

Does smartphone connectivity impact on undergraduate dental students' environmental stress?



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Khan, S.¹

ABSTRACT

Introduction

Several studies have suggested that smartphone addiction has negative effects on mental health and academic performance and may contribute to the development of stress.

Aim

To determine the prevalence of smartphone addiction and its impact on stress levels of students registered for the degree BChD in 2017 at the University of the Western Cape.

Objectives

To establish the impact of smartphone addiction and associated stress levels on student performance.

Methods

A cross-sectional descriptive study with a convenience sample of dental students, based on a self-administered closed-ended questionnaire: "Dental Environment Stress and Smartphone Addiction Scale". The responses were statistically analysed.

Results

Ethical clearance was obtained for the study. The Mann-Whitney test output indicates no difference in attachment between smartphone and non-smartphone owners ($p=0.615$). Students agreed that mobile devices could be used for academic purposes but not that this usage be made compulsory.

Conclusion

More stress is experienced in certain domains and students displayed some degree of attachment, not addiction, to their smartphones. Serious impacts may be experienced by non-smartphone owners.

INTRODUCTION

Mobile devices keep us connected to the world, even though some may question the quality of this connection.¹ Cell phones, smartphones, tablets and computers must be appreciated as useful. They are a necessary addition to our tools of communication, having multiple functionalities which extend to application within the academic environment.² In that scenario it is not just about the communication between students and staff, but notes may be downloaded and assessments conducted via these devices. Indeed, the acquisition of these very expensive IT units may become compulsory when they are required for assessments. Cell phones may then be seen as an asset in the lives of young people and their day-to-day activities, including

ACRONYMS

DES: dental environmental stress

SEB: Self-efficacy and Beliefs

FA: Faculty and Administration

W: Workload

PT: Patient Treatment

CT: Clinical Training

PP: Performance Pressure

SS: Social Stressors

academe.³ However, the insistent demands and the consistent presence of these devices may exacerbate the already stressed dental environment experienced by students.⁴⁻⁵ An added stress occurs when acquiring and then maintaining these expensive technological devices. Paradoxically, the use of cell phones was expected to have reduced the stress in the first place.

Stress is defined simply as a reaction to a stimulus that disturbs our physical or mental equilibrium and it is generally part of life.⁶ It is when the stressors become chronic, that there may be detrimental effects on the health and quality of life of individuals.^{1,7} Difficulties may be experienced in controlling these stressors when mobile devices are used.¹ Consider the tensions involved, for example: keeping up with happenings via social media, wanting to create a social media persona, lack of privacy in social media, just being connected or separation anxiety when without a phone.¹⁻² Moreover, several destructive behavioural characteristics have also been observed in the lives of young individuals with constant exposure to these devices, namely; phone-addiction, sleep deprivation, poor academic performance and increased stress development.^{1-3,7}

Stress-related research amongst dental students has been conducted globally.^{1-3,7-15} Several studies related to stress experienced by dental students have been conducted over the years at the University of the Western Cape (UWC).^{4,8,16} The researchers explored different aspects that could cause stress and/or increase the stress levels of students. The cohorts that were included had very different demographic features, for example:^{4,8,16}

1. Hendricks, Joshi, Crombie and Moola (1994) determined the "perceived sources of stress among black dental students in South Africa (SA) prior to the democratic elections.¹⁶ This study, conducted more than 20 years ago, reported that non-academic (cultural and ethnic differences) rather than academic problems added more to students' stress levels.¹⁶
2. Naidoo et al. (2008) and Pau et al. (2009) determined the "emotional intelligence and its relation to perceived stress"

1. Dr Saadika Khan BChD; PDD (Clin Dent); MSc (Dent); PhD (Comm Health). Senior Lecturer/ Principal Dentist, University of the Western Cape, Private Bag X01, Tygerberg, 7505 Correspondence: Tel: 021 9373006 Fax: 021 9312287 E-Mail: skhan@uwc.ac.za

by conducting a multinational survey across seven different countries (including RSA) which also included a qualitative study amongst English students.⁸⁻⁹ Differences in stress levels between countries and institutions were found as also reported in another study (Alzahem et al., 2011).⁸⁻¹⁰ The differences highlighted were age, gender, educational background and satisfaction with career choices.⁸⁻⁹ A significant inverse relationship between emotional intelligence and perceived stress was detected, implying that students can indeed cope with the stressful demands of this career choice. More so, that emotional intelligence is important in professional competence, and thus has a key role in the selection of students to study Dentistry.⁸⁻⁹

3. Amongst the students of 2010, Wilson et al. (2015) determined their environmental stress levels and risk of burnout as these could contribute to a decrease in efficiency.⁴ This particular study found that dental stressors increase and reach a peak as students progress to their clinical years. The conclusions were that high levels of perceived stress in the particular academic environment subsequently resulted in psychological morbidity and emotional exhaustion among dental students,⁴ possibly predisposing them to professional burnout and decreased productivity.¹⁴

Students in different dental environments have experienced an increase in stress levels with differing factors (both academic and non-academic) contributing to the problem.^{4,8,9,16}

Within RSA, the protest actions that took place in the 2015 and 2016 academic years certainly added another dimension to the stress levels of students, impacting on their studies which could not proceed in an academically conducive environment. At such times of restricted contact, smartphones and computers may be expected to aid and assist communication and to improve accessibility. However, an already stressful setting may be further exacerbated if accessibility is affected, for whatever reason.

Smartphone use may serve as an aid or may impact as a non-academic stressor; its effects and impact on the lives of the UWC dental students have not yet been determined.

AIM

To determine the prevalence and addiction to smartphone use and to assess its impact on the stress levels of students registered for the degree BChD in 2017.

OBJECTIVES

To determine

1. the prevalence of stress resulting from the current dental environment among dental students attending the UWC Faculty of Dentistry.
2. the prevalence of smartphone addiction among the dental students.
3. the correlations between stress levels, current protest actions and the use of smartphones and its impact on students' learning across the different study levels at UWC's Faculty of Dentistry.

Null Hypotheses

1. Stress levels do not differ amongst currently registered dental students from different ethnic or cultural backgrounds, genders and study levels.
2. Students are not addicted to smartphones and their use does not increase their stress levels

Materials and Methods

A cross-sectional descriptive study with a convenience sample including undergraduate dental students registered for 2017 was conducted over a period of three months at the Faculty of Dentistry, UWC, SA. Data was obtained using two self-administered, closed-ended questionnaires:

1. A dental environmental stress (DES) questionnaire which was adapted from a previous study.⁵ It was also modified for RSA and translated to the medium of communication. The

first questionnaire focussed on determining the stress levels of all dental students registered for 2017. The DES questions related to stress are categorized into seven main domains:⁵

- Self-efficacy and Beliefs (SEB),
 - Faculty and Administration (FA),
 - Workload (W),
 - Patient Treatment (PT),
 - Clinical Training (CT),
 - Performance Pressure (PP) and
 - Social Stressors (SS).
2. A Smartphone Addiction Scale to determine the dependence of students on their smartphones and the impact on their stress levels and learning.¹⁷

The second questionnaire focused on the technological devices, such as smartphones (including cell phones), which are required by students and their addiction to that technology.¹⁷ The questionnaire was a validated and shortened version of the Smartphone Addiction Scale (SAS-SV) which has been tested for reliability.¹⁷

Additional questions were related to any protest actions (PA) which had been experienced by students previously. The answers were analysed to correlate the impact on the stress levels of participants. Specially designed questionnaire forms were distributed to the registered undergraduate dental students after information had been provided and their consent obtained to participate in the study. Responses from questionnaires were recorded using 4-point Likert scales: Not Applicable, No Stress, Moderate Stress, Severe Stress and Strongly Agree, Agree, Disagree or Strongly Disagree respectively.^{5,17} These responses were combined as described by Al-Sowaygh and by Kwm et al. to produce indices of stress and of addiction.^{5,17}

Basic student demographic data were also obtained from questionnaires. Statistical analysis included descriptive statistics (frequency distributions, mean and standard deviation calculations) and appropriate non-parametric tests for association between domains and other variables (e.g. Wilcoxon Rank Sum, Kruskal-Wallis and Mann-Whitney U tests). Regression analysis were executed according to the purpose(s) of the study.¹⁸

RESULTS

Ethical clearance was obtained from the UWC Ethics Committee (Registration Number: 13/7/16). All participants signed a consent form according to the Declaration of Helsinki before participating in the study.¹⁹

Demographic Data

The response rates for the different classes by year were relatively consistent at about 90%, except for Class 5 where the rate dropped to 53%. For this reason, a weighting was applied to each student to correct this deviation from the population class proportions which were used with all calculations. The weightings are calculated as population proportion/sample proportion as shown in Table 1.

Students' responses related to the DES questions indicated that stress was experienced in the SEB, W and PP domains as well as in those areas related to protest actions (PA) (Table 2).

Results from a Wilcoxon signed rank test clearly showed a significant bias towards females who experienced a greater prevalence of stress than their male counterparts ($p=0.0000$). A Mann-Whitney U test was also conducted, using the weighted average stress indices of males against females in all domains. The results showed extreme significance in all except the SS domain, which showed no gender difference (Table 3 and 4; Figure 2).

With regards to differences in stress levels between classes, it was no surprise (as in previous studies) that the fourth year class displayed positive levels of stress in the overall and average index (Table 4).⁴ The fifth year students experienced much stress in the

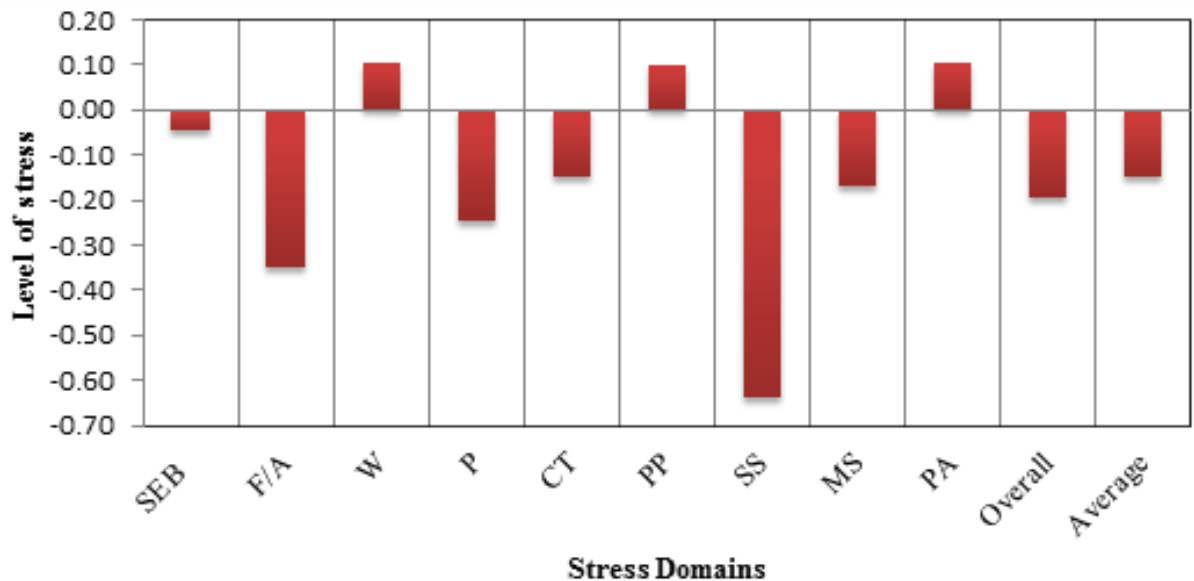
Table 1: Weight calculations per class.

	Class Population	Population proportion	Sample per Class	Class Sample proportion	Weights per Class
Class 1	96	0.22	83	0.24	0.94
Class 2	89	0.21	79	0.23	0.92
Class 3	83	0.19	76	0.22	0.89
Class 4	79	0.18	68	0.19	0.95
Class 5	81	0.19	43	0.12	1.54
Total	428	1	349	1	

Table 2: Average response to certain stress questions.

Stress Questions	A5	A10	A11	A13	A28	A31	A34	C9	C11	C13
Average	0.03	0.43	0.50	0.59	0.17	0.07	0.39	0.42	0.06	0.40
Weighted Average	0.08	0.43	0.50	0.60	0.17	0.07	0.41	0.42	0.12	0.40

Key
 A 5: Clinical requirements
 A10: Examinations and Quizzes
 A11: Fear of being unable to catch up if lagging behind
 A13: Fear of failing course or year
 A28: Lack of time to do assigned work
 A31: Marital adjustment problems
 A34: Patients late or not showing for appointments
 C 9: Effects of protest actions
 C11: Impact of protests action on clinical work
 C13: Effect of protest action on my learning at University



KEY:
 SEB: Self-Efficacy Beliefs
 F/A: Faculty and Administration
 W: Workload
 P: Patient Treatment
 CT: Clinical Training
 PP: Performance pressure
 SS: Social Stressors
 MS: Mobile Stressors
 PA: Protest Action

Figure 1: Weighted average of stress indices

PA domain (having been exposed to protests in both 2015 and 2016), whereas the third year class experienced greater stress in the W and PP domains than did the fifth years. The differences in stress levels across classes were found to be significant ($p=0.000$) from the results of the non-parametric Kruskal-Wallis tests for most domains except the SS and SEB domains.

SMARTPHONE DATA

Most students owned either a cell phone (35.8%) and/or a smartphone (92.2%); a Mann-Whitney U test output indicates no difference in attachment between smartphone and non-smartphone owners ($p=0.615$). Only five students had no smartphone, tablet or computer but this does not imply they

Indices	Rank Sum Female	Rank Sum Male	U	Z	p-value
SEB stress index	46850.00	14225.00	8869.00	4.419742	0.000010
F/A stress index	46090.50	14984.50	9628.50	3.536259	0.000406
W stress index	46600.00	14475.00	9119.00	4.128931	0.000036
P stress index	45522.50	15552.50	10196.50	2.875537	0.004034
CT stress index	46809.50	14265.50	8909.50	4.372630	0.000012
PP stress index	45566.50	15508.50	10152.50	2.926719	0.003426
SS stress index	43303.50	17771.50	12415.50	0.294300	0.768529
MS stress index	45214.00	15861.00	10505.00	2.516676	0.011847
PE stress index	46103.00	14972.00	9616.00	3.550799	0.000384
Overall stress index	47082.50	13992.50	8636.50	4.690196	0.000003
Average stress index	47324.00	13751.00	8395.00	4.971119	0.000001

KEY:

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- W: Workload
- P: Patient Treatment
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Table 3: Mann Whitney U test output for difference between genders in each index.

Table 4: An overall view of average stress prevalence across gender, class and domain

An overall view of average stress prevalence across gender, class and domain	SEB	F/A	W	P	CT	PP	SS	MS	PA
Ave for first year males	-0.18	-0.65	-0.11	-0.68	-0.63	-0.17	-0.67	-0.25	-0.45
Ave for second year males	-0.17	-0.65	-0.07	-0.61	-0.61	0.04	-0.57	-0.30	-0.29
Ave for third year males	-0.16	-0.35	-0.04	-0.14	-0.10	0.02	-0.71	-0.35	0.26
Ave for fourth year males	-0.11	-0.20	0.05	-0.23	-0.05	0.18	-0.50	-0.15	0.26
Ave for fifth year males	-0.33	-0.40	0.14	0.03	-0.33	-0.20	-0.68	-0.45	0.10
Ave for first year females	0.00	-0.61	0.12	-0.51	-0.50	-0.18	-0.67	-0.13	-0.25
Ave for second year females	-0.01	-0.57	0.05	-0.54	-0.53	0.02	-0.64	-0.05	0.00
Ave for third year females	0.00	-0.19	0.20	-0.08	0.23	0.29	-0.64	-0.21	0.22
Ave for fourth year females	0.11	0.07	0.33	0.14	0.32	0.38	-0.57	-0.02	0.48
Ave for fifth year females	-0.01	-0.15	0.10	0.05	0.25	0.27	-0.68	-0.17	0.48

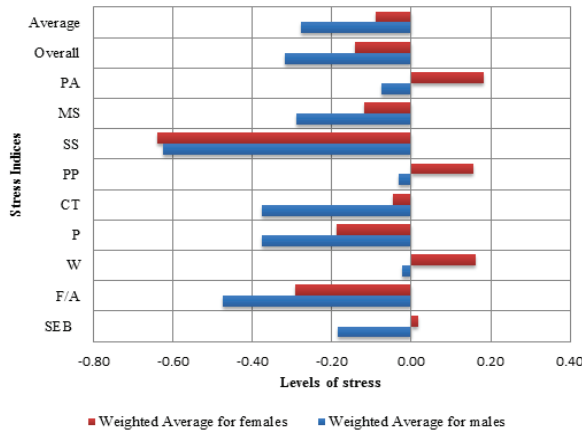
Key
 SEB: Self-Efficacy Beliefs
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had no access to these devices for academic purposes. Gender differences were again observed across questions (similar to the results of stress prevalence), but the Mann-Whitney U results indicated females displayed significant levels of agreement for questions related to 'missing work' (p=0.024), 'cannot not stand not having phone' (p=0.0001) and 'having phone on my mind' (p=0.009) (Table 5).

Students' responses related to addiction are significantly in agreement only with questions referring to 'cannot stand not

having phones' and 'using phones longer than intended', yet they don't perceive themselves to be addicted.

Responses from students indicated agreement (66.5%) of 'being attached to phones' and of experiencing stress (95.7%) 'when losing phones. Students mostly agreed that mobile devices could be used for academic purposes (73.9%) but not that this should be made compulsory (40%); though this is not the major cause of their stress. Students' responses indicated they would be stressed (78.7%) when compulsory assessments are conducted using this



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Figure 2: Weighted average of stress indices male vs female

medium. Generally, results thus indicate students experience addiction symptoms such as ownership, attachment and usage for certain tasks. But, students disagree that they experience any additional signs of addiction such as fretfulness, constant checking and concentration problems.

to smartphones, though not explicit addiction. Significant correlations were observed between DES domains of W, PP, SS, overall and average indices and smartphone addiction questions of 'cannot stand not having phones' and 'not give up using phone even if daily life affected' as well as being 'attached to phones.'

The regression analysis for each index significantly contributing to the prevalence of stress provided results as follows:

- a. **Self-Efficacy Beliefs (SEB) stress index**
The overall stress average was negative, but for questions related to 'fear of unable to catch up' and 'fear of failure' the results indicated high average responses to stress. Correlations with these questions are significantly related to 'compulsory use of mobile devices.' That implies that students who experienced stress when the use of mobile devices become compulsory had a higher SEB stress index. The 'fear of failure' with a new medium or increased rate of failure due to increased difficulties might provide some related explanations.
- b. **Workload (W) stress index**
Overall stress averages were positive for this domain, and the type of stress is related to gender, class, 'cannot stand not having phone' and if 'phones are used for academic work.'
- c. **Performance Pressure (PP) stress index**
PP stress is significantly related to gender, class (females in the senior classes) and 'using phone too much.' The students who experience greater stress in the PP domain are those who admitted 'using their phone longer than intended.'
- d. **Protest Action (PA) stress index**
Stress prevalence was the highest for this domain and it was significantly related to gender, class and smartphone ownership. As has previously been indicated, senior female students and those who do not own a smartphone displayed a higher stress index in the PA domain. The reasons for these responses could be varied; owners could view the situation regarding protests at any time or find distractions on their smartphones or they may be concerned at not being able to do assessments via this medium.

Table 5: Average levels of agreement to Smartphone Addiction Scale questions

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Average	-0.06	-0.36	-1.39	0.66	-0.91	-1.15	-0.84	-0.87	1.15	-1.12
Weighted Average	-0.12	-0.38	-1.42	0.62	-0.93	-1.18	-0.84	-0.94	1.10	-1.18
Ave for males	-0.45	-0.43	-1.35	-0.02	-1.20	-1.48	-0.96	-1.01	0.81	-1.32
Weighted Ave for males	-0.52	-0.46	-1.38	0.00	-1.22	-1.49	-0.96	-1.06	0.70	-1.37
Ave for females	0.10	-0.33	-1.41	0.94	-0.79	-1.01	-0.79	-0.81	1.29	-1.04
Weighted Ave for females	0.04	-0.35	-1.45	0.88	-0.82	-1.05	-0.80	-0.88	1.26	-1.10
Average for first year	0.01	-0.57	-1.35	0.18	-1.14	-1.29	-1.23	-0.89	1.00	-1.31
Average for second year	0.65	0.22	-1.14	0.95	-0.57	-0.71	-0.70	-0.71	1.56	-0.77
Average for third year	-0.22	-0.46	-1.33	0.86	-0.96	-1.26	-0.92	-0.92	1.28	-1.00
Average for fourth year	-0.26	-0.49	-1.53	0.96	-0.78	-1.04	-0.41	-0.40	1.09	-0.97
Average for fifth year	-0.88	-0.65	-1.84	0.23	-1.23	-1.63	-0.91	-1.77	0.53	-1.86

Key

- B1: Missing planned work due to smartphone use
- B2: Smartphone use affecting concentration in class
- B3: Physical bodily pains due to smartphone use
- B4: Cannot stand not having smartphone
- B5: Feeling impatient and fretful when not holding smartphone
- B6: Smartphone on my mind even when not using it
- B7: Will not give up smartphone use even if daily life affected
- B8: Constantly checking phone to know what's happening on social media
- B9: Using smartphone longer than intended
- B10: People around me say I use my phone too much

CORRELATION BETWEEN STRESS LEVELS AND SMARTPHONE ADDICTION

Comparing the results from both questionnaires, students indicated an increase in stress mostly across the SEB, W, PP and PA domains and they also agreed to a level of attachment

DISCUSSION

It is accepted that that smartphones are an indispensable and necessary tool used especially for connecting and communicating between people, in addition to the many other services provided.

Research has also shown that dental students experience stress throughout their career, and that an increase in stress levels is observed amongst senior females in their clinical years.^{1,4,8-10} The current study is in agreement with these findings. Exploring different conditions affecting student learning such as emotional intelligence, cultural differences, burnout, disruptions within the academic setting such as protests and the impact of smartphone use (either social or compulsory academic) will allow researchers to understand their learning needs more comprehensively.^{1,4,8-10}

The benefits of smartphones have been established, including their use in the academic setting as an alternate or additional aid in perusing reading material and in conducting assessments. The role of smartphones in creating anxiety, especially with regards to attachment to the device, lack of privacy, affecting their daily lives and academic performance has also been documented.^{1-3,7} The current study records the advantage of smartphone use for academic purposes and the disadvantage of attachment further exacerbating student stress levels. However, no significant addiction to smartphones was disclosed, and thus any destructive behaviour as referred to in other studies are not anticipated with this cohort of students.^{1-3,7}

The interest in using smartphones for academic purposes must be explored further as these could be of major benefit especially during times of disruptions, for assessments may be conducted online. However, as the results indicated that more stress was experienced by non-smartphone owners, it would be prudent to engage students on this issue before any demand for the use of the devices became compulsory. Smartphones and maintaining them is a costly matter, thus these discussions must take place between students and the institution before finality is reached.

The other related issue of concern would be the role of educators who will need to explore varied assessment options when conducting these via smartphones or online. Senior students may be relieved somewhat if theoretical assessments are conducted via this medium, but being aware that clinical work quotas may not be completed may still be a source of major stress for them, especially during periods of disruptions as previously experienced.

CONCLUSION

More stress is experienced in certain domains related to work, performance and failure; both internal (ability to cope with work) or external (protests) factors may negatively influence these domains. There is some degree of attachment by students to their smartphones, though significant addiction has not been explicitly proven; however, nor can it be concluded that students are not addicted to smartphone use. Serious impact may be expected should compulsory use be implanted for both non-smartphone owners and educators, though this aspect was not researched.

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