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**AWARENESS OF THE EFFECTS OF NEUROENHANCEMENT DRUGS ON
ACADEMIC PERFORMANCE AMONG STUDENTS IN HEALTH RELATED
PROGRAMS**

JENNIE LEONG LEE HA

This project is submitted
in partial fulfilment of the requirement for a
Bachelor of Science with Honours
(Cognitive Science)

Faculty of Cognitive Sciences and Human Development
UNIVERSITI MALAYSIA SARAWAK
(2015)

The project entitled ‘Awareness of the effects of neuroenhancement drugs on academic performance among students in health related programs’ was prepared by Jennie Leong Lee Ha and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours (Cognitive Science)

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Date:

Grade

ACKNOWLEDGMENTS

All praises to God for the strength and blessing in finishing this research. I would like to thank my two supervisors which are Prof. Dr. Hong Kian Sam for my first final year project and Madame Nur Fatimah Mat Yusoff for my second final year project. Without their valuable advice, comments, guidance, and suggestions, I cannot accomplished my research successfully and efficiently. Their experiences and ideas for my final year project had pushed me to write a better thesis for my undergraduate research.

Their motivation and support are very helpful knowledge in completing the research. In addition, I also would like to express my genuine gratitude to my beloved family for their understanding and supportive inspiration.

Other than that, my deepest thankfulness to all my friends who willing to share their talents and information in assisting me throughout the two semesters.

Lastly, I also would like to appreciate for those who indirectly contributed in this research, your compassion really helps me a lot. Once again, thank you very much for every person who involved in this project.

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ABSTRACT

Neuroenhancement drug was the sense of boost cognitive and emotional abilities through pharmacological substances in normal healthy individuals. The purpose of this study was conducted to determine the knowledge of the participants on cognitive neuroenhancement which could improve their academic performances. There were 191 respondents filling up the questionnaire which comprised of four sections, namely demographic background, background knowledge towards neuroenhancement, reason taking neuroenhancement, and concerns about the use of neuroenhancement. Quantitative analysis was used and convenience sampling was selected for respondents who were conveniently vacant to contribute in this research. From the data gathered through questionnaires, several tests had been conducted through the use of SPSS such as Pearson correlation, Independent sample t-test, factor analysis, Cronbach's alpha, chi-square, and ANOVA. The results revealed that there was a significance association between students taking cognitive enhancers could achieve a better results and would progress more quickly in life. Furthermore, there was also a significant association between students taking cognitive enhancers and trouble they were facing in remembering things. Neuroenhancement generally could be used to improve health and enhance quality of life. It could also increase work productivity since human works spans and life spans are increasing. These results highlighted the awareness of the effects of neuroenhancement and related program studies in academic performances.

Keywords: neuroenhancement, depression, dementia, sleep deficiency, academic performances, cognitive enhancement, cognitive disabilities

ABSTRAK

Bahan penambah kognitif adalah sesuatu produk yang boleh merangsangkan kognitif dan kebolehan emosi melalui bahan-bahan farmakologi terhadap individu yang sihat. Tujuan kajian ini dijalankan adalah untuk menentukan pengetahuan responden mengenai bahan penambah kognitif yang boleh meningkatkan prestasi akademik mereka. Terdapat 191 responden mengisi soal selidik yang terdiri daripada empat bahagian, iaitu latar belakang demografi, pengetahuan terhadap bahan penambah kognitif, sebab mengambil bahan penambah kognitif, dan kebimbangan tentang penggunaan bahan penambah kognitif. Analisis kuantitatif telah digunakan dan persampelan mudah telah dipilih untuk responden yang berkelapangan bagi mengisi kajian soal selidik ini. Beberapa ujian telah dijalankan melalui soal selidik ini seperti korelasi Pearson, ujian-t sampel Bebas, faktor analisis, Cronbach alpha, khi kuasa dua dan ANOVA. Hasil kajian menunjukkan bahawa terdapat hubungan yang signifikan antara pelajar yang mengambil bahan penambah kognitif boleh mencapai keputusan yang lebih baik dan bagus. Tambahan pula, terdapat juga hubungan yang signifikan antara pelajar yang mengambil bahan penambah kognitif berdasarkan masalah yang dihadapi oleh mereka dalam mengingati sesuatu perkara. Bahan penambah kognitif umumnya boleh digunakan dalam kesihatan, meningkatkan kualiti kehidupan manusia di samping dapat meningkatkan produktiviti kerja kerana jangka kerja manusia dan jangka hayat yang semakin meningkat. Hasil kajian ini menunjukkan kesedaran mengenai kesan bahan penambah kognitif dan program pengajian yang berkaitan dalam prestasi akademik.

Kata kunci: bahan penambah kognitif, kemurungan, demensia, kekurangan tidur, prestasi akademik, peningkatan kognitif, ketidakupayaan kognitif

CHAPTER ONE

INTRODUCTION

Cognitive enhancement has many terms in previous literatures which named as neuroenhancement, brain doping, brain enhancement, cosmetic psychopharmacology, psycho enhancement, pharmaceutical cognitive enhancer, mind doping, or smart pills (Misun & Hudakova, 2011).

It could be defined as the addition or upgrading of the ability of the mentality of the individual further than what is essential in order to restore or prolong a healthy life. These enhancements could consume by healthy individuals also in order to boost their cognitive capabilities, which beyond in their natural state. Cognitive enhancements has been highlighted in an ethical debate where it is mainly related with the concept of validity, personal identity, societal and individual progress, and people rights (Zahid, 2010).

Other journal described that neuroenhancement drugs was the sense of boost cognitive and emotional abilities through pharmacological substances in normal healthy individuals (Ott, Lenk, Miller, Neuhaus Bühler, & Biller-Andorno, 2012). According to Sahakian and Morein-Zamir (2007), the current cognitive enhancers could develop concentration, memory, planning, and decrease impetuous manners and hazardous decision making. Doctors also approved these cognitive enhancers could treat cognitive disabilities individuals and enhance their quality of life for people who have neuropsychiatric disorders and brain injury. The statistics showed that using cognitive enhancers has been increasing by shift workers and normal healthy people (Sahakian et al., 2007).

It consists of active substances that mainly for attention deficit hyperactivity disorder (ADHD) patients who need the prescription in psychological disorders and medications (Misun

et al., 2011). Active substances can be described as any substance or mixture of substances that deliberate to be used in the manufacture of a medical product. After that the production would become active compositions of that product, which planned to apply an immunological, pharmacological or metabolic action with a new to correcting, modifying or restoring physiological functions or to make a medical diagnosis (APIC Position Paper on the Definition of Active Substance, 2013).

Medication is a substance that is used into or positioned on the body that mostly utilized to treat a disease or condition, for instance, antibiotics are given to cure an infection. Medication could also to treat medical conditions such as anti-depressants used to treat the depression. Furthermore, it could mitigate symptoms of an ailment for instance; pain relievers are used to reduce pain. Vaccinations also included in medications which to avert diseases. For example, the flu vaccine is given in order to help the patients from the difficulty of having the flu (What Is Medication, 2011).

There are several enhancements that could enhance human cognition and its impact on improving the performance among people. Cognition can be defined as the act of thinking, learning, knowing, judging, reasoning and problem solving, and remembering (Zahid, 2010). It is a process or mental action of acquiring knowledge and understanding through experience, thought, and the senses.

Enhancement is a medicine or chemical substance which has a physiological effect when ingested or otherwise introduces into the body. It is mainly used for disease prevention, cure, treatment or diagnosis of disease or used to otherwise enhance physical or mental well-being.

Neuroenhancement has been used by certain university students for a non-medical purpose. They hope by using these kinds of products could achieve their academic performances,

paying full concentration in the classroom, and could even remembering more items. People that employed neuroenhancements normally are physicians, shift-workers, ADHD patients, students, women, and so on. According to Arria and DuPont (2010), neuroenhancements has been applied non-medically by the best students. Other research found that individuals who using neuroenhancement are lower grade achievement persons if compared to the non-users (Arria et al., 2010).

Cognitive enhancement has been debated largely based on three significant assumptions. First, cognitive enhancement has been entered people's daily life and society such as academia (Ferrari, Coenen, & Grunwald, 2012). Second, scientific evidence proved that several pharmacological substances contains cognitive enhancement effects and could function well in later future (Ferrari et al. 2012). Third, prospective ethics are needed in order to prevent a breach happening between ethical considerations.

According to Wolff and Brand (2013), neuroenhancement such as Ritalin could assist in concentration during the learning session. It also can facilitate in academic achievement (Wolff et al., 2013). Others studies also reported that consuming neuroenhancement drugs could aid studying which increase attention or stay alert (Schermer, Bolt, De Jongh, & Olivier, 2009).

Background of the Study

The aspiration to develop our cognition beyond the innate is not a current innovation. Rene Descartes was an initial state supporter for cognitive enhancement in 1600s. He stated that "if it is possible to find some means that generally render men wiser and more capable...I believe we must seek for it in medicine" (Chris Hahn, n.d.). The earliest history in the ancient Greeks applied rosemary twigs in their hair in order to improve their memory. Others cultures also used herbal remedies specific to enhance their memory or thinking (Chris Hahn, n.d.).

Today energy drinks such as caffeinated products which could enhance wakefulness are used by people to alter their cognition (Chris Hahn, n.d.). Now the students changed the energy drinks to prescription medications such as stimulants, which used to treat ADHD patients (Chris Hahn, n.d.). A 2008 survey from Nature indicates that 20% of 1400 respondents have been taking beta-blockers, methylphenidate (MPH) or modafinil, where the rates was reported 15%, 62%, and 44% respectively (Chris Hahn, n.d.).

The appearance of cognitive enhancements is to treat people's cognitive impairment in their mentality. This is due to dysfunction of nerve cells and their synapses, which could cause a failure of interaction between chemical neurotransmitters and their receptors (Zahid, 2010). The impairment of connection between neurons results in the frail combination and propagate of arriving and store information in the brain.

The human brain is created of billion neurons which are interrelated to one another in complex patterns (Zahid, 2010). These connections arise once the transmittance of a neurotransmitter such as acetylcholine, dopamine, and glutamate pass through the small junctions, which we refer as a synapse between nerve cells (Zahid, 2010). The neurons would integrate the different neurotransmitter messages to different strength in order to allocate the information to be processed (Zahid, 2010).

Neuroenhancement has been widely used by healthy people of medical technologies to boost their cognitive capabilities in academic populations and workplaces. Their aims were to help people undergoing from cognitive impairment, which might comprise avoiding the death of brain cells, intensifying receptor responses, and reinforcing the influenced synapses to pertinent neurotransmitter (Zahid, 2010).

Surgeons also consume this neuroenhancement where they often exposed to high workloads which could cause them become lassitude and tension (Franke, Bagusat, Dietz, Hoffmann, Simon, Ulrich, & Lieb, 2013). By using this neuroenhancement, they could reduce the likelihood of mistakes during surgery. Besides that, it could release pressure on surgeons to use neuroenhancement to counteract burnout, concentrate deficits, misery, tiredness or symptoms of depression in order to maintain high cognitive performance (Franke et al., 2013).

According to Franke et al. (2013), neuroenhancement has been a fascination for surgeons, where they act as a time-saving, easy and effective alternative if compared to the time consuming coping approaches such as the sleep, napping, relaxation methods, and so forth. Besides, he also reported that over-consuming coffee could affect tachycardia and worsening tremor. Use of cognitive enhancement could act as a coping tactic to deal with poor working conditions (Franke et al., 2013).

Apart from that, Franke et al. (2013) reported that surgeons or other people use enhancements to overcome the reduction of cognitive performance due to sleep deficiency in shift work. Stimulants and modafinil showed that they could reduce disorder in mood and cognitive performance during sleep deprivation and night shift work. Prior research indicated that at least an instant pro vigilant effect on the consumption of stimulants and modafinil for cognitive enhancement intentions amongst students.

One physician said that students take stimulants for study assistances and would not cause too much problem though they employed the drugs is not for to get high instead to perform better in their examinations. They would not take it once their examinations are finished and back to the normal lifestyle (Arria et al., 2010).

Types of enhancements that could improve human cognition are stimulants, such as Adderall, Ritalin, Beta-Blockers, Modafinil (Provigil), and Donepezil. Donepezil is a memory enhancing drug which to cure Alzheimer's disease; Modafinil is a wake advancing medium for the healing of extreme daytime sleepiness connected with narcolepsy; whilst Adderall and Ritalin is for improve working memory, attention, and control of responses in attention deficit hyperactivity disorder (ADHD) patients (Zahid, 2010).

Stimulants such as methylphenidate (MPH) and dextroamphetamine (d-AMP) is used to treat attention deficit hyperactivity disorder (ADHD) and endorse concentration. These has been reported that it could increase the alertness for people who are taking stimulants and shows that it has positive effects on visuospatial working memory.

Problem Statements

When came to neuroenhancement or cognitive enhancement terms, there was a few students knew about these terms in university. Some people did not know what the purpose of the neuroenhancement. Previous studies on neuroenhancement act as a study aid in academic performance (Riis, Simmons, & Goodwin, 2008). However, less study were conducted to investigate the level of awareness of medical, nursing, social work, and cognitive science students regarding the availability of neuroenhancement for academic purposes. This is a critical part of investigation in conjunction with the growing reliance on neuroenhancement in academic performance as the main condition in determining the knowledge students towards cognitive enhancement and the reason taking it.

Previous research on neuroenhancement generally done in the qualitative and quantitative research (Ott et al., 2012). Due to the significance of neuroenhancement in academic performance towards society nowadays, this quantitative research was carried out to investigate

the reason students taking neuroenhancement and the concerns about the use of neuroenhancement.

Objectives of the Study

Main Objective

The main objective of this research is to determine the knowledge of the participants on cognitive neuroenhancements which could improve their academic performances.

Specific Objective

The specific objectives in this research are:

- Determine the student's awareness regarding the use of cognitive enhancers.
- Determine reasons why students use of cognitive enhancers.
- Determine students concerns regarding the use of cognitive enhancers.
- Determine differences in
 - (a) Students awareness regarding the use of cognitive enhancers based on gender, program etc.
 - (b) Reasons why students use of cognitive enhancers based on gender, program etc.
 - (c) Concerns regarding the use of cognitive enhancers based on gender, program etc.

Research Hypothesis

Table 1

List of hypothesis

Hypothesis	Test
H ₀ : There is no significance association between the reason students taking cognitive enhancers and the trouble they facing in remembering things.	Chi-square test
H ₁ : There is no significance association between neuroenhancement could increase the people cognition in judgment and could gain more acceptance and respect because of the high level of achievement.	Chi-square test
H ₂ : There is no significance association between the reason students taking cognitive enhancers could achieve a better results and would progress more quickly in life.	Chi-square test
H ₃ : There is no significance association between the reason students taking cognitive enhancers and people cognition in judgment such as decision making, thinking, and working memory.	Chi-square test
H ₄ : There is no significance association between the reasons students taking cognitive enhancers and could be more concentrated.	Chi-square test
H ₅ : There is no significance association between neuroenhancement could increase people cognition in judgment and finish much of their work in less time.	Chi-square test
H ₆ : There is no significance association between neuroenhancement could increase the people cognition in judgment and learn more quickly once consuming the neuroenhancement.	Chi-square test
H ₇ : There is no significance association between neuroenhancement could increase the people cognition in judgment and programs.	Chi-square test
H ₈ : There is no significance association between the reason students taking cognitive enhancements and programs.	Chi-square test
H ₉ : There is no significance association between awareness about types of cognitive enhancements and programs.	Chi-square test
H ₁₀ : There is no significance association between awareness about types of cognitive enhancements and people cognition in judgment.	Chi-square test
H ₁₁ : There is no significance association between user and non-user who taking neuroenhancement and programs.	Chi-square test
H ₁₂ : There is no significance difference reason taking neuroenhancement and gender.	Independent sample t-test

H ₁₃ : There is no significant difference between concerns about the use of neuroenhancements and gender.	Independent sample t-test
H ₁₄ : There is no significance difference between CGPA students and gender.	Independent sample t-test
H ₁₅ : There is no significance difference between concerns about the use of neuroenhancement and programs.	Anova
H ₁₆ : There is no significant difference between reasons takings neuroenhancements and programs.	Anova
H ₁₇ : There is no significance difference between CGPA students and programs.	Anova
H ₁₈ : There is no significance relationship between the reason taking neuroenhancements and concerns about the use of neuroenhancements.	Pearson correlation
H ₁₉ : There is no significance relationship between the reason taking neuroenhancements and CGPA students.	Pearson correlation
H ₂₀ : There is no significance relationship between concerns about the use neuroenhancements and CGPA students.	Pearson correlation

Research Framework

Three categories of variables has been identified for the research framework of this study. Demographic variables for this research study were gender, ethnic, previous level of education, marital status, course type, year of study, and the latest CGPA. There was one dependent variable, which is academic performances. The independent variables were background knowledge towards neuroenhancements, reason taking neuroenhancements, and concerns about the use of neuroenhancements. Each of these variables is to measure participant's awareness toward the effect of cognitive neuroenhancement. Figure 1 represents the research framework of this study.

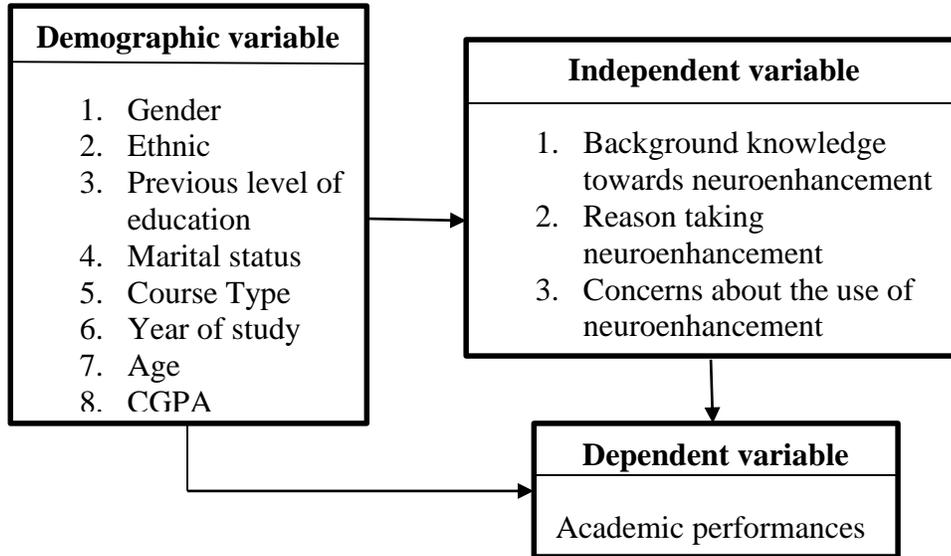


Figure 1. The research framework

Definition of Terms

Drug

The drug can be defined as any chemical substance that influences the functioning of living things and the organisms such as bacteria, fungi, and viruses that infect them (Drug, 2014). Pharmacology is the science of drugs, which comprises with all features in medicine such as their mechanism of action, metabolism, physical and chemical properties, therapeutics, and toxicity (Drug, 2014).

Cognitive enhancement

Cognitive enhancement is an example of brain enhancement, brain doping, mind doping, cosmetic psychopharmacology or neuroenhancement and psycho enhancement among the most common. Brain doping is a non-medically indicated administration of a certain drug that used for patients with depression, dementia, and attention deficit disorder or narcolepsy, whereas neuroenhancement is to increase mental ability in healthy person. Cognitive enhancement is a targeted influence of human cognitive abilities, which are mainly intended to treat mainly

psychological disorders and medications containing them are only on prescription through active substances.

Stimulants

The stimulant is drugs that arouse bodily function especially the human brain and central nervous system (Stimulant, 2014). It could inspire wakefulness, elevated mood, alertness, improved speech and motor activity and reduced appetite. MPH and dextroamphetamine (d-AMP) is the examples of the stimulants. They were widely used by polled students which could enhance attention and concentration.

Modafinil

Modafinil or Provigil is awakening advance agent that permitted in narcolepsy treatment for patients who have extreme daytime sleepiness in sleep apnea and shift work sleep disorder (Chris Hahn, n. d.). It has the minor potential for misuse and craving (Chris Hahn, n. d.). It is used as a cognitive enhancement to advance the vigilance or sleep deprived persons (Chris Hahn, n. d.).

Beta-Blockers

Beta-blocker is known as beta-adrenergic blocking agent which to cure sympathetic nervous system (Beta-blocker, 2014). Their functions are to control the anxiety, hypertension, averting or declining excitation, and cardiac situation such as angina pectoris and cardiac arrhythmias (Beta-blocker, 2014). Moreover, it could be used in glaucoma and lessen the frequency of migraine headaches. Beta-blockers had been verified that it could decrease individual's peril of a second heart attack (Beta-blocker, 2014).

Ritalin

Ritalin is a generic name for methylphenidate, which is a gentle form of amphetamine that used to treat ADHD patients (Ritalin, 2014). ADHD is common in children who are hyperactive, incapable of giving attention for a longer period, and impulsivity (Ritalin, 2014). Ritalin is just a commerce name of a drug that could consume for people with narcolepsy. Though it performs as a stimulant for people, Ritalin is more concentrate on ADHD people to let them tranquil. The results showed that Ritalin could diminish indication of ADHD by expanding the number and activity of a neurotransmitter in the brain (Ritalin, 2014).

Significance of the study

The aim of this research is to investigate medical, nursing, cognitive science, and social work student's knowledge, perceptions, experiences, viewpoints, attitudes, and their participation towards on the neuroenhancements that could improve human cognition and impact of the cognitive performance. As a result, this research may give a better understanding to others on consuming neuroenhancements for ADHD patients and healthy individuals.

Apart from that, this research could provide the evidence and information that there is an improvement by consuming neuroenhancements on their academic performances. Hence, individuals that have ADHD have chances to increase their developmental capability in their cognition.

Scope of the study

This study focuses on how the neuroenhancements could improve human cognition based on attention, learning, and memory. A significant correlation and differences between respondent's knowledge was observed between gender and course types. A cross-sectional survey was conducted in the university, specifically UNIMAS which sampled participants from

undergraduate, postgraduate, and PHD candidates from Faculty of Cognitive Sciences and Human Development (FCSHD), Faculty of Social Science (FSS) and Faculty of Medicine and Health Sciences (FMHS). Questionnaires comprising the demographics and awareness about consuming neuroenhancements was used to collect data from the respondents.