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Sustaining Attention in a Rapidly Changing World: A Survey of the Status among Mathematics Education Students in Nigeria

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Abstract
Mathematics education, along with its processes and outcomes, is not left out in the impact of the technological change resonating across the globe. This survey was designed to ascertain the status quo in attention management by mathematics education students in Nigeria in the face of present-day unlimited liberties and possibilities. Two instruments, the Dispositional In-Class Inattentiveness Questionnaire for Mathematics Education Students (DICIQ-MES) and the Smartphone Addiction Scale – Short Version (SAS-SV), were used to measure the students' levels of inattentiveness and smartphone addiction respectively. The instruments were administered to a sample of 105 mathematics education students at a University in North Central Nigeria. The findings of this study revealed a considerably low level of dispositional in-class inattentiveness and a moderately low level of smartphone addiction among mathematics education students. The study also established a statistically significant positive relationship between smartphone addiction and dispositional in-class inattentiveness among the students. Considering the outcome that attention management is becoming one of the most important skills for learners in this era, this study upholds that mathematics educators teach today's students how to manage and direct their attention to enable them become successful learners.

Keyword: Mathematics education, Attention, Smartphone addiction, Dispositional inattentiveness

Introduction

It is a fact that life in the 21st century is an outcome of immense scientific and technological transformation, a change that is as rapid as it is intense. Every aspect of human endeavour seems to be spinning on the fast lane with innovations of yesterday requiring updates today. Change is exerting its influence in agriculture, business, medicine, sociology, education, to name but a few key areas. Advances in Information and Communication Technology (ICT) are redefining world economy into a knowledge-based global network. The World Development Report 2016 reveals amazing statistics on the greatest information and communications revolution in human history (World Bank, 2016). The deep penetration of digital technologies into the fabric of society have boosted growth, expanded opportunities, and improved service delivery, resulting in a high level of connectivity between people, business, and governments. The world, indeed, has become a global village.

Education, along with its processes and outcomes, is not left out of the impact of the tidal change happening across the globe. Schools all over the world are becoming an integral part of the broadband and technological transformation, harnessing the potentials of technology to drive and empower more personalized learning. This calls for more than a change in pedagogy; it suggests a change in the very meaning and nature of education, particularly for the new genre of students for whom leisure and learning constitute an inseparable whole.

At the heart of the current force of change is the Internet, linking people to unimaginable quantity of data. The number of internet users has become more than tripled in the past decade with the quantity of accessible data enjoying an annual increase of 4300 %, speeding towards a milestone of 35 Zettabyte by the year 2020 (World Bank, 2016; Computer Science Corp, 2012). Students across the world are joining the rest of the society to maintain impressive online presence as well as gleaning abundant information relevant to their fields of study. An accompanying outcome of this digital reality is the pressure on students to sustain their profiles on social network platforms such as Facebook,

Twitter, Whatsapp and Instagram, irrespective of their physical location and the duty at hand. It has, thus, become normal to observe students constantly shifting their attention from educational tasks to attend to mundane calls and notifications on their mobile devices.

The phenomenon of inattentiveness is fast becoming an issue of concern, particularly in mathematics education, where students' behavioural engagement relates to performance in school work. Basically, attention implies taking possession of the mind in clear and vivid form (Styles, 2006, as cited in Bester & Bran, 2013). Being attentive indicates an ability to regulate the amount of information one processes at a given point in time. The intensity and amount of focus students can sustain has been affirmed to be on the decrease in recent times (Microsoft, 2015). Linking this downturn to digital technology, Valkenburg (2011) observes that unchecked interference from technology has distracted the brain with a constant of visual stimuli and information that has diminished the ability of the individual to process information deeply and to later use remembered information in a novel way. This is a huge challenge to the aims and objectives of mathematics education, especially in Nigeria.

Schools, particularly Nigerian universities, are essential citadels of learning. They are centres for the delivery of knowledge and skills at the highest levels. Nigerian universities are also cultural institutions meant for relaying all elements of societal values, norms and ways of life to young adults. All these targets are packaged in the programmes hosted in these institutions of higher learning and achieving them requires every concerted effort on the part of the students. It takes effort to redefine educational commitment which in turn dictates daily choices, including the need to practice moderation in the usage of mobile devices within and outside a learning environment.

Considering the fact that attention in mathematics education is a conscious choice to control and select relevant impulses, it has become highly imperative to unravel the sub-structural events rapidly unfolding on Nigerian campuses. Inasmuch as the onus lies on the teacher to present mathematics instruction in an engaging manner, more responsibilities on eventual outcomes lie with the students. In an environment of unlimited liberty and possibility, how much attention are mathematics education students giving to their studies? How are the students handling the ubiquity of smartphones in optimizing their learning experiences? What is the status of smartphone addiction among mathematics education students in Nigeria? These, among other concerns, form the bases for this study.

Literature Review

Attention has been defined as a system of cognitive control in which the vast amount of information processed by the cognitive system is reduced to a tolerable extent (Bester & Brand, 2013). The concept of attention enjoys a very wide treatment right from the inception of academic psychology. As early as 1908, Titchener could assert that the doctrine of attention is the nerve of the whole psychological system, and that as men judge of it, so shall they be judged before the general tribunal of psychology (Kahneman, 1978). Attention is attained not merely by being wide awake and activated by the teacher. It entails performing work, expending limited resources, and a significant amount of mental effort.

Outputs from several researchers present an increasing set of components as constituting attention. Many associate arousal, effort, capacity, perceptual set, control, and consciousness with the process of attention, but there is a broad agreement that attention involves selecting some information for further processing while inhibiting other data from receiving further processing. Furthermore, attention could be sustained (prolonged focus), selective (maintaining focus despite distractions), and alternating (shifting attention between tasks) (Microsoft, 2015). Bester and Brand (2013) assert that the focus of attention can be controlled in a goal-driven manner leading to concentration by the students in a wholesome mind. This is required for quantifiable success in mathematics education.

As time goes by, the focus of some researchers is now shifting to the role of technology in sustaining attention among students. Schmidt and Vandewater (2008) observe that over the past half-century, the advent of each new electronic medium or technology has been both celebrated and viewed with alarm. The immediacy of computer technology has had a profound impact on the way people read or do not read, on the way people focus and reflect on what they have learned (Valkenburg, 2011). What researchers now term the "paradox of technology" refers to people's obsession with the smartphone on a level bordering noticeable salience, euphoria, tolerance, withdrawal, conflict and relapse (Roberts, 2016).

Empirical works within school environments establish that use of digital devices such as smartphones, tablets and laptop computers caused students to pay less attention in the classroom and miss instruction (McCoy, 2013). Another encompassing study by Common Sense Media (2016) found 50% of teens addicted to their mobile devices, with 77% of parents feeling their teens get distracted and do not pay attention.

Kibona and Mgaya (2015) found a negative correlation between academic performance and smartphone addiction among higher learning students. In a detailed study from Nigeria, Ayodele, Mosunmola, Senamu, Gbenga and Aderonke (2015) confirmed that the prevalence and continuous engagement in online social networking by undergraduates has continued to be on the increase, with attention deficit in students' academic activities increasing with respect to amount of time spent on online social networking services.

One of the overarching outcomes of present-day use of technology is the general waning in the attention span of humans. A wide study by Microsoft (2015) observed that human attention is dwindling with increased dependence on modern technology. The study found that addictive technology behaviours among young adults have reduced the average human attention span from 12 seconds in 2000 to a present level of 8 seconds. This era of infinite information availability is reducing the desire to be inquisitive, to think, comprehend, and ultimately retain information. (Weyers,n.d.).

Digital technologies affect mathematics education students by placing unnecessary demands on their attention, memory and learning. The results of these demands usually manifest as cognitive overload, multi-tasking, and continuous partial attention (CPA). Cognitive overload is causing cognitive fatigue and poverty of attention (Goodwin, 2015; Microsoft 2015) among students who are daily bombarded with information. Learners claim to adopt multi-tasking as a coping strategy, but actually, multi-tasking is an excuse for being unable to focus on the task at hand, considering that under most conditions, the brain simply cannot do two complex tasks at the same time (Becker, 2015). Multi-tasking appears to overload the working memory and divide attention, leading to CPA and interruptions that disrupt the encoding and retrieval of content (Goodwin, 2015).

Almost all modern teaching strategies, approaches and methods incorporate ways of engaging and sustaining students' attention in the classroom. There is an endless list of techniques including auditory cues, visual signals, routine phrases, eye contact, colour, illustration, and shrewd time management. Teachers always strive to ensure attention, particularly in mathematics education, but success really depends on students who must make the effort to achieve attention. Goodwin (2015) recommends teaching meta-cognitive and study strategies to students to help them deal with the mass of digital content they experience, so that it does not impede their learning.

Nigerians are increasingly becoming technology enthusiasts. Statistics available at the Nigerian Communications Commission (NCC) as at June, 2016, puts the number of phone subscribers in the country at over 149 million, with a high percentage of users accessing information via smartphones and other handheld devices (Nigerian Communications Commission, 2016). Twinpine Network (2016) reported that Nigeria was the most mobilized country in the world ahead of India and South Africa, with 40% mobile penetration and 30% smartphone penetration rate. Nigerians spend an average of 193 minutes on smartphones daily across all media, according to the Twinpine Network report. This category of users comprises of young adults, mostly undergraduates in Nigerian higher educational institutions. The high level of smartphone penetration among mathematics education students in Nigeria may have an attendant impact on the level of their attentiveness in academic activities. This study therefore is designed to determine the status quo in attention management among mathematics education students in Nigeria.

Research Questions

The following questions were raised to guide the study.

i. What is the level of inattentiveness among mathematics education students in Nigeria?
ii. What is the level of smartphone addiction among mathematics education students in Nigeria?
iii. Which gender is more affected by inattentiveness among mathematics education students in Nigeria?
iv. Which gender is more affected by smartphone addiction among mathematics education students in Nigeria?
v. What is the relationship between level of inattentiveness and level of smartphone addiction among mathematics education students in Nigeria?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

i. There is no significant difference in the level of inattentiveness between male and female mathematics education students in Nigeria.
ii. There is no significant difference in the level of smartphone addiction between male and female mathematics education students in Nigeria.
iii. There is no significant relationship between level of inattentiveness and level of smartphone addiction among mathematics education students in Nigeria.

Methodology

Survey research design was adopted for this study. The target population comprises of 427 mathematics education students studying for a Bachelor of Science (Education) in the three mathematics education programmes hosted in a University in North Central Nigeria. A sample of 105 mathematics education students was randomly selected across programme options and levels of study.

Two instruments were used for data collection in this study. The first is the researcher-developed Dispositional In-class Inattentiveness Questionnaire for Mathematics Education Students (DICIQ-MES). The DICIQ-MES is an adaptation from Lana and Harris (2015) Behavioral Engagement Related to Instruction (BERI) protocol and Brown and Ryan (2003) Mindful Attention Awareness Scale (MAAS) - (Cronbach alpha = 0.90). The second instrument is a full adoption of Kwon, Kin, Cho and Yang (2013) Smartphone Addiction Scale-Short Version (SAS-SV), which has a reported Cronbach alpha reliability coefficient of 0.911.

Basically, the DICIQ-MES is a 16-item questionnaire structured on a 6-point Likert-type scale with Almost Never = 1, Very Infrequently = 2, Somewhat Infrequently = 3, Somewhat Frequently = 4, Very Frequently = 5, and Almost Always = 6. Items covered aspects of inattentive behavior in the class such as settling in and packing up, unresponsiveness, off-task distractions, disengaged computer use, disengaged student interaction and student-student distraction. Higher scores on the DICIQ-MES indicate higher level of dispositional inattentiveness, the benchmark for decision being a mean score of 3.50. The SAS-SV also employs a six-point Likert-type scale ranging from Strongly Disagree = 1 to Strongly Agree = 6. Higher scores in the SAS-SV indicate higher level of smartphone addiction, with benchmark for decision being a mean score of 3.50. Both instruments were administered to each respondent at the same time.

Mean and standard deviation differences were used to answer the first four research questions. The fifth research question was answered using Pearson Product Moment Correlation Coefficient. The first two hypotheses were tested using t-test, while the third hypothesis was tested using the paired t-test of significance of correlation, all at 0.05 level of significance.

Results and Discussion

The results of this study are presented according to the research questions and hypotheses.

Research question one: What is the level of inattentiveness among mathematics education students in Nigeria? This research question is answered with data in Table 1.

Table 1: Level of Dispositional In–class Inattentiveness

S/No.	Items	Mean	SD	Remark
1	I tend to leave the class before the end of mathematics lectures.	1.533	1.119	VI
2	I hardly answer questions in mathematics class.	2.810	1.830	SI
3	I chat on Whatsapp, Facebook, and other social networks during mathematics lectures.	1.571	1.151	VI
4	I tend to ransack and unpack my school bag, purse and books even when a mathematics class is going on.	1.495	0.992	AN
5	I am fond of working on another assignment during mathematics lectures.	1.666	1.190	VI
6	I tend to show stuff on phone to other students during mathematics classes.	1.610	1.070	VI
7	I don't like taking notes during mathematics lectures.	1.619	1.281	VI
8	I send text messages on my phone during mathematics lectures.	1.391	0.791	AN
9	I don't like participating in mathematics class discussion.	2.229	1.683	VI
10	I tend to get busy downloading materials on my smartphone while in mathematics lectures.	1.486	1.048	AN
11	I tend to discuss other things with classmates during mathematics lectures.	1.762	1.205	VI
12	I play with my phones during mathematics lectures.	1.657	1.183	VI
13	I doss (sleep) off during mathematics lectures.	1.714	1.063	VI
14	I browse the internet on my phone during mathematics lectures	1.705	1.430	VI
15	I listen to music while in mathematics lectures	1.295	0.898	AN
16	I am fond of reading non-class related materials while mathematics lecture is ongoing.	0.008	0.731	AN
	Grand Mean	**1.597**		

Key: Almost Never (AN) ≅ 1; Very Infrequently (VI) ≅ 2; Somewhat Infrequently (SI) ≅ 3; Somewhat Frequently (SF) ≅ 4; Very Frequently (VF) ≅ 5; Almost Always (AA) ≅ 6.

The results in Table 1 indicate low levels of dispositional in-class inattentiveness across all items. The grand mean of 1.597 is lower than the benchmark of 3.50, implying that the level of inattentiveness among mathematics education students in Nigeria is low

Research question two: What is the level of smartphone addiction among mathematics education students in Nigeria? This research question is answered with results in Table 2.

Table 2: Level of Smartphone Addiction among Mathematics Education Students in Nigeria

S/No.	Items	Mean	SD	Remark
1	I often miss out planned work due to smartphone use.	2.343	1.413	Disagree
2	I have a hard time concentrating in class, while doing assignments, or while working due to smartphone use.	2.495	1.612	Disagree
3	I feel pain in the wrists or at the back of the neck while using a smartphone.	2.600	1.523	Somewhat Disagree
4	I won't be able to stand (can't bear) not having a smartphone.	2.600	1.656	Somewhat Disagree
5	I feel impatient and fretful when I am not holding my smartphone.	2.295	1.434	Disagree
6	I have my smartphone in my mind even when I am not using it.	2.429	1.506	Disagree
7	I will never give up using my smartphone even when my daily life is already greatly affected by it.	2.181	1.413	Disagree
8	I often use my smartphone longer than I had intended.	2.810	1.563	Somewhat Disagree
9	The people around me tell me that I use my smartphone too much	2.550	1.481	Somewhat Disagree
10	I constantly check my smartphone so as not to miss conversation notification from friends on Whatsapp, Facebook, Twitter, and other social networks.	3.391	1.848	Somewhat Agree
	Grand	**2.569**		

The results in Table 2 point to a low level of smartphone addiction, particularly across nine (9) items out of the ten (10) items of the SAS–SV. The grand mean of 2.569 is lower than the benchmark of 3.50, indicating a low level of smartphone addiction among mathematics education students in Nigeria. However, the students somewhat agree that they constantly check their smartphone so as not to miss conversation notifications from friends on Whatsapp, Facebook, Twitter, and other social networking platforms.

Research question three:
Which gender is more affected by inattentiveness among mathematics education students in Nigeria? Results in Table 3 answer this research question.

Table 3: Comparison of Dispositional In–class Inattentiveness among Male and Female Mathematics Education Students

Gender	N	Mean DICIQ–MES Score	Standard Deviation
Male	85	26.918	10.774
Female	20	22.600	5.789

As shown in Table 3, male mathematics education students scored higher than their female counterparts on the DICIQ–MES. This outcome indicates that the male gender is more affected by in-class inattentiveness among mathematics education students in Nigeria.

Research question four:
Which gender is more affected by smartphone addiction among mathematics education students in Nigeria? This research question is answered with results in Table 4.

Table 4: Comparison of Smartphone Addiction among Male and Female Mathematics Education Students

Gender	N	Mean SAS–SV Score	Standard Deviation
Male	85	25.576	9.787
Female	20	23.700	7.535

The results displayed in Table 4 indicate that male mathematics education students scored higher on the SAS–SV than female mathematics education students. This implies that the male gender is more affected by smartphone addiction among mathematics education students in Nigeria.

Research question five:
What is the relationship between level of inattentiveness and level of smartphone addiction among mathematics education students in Nigeria? Table 5 contains results that answer this research question.

Table 5: Correlation between Level of Inattentiveness and Smartphone Addiction among Mathematics Education Students

Variable	N	r
Inattentiveness	105	0.366
Smartphone addiction	105	

The result in Table 5 indicates that there is a weak positive relationship between the level of inattentiveness and level of smartphone addiction among mathematics education students in Nigeria.

Hypothesis one: There is no significant difference in the level of inattentiveness between male and female mathematics education students in Nigeria. Results of test of this hypothesis are found in Table 6.

Table 6: t–test Analysis of DICIQ–MES Scores of Male and Female Mathematics Education Students

Gender	N	Mean	Standard Deviation	T	t–critical	p–value
Male	85	26.918	10.774	1.730	1.983	0.0866
Female	20	22.600	5.789			

$\alpha = 0.05$

The results of the t–test analysis displayed in Table 6 indicate that the difference in the mean DICIQ–MES scores of male and female mathematics education students is not significant, with the p–value of 0.0866 greater than the stated (0.05) level of significance.

Hypothesis two: There is no significant difference in the level of smartphone addiction between male and female mathematics education students in Nigeria. Results of test of this hypothesis are contained in Table 7.

Table 7: t–test Analysis of SAS–SV Scores of Male and Female Mathematics Education Students

Gender	N	Mean	Standard Deviation	t	t–critical	p–value
Male	85	25.576	9.787	0.802	1.983	0.4243
Female	20	23.700	7.533			

α = 0.05

As shown in Table 7, the p–value of 0.4243 is greater than the stated level of significance (0.05), implying that the difference between the levels of smartphone addiction of male and female mathematics education students in Nigeria is not statistically significant.

Hypothesis three: There is no significant relationship between level of inattentiveness and level of smartphone addiction among mathematics education students in Nigeria.

Table 8: Paired t–test of Significance of Correlation between Inattentiveness and Smartphone Addiction

Variable	N	r	p–value
Inattentiveness	105	0.366	0.0001
Smartphone addiction	105		

α = 0.05

The results displayed in Table 8 indicate Pearson Product Moment Correlation Coefficient (r) of 0.366, which is significant (p = 0.0001) at 0.05 level of significance. This outcome established a positive relationship between dispositional in-class inattentiveness and smartphone addiction among mathematics education students in Nigeria.

The findings of this study have thrown new light on the status of inattentiveness and smartphone addiction among mathematics education students in Nigeria. The results from Table 1 point to a considerably low level of dispositional in-class inattentiveness (grand mean = 1.597) among mathematics education students in Nigeria. Likewise, Table 2 indicates that there is a moderately low level of smartphone addiction (grand mean = 2.569) among mathematics education students in Nigeria. The respondents also accepted that they constantly check their smartphones for social media notifications while in class.

Despite the levels of dispositional in-class inattentiveness and smartphone addiction among mathematics education students in Nigeria, the paired t-test of significance of correlation presented in Table 8 established a significant positive correlation between inattentiveness and smartphone addiction among the subjects of this study. This finding is in tandem with that of McCoy (2013) who found that continuous engagement with digital devices caused students to pay less attention and miss instruction. Similarly, Ayodele, Mosunmola, Senamu, Gbenga and Aderonke (2015) connects attention deficit in students to increase in amount of time spent on online social networking services. This outcome is attested to particularly, by mathematics education students' acceptance of item 10 of the SAS-SV used in this study.

With respect to gender, this study found no significant difference in the levels of inattentiveness and smartphone addiction, even though male mathematics education students scored higher in both variables. This finding is in agreement with the outcome of Piaw (2014) who observed that male students possessed lower attention levels (high levels of inattentiveness) as compared to the female. The variation in levels of smartphone addiction among male and female mathematics education students observed in this study (Table 4) is also in line with the findings of Roberts, Yaya and Manolis (2014) who reported that cell phone addiction vary considerably among male and female cell-phone users. In the same vein, Al-Barashdi, Bouazza, Jabar and Zubaidi (2015) found that male University

students are addicted to their smartphones than females. This variation which favour male mathematics education students over their female counterparts however, is in conflict with the observations of Derla (2016) who opined that compared to men, women spend more time on their Smartphones, and are more likely to get addicted to the gadget than men.

Conclusion

This study has attempted to determine the level of attention management and smartphone addiction among mathematics education students in Nigeria. Outcomes of the survey established low levels of inattentiveness and smartphone addiction among the students, indicating that despite intense technological penetration in Nigerian higher education, learners still maintain their focus in achieving desired educational goals. Despite these overall outcomes, the study specifically observed that students often check their smartphones for notifications from social media, email and SMS, irrespective of where they are.

Recommendations

Based on the findings of this study, the following recommendations are put forward.

1. Students of mathematics education should fine-tune personal strategies of being focused in their academic work and other life endeavours.
2. Attention management is gradually becoming one of the most important skills for learners to master in the 21st Century. Mathematics educators and parents should teach today's students how to manage and direct their attention to support them to become successful learners.

Suggestions for Further Study

Despite the robustness of this study, it is limited by the size of the sample. A further study might want to expand the scope of this work to include samples from universities across the six geopolitical zones of Nigeria. Also, an in-depth study from Nigeria is required to correlate inattentiveness and smartphone addiction to students' academic achievement in terms of their cumulative grade point average (CGPA).

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