Participants were advised to use the intervention daily over the 8 weeks of the trial.	Perceived Stress Scale (PSS). Depression, Anxiety and Stress Scale (DASS).	Mindfulness practice reduced stress and anxiety in senior medical students. Stress is prevalent in medical students and can have adverse effects on both student health and patients. A simple, self-administered, evidence-based intervention now exists to manage stress in this at-risk population and should be widely utilised.
Sibinga et al (2011)	33 youth (the average age was 16.8 years); 26 (79%) attended	Analysis involved comparison of pre- and postintervention surveys and content analysis of	9 weekly MBSR sessions.	attendance, psychologic symptoms (Symptom Checklist 90-Revised), and	Quantitative data show that following the MBSR program, participants had a significant reduction in hostility ($p = 0.02$), general discomfort ($p = 0.01$), and emotional discomfort ($p = 0.02$). Qualitative data (n = 10) show perceived improvements in

	the majority of the MBSR sessions and were considered "program completers." Among program completers, 11 were HIV-infected, 77% were female, all were African American.	interviews.		quality of life (Child Health and Illness Profile-Adolescent Edition)--and qualitative data--in-depth individual interviews conducted in a convenience sample of participants until interview themes were saturated.	interpersonal relationships (including less conflict), school achievement, physical health, and reduced stress. The data suggest that MBSR instruction for urban youth may have a positive effect in domains related to hostility, interpersonal relationships, school achievement, and physical health. However, because of the small sample size and lack of control group, it cannot be distinguished whether the changes observed are due to MBSR or to nonspecific group effects.
Roberts & Danoff-Burg (2010)	553 undergraduates (385 females; mean age = 18.8 years)	participants completed questionnaires. Data were collected from September 2007 through December 2007.		questionnaires assessing mindfulness, perceived health, health behaviors, health-related activity restriction, and stress.	results suggest that mindfulness is related to decreased stress, which in turn contributes to increased positive health perceptions and health behaviors (eg, binge eating, sleep quality, and physical activity). The findings support the utility of mindfulness in promoting physical and psychological health in college students.
Franco et al (2010) RCT	68 teachers, from various public schools; half of them formed the experimental group, and the another half the control group.			The levels of psychological distress were measured, in both groups, by the Symptom Checklist-90-R (SCL-90-R) before and after the application of the programme.	Statistical analysis shows the significant reduction of three general measures of psychological distress (Global Severity Index, Positive Symptom Distress Index, and Positive Symptom Total), as well in all its dimensions (somatization, obsessive-compulsive, interpersonal sensibility, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism), in the experimental group compared with the control group. Follow-up measures show that these results were maintained for four months after termination of the intervention in the experimental group.
Mendelson et al (2010) RCT	4 urban public schools were randomized to an intervention or wait-list control condition (n=97 fourth and fifth	A pilot randomized controlled trial assessing the feasibility, acceptability, and preliminary outcomes of a school-based mindfulness and yoga intervention.	12-week	Stress responses, depressive symptoms, and peer relations were assessed at baseline and post-intervention.	Findings suggest the intervention was attractive to students, teachers, and school administrators and that it had a positive impact on problematic responses to stress including rumination, intrusive thoughts, and emotional arousal.

	graders, 60.8% female).				
Caldwell et al (2010)	166 college students	To assess the effect of mindfulness movements	15 week classes in Pilates, Taiji quan, or GYROKINESIS.	At beginning, middle, and end of the semester, participants completed measures of mindfulness, self-regulatory self-efficacy, mood, perceived stress, and sleep quality.	Total mindfulness scores and mindfulness subscales increased overall. Greater changes in mindfulness were directly related to better sleep quality at the end of the semester after adjusting for sleep disturbance at the beginning. Tiredness, Negative Arousal, Relaxation, and Perceived Stress mediated the effect of increased mindfulness on improved sleep. Movement-based courses can increase mindfulness. Increased mindfulness accounts for changes in mood and perceived stress, which explain, in part, improved sleep quality.
Bowen & Marlatt (2009) RCT	Undergraduate smokers (N = 123)	randomly assigned either to a group receiving brief mindfulness-based instructions or to a no-instruction control group.	A brief mindfulness-based instruction set	smoking-related urges and behavior	Results suggest that groups did not differ significantly on measures of urges. However, those in the mindfulness group smoked significantly fewer cigarettes over a 7-day follow-up period as compared to those in the control group. These findings suggest that the mindfulness techniques may not initially reduce urges to smoke but may change the response to urges.

Appendix 2 IRB Approval

BUDDHIST DALIN TZU CHI HOSPITAL

BUDDHIST DALIN TZU CHI HOSPITAL
2, Min-Sheng Road, Dalin Town, Chia-Yi
TAIWAN R.O.C. (622)
TEL:05-2648000
FAX:05-2648999

佛教慈濟醫療財團法人大林
慈濟醫院 (622)
嘉義縣大林鎮民生路2號
電話：(05)2648000
傳真：(05)2648999

同意臨床試驗證明書

檢送由 蔡宗晃 醫師 所主持之「**正念課程對大學生學習效能、情緒智慧及身心健康成效之探討。**」計畫，經本院研究倫理委員會審查通過。本會組織與執行皆遵守中華民國一百年十二月二十八日訂頒「人體研究法」相關規範，特此證明。

大林慈濟醫院研究倫理委員會

主任委員

中 華 民 國 一 0三 年 九 月 三十 日

Appendix 3 The course outline of the intervention mindfulness meditation

Week	Content
1	Course description and specification Elementary body scan Mindful eating
2	Advanced body scan 3-min breathing meditation Training attention and awareness through mindful breathing Elementary diary on mindfulness practice
3	Walking meditation (Live in the moment) Breathing techniques The classical based of the mindfulness meditation courses
4	Mindful meditations
5	Mindfulness practice before sleeping Non-judgmental vs judgmental
6	Mindfulness and the Noble Eightfold Path
7	From mindfulness to the “fullness of understanding” or "clear comprehension" or "clear knowing," Mindfulness diary writing skills
8	How do we know the world Mindfulness and health
9 Mid-term exam week	50-min of mindfulness meditation practice
10	The beginner’s mind (original intention) The benefits of mindful speech
11	Mindfulness improves interpersonal skills Short use of DBT
12	Mindfulness and scientific research Mindfulness attitudes:

	1. beginner's mind; 2. non-judging; 3. acceptance(things as they really are); 4. patience(let life unfolds); 5. letting go/letting be; 6. non-striving/non-doing; 7. trust
13	Mindful living
14	The purpose of behavior with full understanding or clear comprehension: where you are, where your mind is. The use of the beginner's mind Balanced view of pros and cons
15	Perspective views are decided by angles. Investigating the filters of knowing (cognition).
16	Principle of not harming and principle of sincere treating
	Thoughts as thoughts, not necessarily the reality The example of MBCT The origin of life dependent Helpers also need mindfulness: be happy before helping others to be happy
18	50-mins of mindfulness meditation practice

Appendix 4 The present edition of the CLEI (2008 Edition) comprises six scales with 50 questions

Items of the Six-CLEI Scales

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1. Academic Self-Efficacy (ASE Scale) (14 items)

23. I believe that I have the ability to complete college.
26. I have goals that I want to achieve by being in college.
43. I have high academic expectations of myself.
24. I believe it is possible for me to make good grades.
* 28. I turn in assignments only partially completed.
* 42. I doubt that I can make the effort to finish college.
50. I am determined to do what it will take in order to succeed with my goals.
* 5. I do not turn in assignments.
21. My family cares how I do academically.
* 38. Family members criticize me because I am not a great student.
4. I am aware of the assignments that are due in the next week.
47. Gaining knowledge is important to me.
* 49. I question why I need a degree for the career I want to pursue.
20. People in my community value a college education.

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2. Organization and Attention to Study (OAS Scale) (8 items)

2. I organize my time so that I have plenty of time to study.
30. I make study goals and keep up with them.
* 1. I wait to study until the night before the exam.
31. I break big assignments into manageable pieces.
* 51. I cannot get into studying even if there is nothing else to do.
* 48. I find myself daydreaming when I study.
* 25. I find my attention wandering in class
6. I organize class information in a way that helps me retain and apply it later.

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3. Stress and Time Press (STP Scale) (6 Items)

* 36. I feel there are so many things to get done each week that I am stressed.
* 13. I have symptoms of stress from all of the pressure I have been under since coming to college.
* 3. I do not seem to have time to get everything done that I need to do.
* 32. It seems as though I am playing catch-up.
* 37. My living situation distracts me from my studies.
7. I plan in advance to prevent becoming overwhelmed with assignments at the last minute.

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4. Involvement with College Activity (ICA Scale) (9 Items)

9. I participate in social activities on campus.
11. I belong to an organized club on campus.
34. I attend events such as concerts, plays, speakers, or athletic contests as a part of the college experience.
29. I know someone with whom I can study.
40. I have friends here at school.
10. I belong to a study group.
15. I consider college to be a great time in my life.
41. My friends have good study habits.
17. I enjoy being a student here.

5. Emotional Satisfaction (ES Scale) (7 items)

14. I like my courses.
39. My instructors show interest in me.
* 18. I hate school, but I know I have to do it.
27. I see connections between my classes and my career goals.
* 12. I am discouraged with how I am treated by my instructors.
19. I can talk with people who provide encouragement to me about what I am learning.
* 16. I become overwhelmed when I think of my assigned class requirements.

6. Class Communication (CC Scale) (6 Items)

* 8. I avoid speaking in class.
33. I ask questions in class.
* 46. I cannot seem to express my ideas on paper very well.
* 35. I avoid classes in which participation is required.
* 44. I dread the thought of getting test results in certain classes.
* 22. I find it difficult to get the assistance I need for my academic success.

"Experimental Item"
45. I can make connections between what I learn in class and my plans for a career.

Note. *, Indicates items in negative continuum of which the raw scores need to be transformed to reverse scores: 1 to 5, 2 to 4, 4 to 2, and 5 to 1.

Source: Newton et al., 2008

Appendix 5 The Chinese version of the CLEI with nine scales with 38 questions (Chen, 2010)

表 4-2 中文版大學生學習效能量表的第二次因素分析結果摘要表(N=318)

因素的標示及其原題號個別題項	特徵值	因素負荷量	共同性 (h^2)
因素一：情緒滿意度	4.854		
17. 我喜歡當本校的學生。		.815	.677
18. 我討厭學校，但我知道我必須去上課。		.725	.568
14. 我喜歡我的課程。		.670	.555
15. 我把大學視為我人生中一段美好的時光。		.529	.547
27. 我明白我的課業與我的生涯目標息息相關。		.520	.597
因素二：計畫與時間管理	3.942		
31. 我會把龐大的作業劃分成容易辦好的小單元去做。		.745	.635
7. 我會事先做好規劃，避免使作業拖延到最後繳交時刻而不知所措。		.695	.615
4. 我會留心未來一週內要交的作業。		.682	.575
2. 我會安排時間讓自己有充裕的時間可以讀書。		.622	.525
因素三：成就追求	4.721		
47. 我會把知識的獲得看得很重要。		.793	.519
50. 我會為了成功達成我的目標而堅定地採取必要的行動。		.722	.605
45. 我可以使我在課堂所學的東西和我的生涯規劃做連結。		.548	.627
30. 我會設定讀書目標，並且迎頭去追求這些目標。		.503	.524
26. 我具有想要透過上大學來達成的目標。		.471	.608
因素四：學業壓力	3.238		
36. 我覺得每個星期有許多事情需要完成，這讓我感到壓力。		.779	.662
16. 當想到課堂上指派的作業時，我覺得壓力很大而不知所措。		.766	.588
3. 我似乎沒有時間做好我該做的每一件事情。		.567	.519
13. 自從上了大學以後，我經歷來自各方面的所有壓力，使我出現了壓力症狀。		.481	.649
6. 我會以有利於自己往後記憶與應用的方式來組織聽課內容。		.415	.484

(續)表 4-2 中文版大學生學習效能量表的第二次因素分析結果摘要表(N=318)

因素的標示及其原題號個別題項	特徵值	因素負荷量	共同性 (h^2)
因素五：學業專注力	3.084		
48. 我發現自己會在念書時做白日夢。		.695	.598
25. 我發現在課堂上我的注意力會恍惚或跑掉。		.591	.554
51. 即使沒有其他事情可做，我也無法專注於課業當中。		.567	.556
49. 我不懂我為什麼要為了自己想要追求的生涯而需要一個學位。		.492	.531
42. 我懷疑自己能否全力以赴地完成大學學業。		.461	.539
因素六：課堂溝通	3.699		
8. 我在課堂上會逃避發言。		.863	.720
33. 我會在課堂上發問。		.742	.630
35. 我避開上要求參與和分享的課。		.668	.561
39. 我的教師們會表現出對我的關注。		.377	.503
因素七：學業自信	4.274		
23. 我相信我有能力完成大學學業。		.852	.738
24. 我相信我有表現出良好成績的潛能。		.703	.710
43. 我對自己的學業有高度的期待。		.452	.423
因素八：校園活動參與感	2.307		
10. 我參與讀書會或學習社群。		.716	.626
34. 我會參與音樂會、演講、戲劇表演、運動競賽等活動，當作大學經驗的一環。		.680	.635
9. 我會參與校內的社交活動。		.642	.560
12. 我的教師們對待我的方式，使我感到灰心。		.401	.461
因素九：同儕交流	3.037		
41. 我的朋友們有良好的讀書習慣。		.806	.654
29. 我認識可以一起念書的人。		.795	.688
40. 我在學校擁有朋友。		.551	.546

註：此九個因素共可解釋變項結構變異量的 58.71%，由於本研究使用斜交轉軸的方法，因此無法取得每個因素的變異量百分比。

Source: Chen, 2010

Appendix 6 The consent from Chen to use the translated and amended Chinese version of the CLEI

Translation:

Dear Hoiching,
Regarding your inquiry, I agree to authorize the use of the Chinese version of College Learning Efficacy Inventory. I wish success to your study! PS Chen

Original email contacts:

自然醫學研究所-何海鵑 <10268018@nhu.edu.tw> 2014/11/30

寄給 陳佩詩

非常感謝您!!! 祝福! :)

陳佩詩 <peschen@gmail.com> 於 2014 年 11 月 28 日 下午 2:21 寫道：

海鵑你好，
關於你的詢問,我同意授權使用中文版大學生學習效能量表,並祝福你研究順利!

佩詩

Appendix 7　Thesis Presentation

Center for General Education, KNJC

研習證書

Certificate of Attendance

康寧通識

通研字第 1040629011 號

南華大學 自然醫學研究所何海鵲研究生中華民國 104 年 6 月 29 日參加康寧醫護暨管理專科學校通識教育中心舉辦第八屆『通識教育卓越與前瞻』全人教育學術研討會，並發表論文，全程共計 8 小時。特此證明

康寧醫護暨管理專科學校

通 識 教 育 中 心

康寧醫護暨管理專科學校 通識教育中心 台北市康寧路3段75巷137號

中華民國 104 年 6 月 29 日