

EFFECT OF CAFFEINE AND GENDER ON ACADEMIC PERFORMANCE

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ABSTRACT

Academic Performance (AP) is of primary importance to undergraduate students because it is related to future economic and occupational success. Therefore, it is not surprising that students want to maximize their Grade Point Average (GPA), by studying hard so as to perform well in their examination which is the common measure of AP. This study explored the effect of Caffeine and Gender on Academic Performance among undergraduate students. 32 volunteered undergraduates studying Psychology in Enugu State University of Science and Technology (ESUT) were randomly assigned to groups: experimental and control groups. The experimental group which comprised 16 subjects, 8 males 8 females was administered with caffeine as a treatment condition; whereas the control group which was made up of 8 males and 8 females' subjects were given chocolate tea as a placebo. A two- way ANOVA (F-test) was employed to test the hypothesis. Results confirmed non-significant effect of caffeine use on Academic performance $F(1, 28)=.056, p>.05$ Also there was non - significant influence of gender on academic performance $F(1,28)=1.073, p>.05$ and no interaction effect of caffeine and gender on academic performance. The result was discussed in relation to relevant literature.

Keynote: Caffeine, Gender and Academic Performance.

INTRODUCTION

Many organisms exist in the world and among them is man. In the Phylogenic scale, man occupies the highest position. Gender plays an important role in man because it is the identification of man, it depicts whether one is a male or a female and the necessary characteristics expected of them. Those characteristics may include biological Sex (i.e. the state of being male, female or intersex), sex-based social structures (include gender roles and other social roles), or gender identity, (Udry 1994, Haig & Ann-maree 2004). The occupying of the highest position in the phylogenic scale by man is made possible by bimetallism and large complex brain. With large complex brain, man is able to communicate his thoughts, ideas and feelings and influence others. His ability to influence others makes it possible for change in thoughts, ideas, feelings and actions to occur, hence the phenomenon is learning. Learning is an experiential process resulting in a relatively performance change in behavior that cannot be accounted for by temporary states like influence of drug or alcohol (Omeje and Agu 2004). Learning is any change in behavior resulting from experiences especially conditions or the act or process of acquiring knowledge or skills or knowledge gained by study. (Sijuwola, 2008). In other words, learning could be seen as knowledge or skill acquired that enhances the learners ability.

Learning could also be said to be a gradual process by which one acquires new knowledge or skills which could be seen or noticed through performance. The relative permanent nature of the change has implication for duration of learned material which indicates that learned materials are stored to be retrieved when necessary. The ability to store the learned material is made possible by memory. In psychology, memory is the process in which information is encoded, stored, and retrieved. Encoding allows information

that is from the outside world to reach our senses in the forms of chemical and physical stimuli, thereby the information must be changed so that it could be stored in memory. The following are the types of memory:

- A. Sensory Memory:** Sensory memory holds sensory information for less than one second, after an item is perceived, the ability to look at an item, and remember what it looked like within just a split second of observation, or memorization, is the example of sensory memory. It is out of cognitive control and is an automatic response. The first experiment exploring this form of memory was conducted by Sperling (2003). There are three types of sensory memories
- **Iconic Memory:** This is a fast decaying store of visual information, a type of sensory memory that briefly stores an image which has been perceived for a small duration.
 - **Echoic Memory:** This is a fast decaying store of auditory information, another type of sensory memory that briefly stores sounds that have been perceived for short duration.
 - **Haptic Memory:** This is a type of sensory memory that represents a database for touch stimuli (Carlson, 2010).
- B. Short-Term Memory:** this is a type of memory that allows recall for a period of several seconds to a minute without rehearsal. Its capacity is also very limited. Ovie (2015), conducted experiments showing that the store of short-term memory was 7 ± 2 items. Modern estimates of the capacity of short-term memory are lower, typically of the order of 4-5 items; (Cowan 2001). However, memory capacity can be increased through a process called “Chunking” (Miller 1956). For example, in recalling a ten-digit telephone number, a person could chunk the digits into three groups: first, the area code (such as 123), then a three-digit chunk (456) and lastly a four-digit chunk (7890).
- C. Long-Term Memory:** The storage in sensory memory and short-term memory generally has a strictly limited capacity and duration, which means that information, is not retained indefinitely. By contrast, long-term memory can store much large quantities of information for potentially unlimited duration (sometimes a whole life span). Its capacity is immeasurably large. For example, given a random seven-digit number we may remember it for only a few seconds before forgetting, suggesting it was stored in our short-term memory. On the other hand, we can remember telephone numbers for many years through repetition; this information is said to be stored in long-term memory. While short-term memory encodes information acoustically, long-term memory encodes it semantically; Baddeley (1966) discovered that after 20 minutes, test subjects had the most difficulty recalling a collection of words that had similar meanings (e.g. big, large, great, and huge). Moreover, there is episodic memory, “which attempts to capture information such as ‘what’, ‘when’ and ‘where’” (Heather & Robertson, 1998). Long-term memory is typically divided up into two major headings: Explicit memory and implicit memory (Atkinson, Shiffrin, 1968). Also, explicit memory (declarative memory) refers to all memories that are consciously available. These are encoded by the hippocampus, entorhinal cortex, and perirhinal cortex, but consolidated and stored elsewhere. The precise location of storage is unknown, but the temporal cortex has been proposed as a likely storage capacity. Explicit memory (declarative memory) has three major subdivisions:
- D. Episodic Memory:** This refers to memory for specific events in time, as well as supporting their formation and retrieval. Some examples of episodic memory would be remembering someone’s name and what happened at your last interaction with each other (Ranganath, Michael, & Craig 2005; and Wood, Baxter, & Belpaeme 2011). Experiments conducted by Spaniol and colleagues indicate that older adults have worse episodic memory that requires context dependent memory (Spaniol, & Madden, Voss 2006).
- E. Semantic Memory:** This refers to knowledge about factual information, such as the meaning of words. Semantic memory is independent information such as information remembered for a test (Wood, Baxter, & Belpaeme 2011). In contrast with episodic memory, older adults and younger adults do not depend on context memory (Spaniol, Madden, & Voss 2006).
- F. Autobiographical Memory:** This refers to knowledge about events and personal experiences that form an individual’s own life. Though similar to episodic memory, it differs in that it contains only those experience which directly pertain to the individual, from across his life span. Conway and Pleydell-pearce (2000) argue that this is one component of the self-memory system.

Implicit memory (procedural memory) refers to the use of objects or movements of the body such as how exactly to use a pencil, drive a car, or ride a bicycle. This type of memory is encoded and it is presumed stored by the striatum and other parts of the basal ganglia. The basal ganglia are believed to mediate procedural memory and other brain structures and are largely independent of the hippocampus (Foerde & Poldrack 2009). Research by Manelis, Hanson, and Hanson (2011) found that the reactivation of the parietal and occipital regions was associated with implicit memory. Procedural memory is considered

non-declarative memory or unconscious memory which includes priming and non-associative learning (Wood, Baxter, & Belpaeme 2011, & Siegel, 2003). The quality of learning depends on the amount of information one is able to encode and retrieved when necessary. The amount of material retrieved from memory shows the quality of learning that took place, this is accessible by performance.

Performance on its own is how well an individual tends to exhibit the learned behavior. It is also the act or process of carrying out a sequence of learned behavior. Students tend to exhibit their learned materials through academic performance (AP) which is highly important to many of them.

Academic performance is a good measure of intelligence and problem solving abilities (Poropat, 2009). Positive academic performance of undergraduate students is also correlated with future occupational and economic success (Poropat, 2009). Some Variables have been shown to affect academic performance; among them are Caffeine and Gender.

Caffeine is a bitter alkaloid found especially in coffee, tea, cocoa, and kola nuts and can be extracted from seeds and plants and used medically as a stimulant and diuretic drugs. (Poropat, 2009). The technique used to separate an organic compound from a mixture of compounds is called extraction. Extraction process selectively dissolves one or more of the mixture compounds into a suitable solvent. The solution of these dissolved compounds is referred to as the Extract. Here the organic solvent dichloromethane is used to extract caffeine from an aqueous extract of tea leaves because caffeine is more soluble in dichloromethane (140 mg/ml) than it is in water (22 mg/ml). Caffeine is a central nervous system and metabolic stimulant, (Nehlig, Daval, & Debry 1992) and is used both recreationally and medically to reduce physical fatigue and to restore alertness when drowsiness occurs. It produces increased wakefulness, faster and clearer flow of thought, increased focus and better general body coordination (Boltons, 1981). Effect of caffeine begins less than an hour after consumption, and a moderate dose usually wears off in about five hours (Boltons, 1981). Caffeine has a number of effects on sleep, and it improves performance during sleep deprivation but may lead to subsequent insomnia (Snel, & Lorist 2011). In shift workers, caffeine leads to fewer mistakes caused by tiredness (Pela, 2014). In athletics, moderate doses of caffeine can improve sprint (Butler, 1990), endurance, and team sports performance, but the improvements are usually not very large. Some evidence suggests that coffee does not produce the ergogenic effects observed in other caffeine sources (Graham 1998). High doses of caffeine, however, can impair athletic performance by interfering with coordination (Tarno Polsky (2010). Since caffeine has been shown to have effect on behavior, it is therefore not surprising that it may also affect academic performance since students take it to keep awake during studying

Another variable of interest is "Gender". The modern English word gender comes from the Middle English *gender*, a loanword from Norman-conquest-era Old French. This in turn, came from Latin *genus*. Both words mean "tined," "type," or "sort". They derive ultimately from a widely attested proto-Indo-European (Shepard, 2009). Gender is the range of characteristics pertaining to, and differentiating between masculinity and femininity. Sexologist, introduced the terminological distinction between biological sex and gender as a role. In many other contexts, however, even in some areas of social sciences, the meaning of gender has undergone a usage shift to include sex (Udry, Richard 1994 & Haig, David 2004). In the English Literature, the trichotomy between biological sex, psychological gender, and social and sex role first appeared in a feminist paper on transsexuals in 1978 (Haig, David 2004 & Yudkin 1978). Some cultures have specific gender-related social roles that can be considered distinct from male and female, such as the hijra of India and Pakistan. Gender identity is the gender a person self-identifies as one's biological sex and is directly tied to specific social roles and expectations. Butler (1990) considers the concept of being a woman to have more challenges, owing not only to society's viewing women as a social category but also as a felt sense of self, a culturally conditioned or constructed subjective identity. According to gender theorist Butler (1990), gender can have ambiguity and fluidity. There are two contrasting ideas regarding the definition of gender.

The World Health Organization defines gender as the result of socially constructed ideas about the behavior, actions and roles a particular sex performs. The belief, values and attitude taken up and exhibited by them is as per the agreeable norms of the society and the personal opinions of the person is not taken into the primary consideration in assignment of gender and imposition of gender roles as per the assigned gender. Although a person's sex as male or female stands as a biological fact that is identical in any culture, what that specific sex means in reference to a person's gender role as a woman or a man in society varies cross culturally according to what things are considered to be masculine or feminine (Birke, & Lynda 2001).

Purpose of the Study

From the foregoing, it could be deduced that caffeine seems to have effect on human behavior. Laura Lussier (2010) has observed that students who are beginning their undergraduate degree programs

often find it difficult to manage their time and thus reduce the amount of sleep they receive each night, in order to stay awake and read for exams they turn to caffeine as a quick source of energy and alertness. Moreover gender has been shown to have an effect on performance. Research conducted by Johns, Svoboda & Kayla (2009) on the effect of caffeine and gender on physiology and performance showed that females performed better than males on the recall tasks. Therefore, the researcher set out to find out whether caffeine and gender will have effect on the academic performance (AP) of students in Igbo culture environment.

Specifically, the aims of the study were:

1. To find out if caffeine would significantly affect academic performance of undergraduates
2. To investigate the influence of gender on academic performance
3. To find out if there would be significant interaction effect caffeine and gender on academic performance.

METHOD

Participant

40 participants who volunteered to take part in the study were drawn from 100-Level student of Psychology in Enugu state University of Science and Technology (ESUT) to participate in the study; the sample contained 16-males and 16-female subjects. Ages range from 18-24 years with an average age of 20.28 years.

Instrument

JAMB 2013 English question paper Type-D, Coffee and Tea.

Joint admission and matriculation examination board (JAMB) English examination question type-D was used because of the compulsory nature of English language in the Country; which an average student is expected to have a credit in English Language before he or she could be admitted into the University. The English examination question comprised of 100 objective questions, to be answered using an optical mark recognition (OMR) numbered from 1-100 with options of A-D in each number. The participants were expected to shade the correct answers within 1hour.

Coffee is another instrument used in this study because it was the treatment being administered to the experimental group. The coffee used was 2grams (g) of NESCAF classic, which contains about 15.71 milligrams (mg) of caffeine. Cowbell chocolate tea was used as a Placebo.

Procedure

They were instructed not to take their breakfast when coming to school the next day and they should endeavor to be in school as early as 7:00am, giving them assurance that their breakfast will be taken care of. This was basically to control the extraneous variables. When the participants arrived at the laboratory, they were introduced to the nature of the experiment. However, 8 indicated that they neither take coffee nor tea, resulting in 32 valid participants.

In a controlled setting in the Laboratory, the participants were randomly assigned to groups; the experimental and control groups, which comprises of 8 males and 8 females each. 2g of NESCAF coffee classic were administered to each participant in the experimental group; and the quantity of caffeine contained in the coffee was 15.71mg. Cowbell Chocolate tea were given to the control groups as a placebo; this was for them not to feel cheated.

The whole participants, both the experimental and the control groups were left in the laboratory under a close supervision for a period of 30 minutes; this was for the effect of the caffeine given to the experimental groups to get at its peak. After the 30 minutes, they were all moved to the class in a normal examination setting where they were given the English examination test to shade the correct answers within a period of 1 hour.

Design/Statistics

The design used in this study is “Factorial Design” (2(coffee vs. chocolate) X2(Gender: male vs. female), this is because variables were manipulated (Administration of coffee). The statistics applied in this study is “Two – way Analysis of Variance F-test (Two-way ANOVA). This is because of two independent variables and possibility of interaction.

RESULTS

Table 1: Mean and Standard Deviation of Caffeine use and Gender on Academic Performance

CAFFEINE	GENDER	MEAN	STANDARD DEVIATION	N
Caffeine	Male	32.8750	12.91110	8
	Female	40.2500	22.79254	8
	Total	73.125	9.88144	16
No Caffeine	Male	36.2500	12.05642	8
	Female	39.2500	31.87524	8
	Total	75.5	19.81882	16
Total	Male	34.5625	12.19272	16
	Female	39.7500	27.32987	16
	Total	74.3125	15.13715	32

Table one above shows the mean and standard deviation of participants on academic performance. Observation of table 1 shows that participants who performed under the influence of caffeine obtained a lower mean score on academic performance (M=73.125; SD=22.79254) when compared with those who did not take caffeine, but who obtained a higher total mean of 75.5 (SD=31.87524).

The table mean also shows that males obtained a lower total mean of 34.56 (SD=12.19) on academic performance when compared with females who obtained a total higher mean of 39.75 (SD=15.137).

Table: 2 ANOVA Summary of Caffeine use and Gender on Academic Performance

SOURCE	TYPE III SUM OF SQUARES	df	MEAN SQUARE	F	Sig.
Intercept	44178.781	1	44178.781	220.211	.000
Caffeine	11.281	1	11.281	.056	.814
Gender	215.281	1	215.281	1.073	.309
Caffeine Gender	38.281	1	38.281	.191	.666
Error	5617.375	28	200.621		
Total	50061.000	32			
Corrected Total	5882.219	31			

a. R squared = .045 (Adjusted R squared = -.057) Results in table 2 above indicate non-significant effect of caffeine use on academic performance, $F(1, 28) = .056, P > .05$

This means that there is no significance difference in academic performance between participants who took caffeine and those who did not take caffeine, thus the null hypothesis is accepted.

Table 2 also indicates non significant influence of gender on academic performance, $F(1, 28) = 1.73, P > .05$

This means that there is no statistically significant difference in academic performance between males and females. Thus, the second null hypothesis is accepted. Moreover, no interaction effect was indicated.

Discussion

Based on the findings of this study, the first hypothesis which stated that there would be a significant effect of caffeine on academic performance; was rejected, caffeine had no significant effect on academic performance. Hence, null hypothesis was accepted. Thus, is in line with the studies carried out by Gilliland & Andress (1981) on the relationship between “Ad Lib caffeine consumption, symptoms of caffeine’s and academic performance”, which indicated no effect of caffeine on academic performance. And also Johns, Svoboda & Kayla (2009), on the effects of caffeine on performance and self-report mood measure during execution of a complex cognitive task, which the result showed no effect of caffeine on performance. The result of this research is also in contrast with the study carried out by Gonnella (2009) on the relationship between caffeine consumption and student GPA, which the result indicated that caffeine has an effect on academic performance. On the other hand, the second hypothesis which states that there would be significant gender difference in academic performance of students was also rejected. There was no statistically significant difference in academic performance between males and females, which is not in line with any of the empirical works reviewed. This may be as a result of environment because those researches were carried out in western world whereby this particular research was carried out in Africa, specifically the Igbo cultural environment in Nigeria. Thus the second Null hypothesis was also accepted.

Implications of the Findings

Dangers of drug abuse: Based on the findings of this study, caffeine and gender has no significance effect on academic performance. This result in turn supports the empirical work done by Svoboda and Kayla (2009) which result showed that there is no effect of caffeine on performance. This finding goes further to discourage the frequent caffeine use by students, this is because it may lead to addiction and may cause insomnia due to the wakefulness nature of the substance.

Therefore, the researcher suggest that students should always study hard without any drug inducement and they should not always capitalize their academic success as being male or female, hard work in academics pays.

Summary/ Conclusion

The findings of the study are summarized as following: There is no significant effect of caffeine and gender on academic performance and there is no interaction effect of caffeine and gender on academic performance.

Based on the result of the findings the researcher hereby brings to conclusion that academic performance does not depend on drugs or whether one is a male or female. Student should study hard to achieve a better academic performance instead of depending on coffee.

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