

Relationship between Age, Gender, Mobile Phone Usage and some Cognitive Functions among the Nigerian Students

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Authors' contributions

This work was carried out in collaboration between both authors. Author LKD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author JSH managed the analysis and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: Advanced mobile technology especially mobile phones provide useful and convenient means for individuals to communicate and access the internet anytime and anywhere. However, electromagnetic field (EMF) energy from the mobile phones has been mentioned to hamper neuronal activity and cognitive function in humans.

Aim: This research was therefore undertaken to determine the relationship between age, gender, mobile phone usage and some cognitive functions among the Nigerian students.

Methodology: This study used data from 500 students randomly selected from populations in University of Port-Harcourt. Different ages specified by the respondents through structural. Questionnaires were used. Data obtained from the retrieved questionnaire were analyzed using multiple STATGRAPHICS for the descriptive statistics. While SPSS (IBM Amos V21.0.0, USA) was used for the inferential statistics.

Results: The results revealed that, there was no significant association between age and smartphone ownership ($P > 0.05$). However, for gender, there were significant distributional

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differences in males (38.5%) and females (29.4%) ($P=0.022$), as well as stress caused by phone usage (males=76.8%; females=89.7). Correlations of cognitive function variables revealed significant relationship between all the cognitive functional variables.

Conclusion: Distraction was found to have a significant relationship with stress ($P=0.033$). Therefore attachment to use of smart phone among youths should be advisably minimized.

Keywords: Cognitive; electromagnetic; mobile phone; neuronal activity; questionnaires.

1. INTRODUCTION

Mobile phone is a phone that can make and receive telephone calls over a radio link while moving around a wide geographic area [1]. Advanced mobile technology especially mobile phones provide useful and convenient means for individuals to communicate and access the internet anytime and anywhere [2]. However, electromagnetic field (EMF) energy from mobile phones has been suggested to have effects on neuronal activity and cognitive function in humans[3] [4]. Today mobile phones allow users to call, text, email, video conference, micro blog, interact on social-networks, surf the internet, watch and share videos and pictures, play video games and utilize a tremendous array of software driven applications [2]. Mobile phones can be accepted as computers in terms of their functioning capability [5]. Previous studies have attributed addictive behavior to youth mobile phone use [6]. No research that we are aware of has examined the relationship between age, gender, mobile phone usage and some cognitive functions among the Nigerian students. However, emerging research has explored the relationship between a range of health related variables: Problematic cell phone use has been described as an addiction like behaviour leading individuals to use the cell phone compulsively [7]. There is also evidence that one in every four young adults is reported to have problematic smartphone use and this is accompanied by poor mental health e.g. higher anxiety, stress, depression [8]. Considering the proliferation and use of mobile phones among the Nigerian University students today for different purposes, there is need to analyze or investigate the influence of mobile phone use on some cognitive functions, gender and age among the Nigerian students.

2. MATERIALS AND METHODS

This study is a descriptive survey research. A sample size of five hundred (500) respondents randomly selected from the University of Port-

Harcourt, School of Basic Studies who met the criteria for the study were used. Every member of the population had an equal Probability of Selection (EPS). The samples included male of different ethnic and religious background. All participants were students receiving education in the University of Port-Harcourt. The students and their lecturers were reached as a result of repeated visits by researchers.

2.1 Study Protocols

The major instrument for data collection was the questionnaire; the questionnaires were adequately evaluated and edited in order to guarantee its suitability for the study. The questionnaire was divided into three (3) sections; section A, B and C. Section A is concerned with demographic data of the respondents, section B contains the research question on assessment of cognitive skills of the students while section C assessed how mobile phone has affected academic performance of student. A detailed explanation of the aim and importance of the study was done to the respondents, to enable us meet the target of the research. They were also assured that every information given would be handled confidentially. As soon as consent was obtained, the respondents were requested to manually fill the questionnaire. The questionnaires were administered by the author, who resides in the neighborhood of the University. The data collected were assessed for completeness and responses failing to meet the 75% cut-off (on all valid questions) were excluded. The questionnaire was adopted from Peg Dawson and Richard Guare.

2.2 Inclusion Criteria

The inclusion criteria for the study include;

- ✓ Human subjects
- ✓ Students from same institution (University of Port-Harcourt)
- ✓ Consenting teenagers and adults using a mobile phone.

- ✓ Young adults that does not have any visual or auditory deficiencies.
- ✓ Physically and mentally healthy

2.3 The Exclusion Criteria Include

- ✓ Non-human subjects
- ✓ Students from a different institution
- ✓ Young adults that have any visual or auditory deficiencies.
- ✓ Mentally unhealthy

2.4 Statistical Analysis

The statistical tools used for this study were STATGRAPHICS centurion CVI version 16.1.11 (StatPoint Tech., Inc.) and Statistics Package for Social Science (SPSS IBM® Amos V21.0.0, USA).

3. RESULTS AND DISCUSSION

Demographic Distributions: Figure 1 shows the demographic data of respondents as 97.64% were ≤ 18 years while 2.36% of respondents were greater than 18years. 38.19% of respondents were female while 61.81% were male. Also the study revealed that 92.52% of respondents were smart phone users while 7.48 were not.

Phone use outcome: Figure 2 shows responses for phone usage outcome as 48.82% of the respondents were attached to their phones while 51.18% were not attached to their phones. 84.65% of respondents were often distracted by their phone while 15.39% were not. On perceived benefit is that, 35.04% respondents have benefits from phone usage while 64.96% had no benefit from phone usage. Also, 81.69% of the respondents were stressed after phone usage while 18.31% were not. This implies that, most of the respondents were not attached to their phones, however distracted by their phones, had no benefit and were stressed as well after usage of their phones.

Relationship between Demography and Phone use Outcome: Table 1below shows the relationship between demographic parameters (age, sex and smart phone ownership) and phone usage outcome (attachment, distraction, benefit and stress); The results revealed that, although the population distribution for age and smartphone usage were greatly skewed, there was no significant association between age, smartphone ownership and phone use outcomes

($P>0.05$). However, for sex, there was significant distributional differences in males (38.5%) and females (29.4%) for benefit ($P=0.022$), as well as stress caused by usage (males=76.8%; females=89.7).

Regression weight and standardized (z-statistics) estimate measures executive functions as a factor of phone use in the SEM analysis: Table 2 estimating measures of executive functions as factors of phone usage outcome, it was revealed that sustained attention has a significant relationship with benefit ($P=0.005$). Also, sustained attention and flexibility were also found to have a positive significant relationship with stress ($P=0.029$) for sustained attention and ($P=0.036$) flexibility.

Correlations of executive phone usage outcome: Table 3 shows correlations of executive phone usage outcomes, the results revealed that the distraction had a significant relationship with stress ($P=0.033$).

Correlations of executive function variables: Table 4 shows correlations of executive function variables. Results revealed significant relationship between all the executive function variables (working memory, cognitive flexibility, attention capacity, time management, and stress tolerance). However, time management and flexibility showed the strongest significant relationship ($r=0.512$), followed by flexibility and stress tolerance($r=0.461$) as well as time management and stress tolerance($r=0.453$).

Previous research into cell phone use and related functions focused on problematic cell phone users [7] [9]. The present study builds upon this previous research by evaluating the relationship between age, gender, mobile phone usage and some cognitive functions among the Nigerian students.

Our findings demonstrate that, among the sample of students most of the respondents were 18years old or less (97.64%) and were predominantly male (61.81%). However, 64.96% agreed that they had no benefit from phone usage and most of the participants are often stressed after phone usage (81.69%). Our results shows significant distributional differences in males (38.5%) and females (29.4%) for benefits ($P=0.022$) from phone usage, which agrees with [10] whose study found out that boys demonstrated higher levels of habitual use and self-efficacy of smart phones than girls.

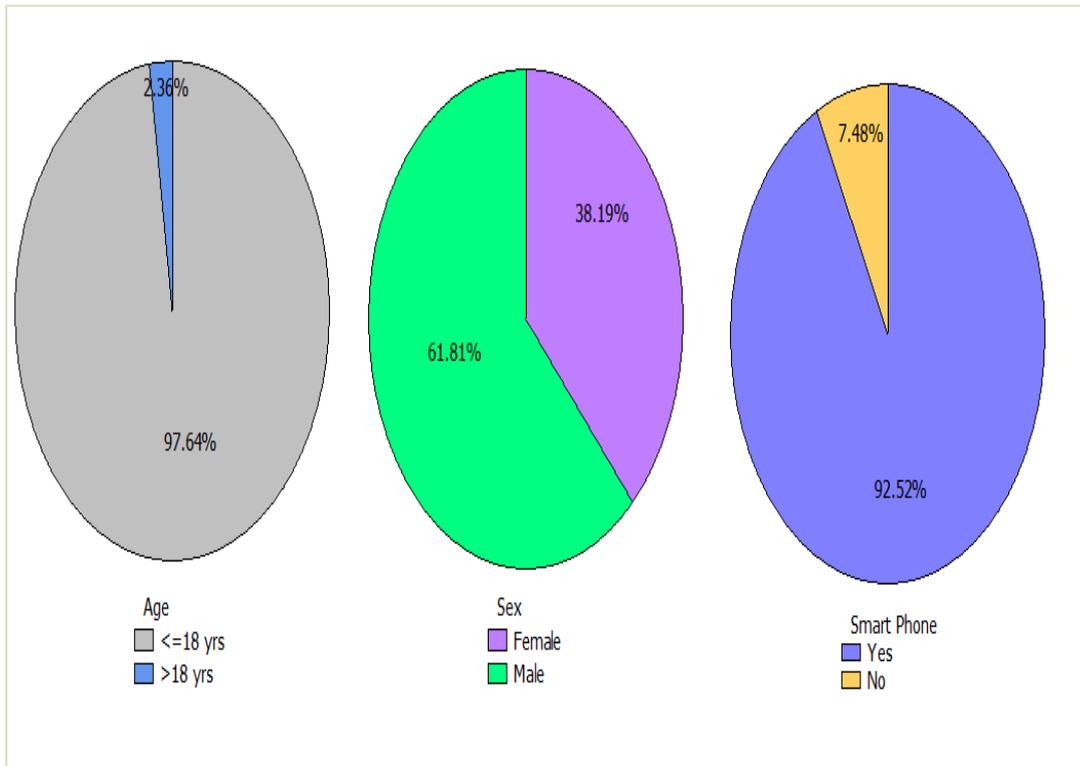


Fig. 1. Study Demographic Distributions

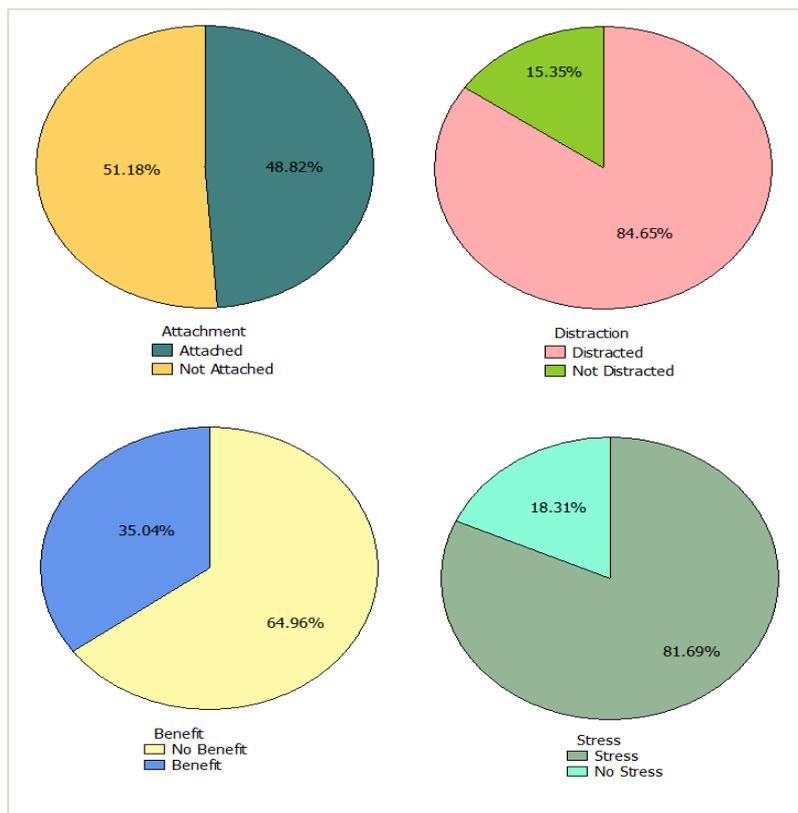


Fig. 2. Phone use outcomes

Table 1. Relationship between Demography and Phone use Outcomes

Variables	Age (%)		Chi-square	Sex (%)		Chi-square	Smart Phone Ownership (%)		
	≤18 yrs (97.6)	>18 yrs (2.3)		Male (61.8)	Female (38.2)		No (7.5)	Yes (92.5)	Chi-square
Attachment									
Attached	242 (48.8)	6 (50)	P>0.05	147 (46.8)	101 (52.1)	P>0.05	13 (34.2)	235 (50.0)	P>0.05
Not Attached	254 (51.2)	6 (50)		167 (53.2)	93 (47.9)		25 (68.8)	235 (50.0)	5
Distraction									
Distracted	420 (84.7)	10 (8.3)	P>0.05	263 (83.8)	167 (86.1)	P>0.05	36 (94.7)	394 (83.8)	P>0.05
Not Distracted	76 (15.3)	2 (1.7)		51 (16.2)	27 (13.9)		2 (5.3)	76 (16.2)	5
Benefit									
No Benefit	325 (65.5)	5 (41.7)	P>0.05	193 (61.5)	137 (70.6)	4.414 (0.022)	26 (68.4)	304 (64.7)	P>0.05
Benefit	171 (34.5)	7 (58.3)		121 (38.5)	57 (29.4)		12 (31.6)	166 (35.3)	5
Stress									
Stress	407 (82.1)	8 (6.7)	P>0.05	241 (76.8)	174 (89.7)	13.424 (<0.01)	30 (78.9)	385 (81.9)	P>0.05
No Stress	89 (17.9)	4 (3.3)		73 (23.2)	20 (10.3)		8 (21.1)	85 (18.1)	5

Table 2. Regression weight and standardized (z-statistics) estimates measures of executive functions as a factor of phone use in the SEM analysis

Variable	Relationship	Estimate	Z-Estimate	S.E.	C.R.	P-value
WM	<---	Attach	-0.077	-0.012	0.29	0.790
SA	<---	Attach	0.211	0.028	0.325	0.517
TM	<---	Attach	0.641	0.086	0.329	0.051
FLEX	<---	Attach	0.304	0.038	0.349	0.384
ST	<---	Attach	0.728	0.086	0.375	0.052
WM	<---	Distract	0.286	0.032	0.403	0.479
SA	<---	Distract	-0.178	-0.017	0.453	0.695
TM	<---	Distract	0.246	0.024	0.457	0.591
FLEX	<---	Distract	0.175	0.016	0.485	0.718
ST	<---	Distract	0.414	0.035	0.522	0.428
WM	<---	Benefit	-0.14	-0.021	0.304	0.645
SA	<---	Benefit	-0.956	-0.123	0.341	0.005**
TM	<---	Benefit	-0.449	-0.058	0.345	0.192
FLEX	<---	Benefit	-0.52	-0.063	0.366	0.155
ST	<---	Benefit	-0.108	-0.012	0.393	0.784
WM	<---	Stress	-0.047	-0.006	0.377	0.900
SA	<---	Stress	0.925	0.097	0.423	0.029*
TM	<---	Stress	0.491	0.051	0.427	0.250
FLEX	<---	Stress	0.953	0.093	0.453	0.036*
ST	<---	Stress	-0.036	-0.003	0.488	0.941

Note: 1. WM-Working memory; SA-Sustained attention; TM-Time management; FLEX-Flexibility; ST-Stress Tolerance 2. Z-standardised score; S.E-Standard error; C.R-critical ratio; P-probability; 3. Sex, Age and smart phone use were statistically controlled; 4. Significant at *P<0.05, **P<0.01

Table 3. Correlations of executive phone usage outcomes

Variable Relationship	Estimate	Z-Estimate (r)	S.E.	C.R.	P
Attachment <--> Distraction	0.006	0.034	0.008	0.757	0.449
Attachment <--> Benefit	-0.008	-0.034	0.011	-0.762	0.446
Benefit <--> Stress	0.011	0.058	0.008	1.298	0.194
Distraction <--> Stress	0.013	0.095	0.006	2.127	0.033*
Attachment <--> Stress	0.009	0.045	0.009	1.008	0.313
Distraction <--> Benefit	-0.005	-0.027	0.008	-0.6	0.548

Note: 1. Z-standardised score; S.E-Standard error; C.R-critical ratio; P-probability; 2. Significant at * $P < 0.05$

Table 4. Correlations of executive function variables

Variable Relationship	Estimate	Z-Estimate (r)	S.E.	C.R.	P
WM <--> SA	3.087	0.256	0.553	5.584	***
WM <--> TM	2.825	0.233	0.553	5.11	***
TM <--> FLEX	7.515	0.512	0.732	10.261	***
SA <--> ST	3.074	0.196	0.709	4.336	***
FLEX <--> ST	7.711	0.461	0.817	9.434	***
WM <--> FLEX	2.465	0.192	0.582	4.236	***
WM <--> ST	2.674	0.194	0.624	4.283	***
SA <--> FLEX	4.137	0.283	0.674	6.137	***
SA <--> TM	4.866	0.354	0.648	7.507	***
TM <--> ST	7.132	0.453	0.768	9.291	***

Note: 1. WM-Working memory; SA-Sustained attention; TM-Time management; FLEX-Flexibility; ST-Stress Tolerance 2. Z-standardised score; S.E-Standard error; C.R-critical ratio; P-probability; 3. Significant at *** $P < 0.001$

The study also showed that, smart phone users showed less working memory than non-smart phone users: The result agrees with [11] who posited that frequent media taskers differed from light/nonusers with respect to their working memory capacity, and also exhibited diminished long-term memory. But disagrees with [12] who demonstrated increased task performance on video game trials, suggesting increased working memory.

Female showed better working memory than males while respondents above 18years showed better working memory than those ≤ 18 years. The results demonstrated that sustained attention had a significant relationship with benefits ($P=0.005$). Also, sustained attention and flexibility were found to have a positive significant relationship with stress ($P=0.029$) for sustained attention and ($P=0.036$) flexibility.

4. CONCLUSION

In conclusion, this research identified a relationship between smart phone usage and some cognitive functions: like less working memory in smart phone users than in non-smart phone users as respondents above 18years showed better working memory than those

≤ 18 years. There was a significant distributional difference in males and females in terms of benefits from phone usage, which implies that males benefit more from phone usage than females.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

The present study was approved by the relevant ethical committee of our institution, and has therefore been performed in accordance with the ethical standards laid down by the University. Also, informed consent was obtained from respondents after explaining to them the objectives of the study in the language they understood. Only those who met the inclusion

criteria were recruited for data collection. They were equally told that they are free to withdraw from the study at any time. They were assured of confidentiality and their right to privacy was assured and maintained.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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