Smartphone usage pattern for science teachers: The case of Zimbabwe

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***Abstract*: Smartphones are new generation educational tools usable by science teachers for both socialization and communication, and academic use. Concern is however on how such devices are used by the teachers who are central to curriculum implementation. The study was therefore carried out to establish the characteristics of science teachers' interactions with their devices (usage patterns) in Zimbabwe. The User Gratification Theory guided the descriptive survey design from a quantitative research approach that was employed in collecting and analyzing data, collected through the Kobo Toolbox online survey application. The findings show that smartphone use is more popular for socialization and communication than for academic purposes and the usage patterns vary with age. Late career science teachers use smartphones mainly for socialization and communication while accessing social media and leisure material are very popular with the early career science teachers. Smartphones are also popular as 'pocket libraries' for early career science teachers while reading news is popular with the late career science teachers.**

***Key words*: Usage pattern, smartphone, pocket library, curriculum implementation**

I. INTRODUCTION

Mobile devices are a new generation of educational tools that can afford users the convenience, creativity and instant access to a wealth of resources with a great potential of transforming learning (Dias & Victor, 2017). The world over, smartphones are the most popular mobile devices that have incredulously become an indispensable part of communication in the 21st century and people spend considerable time interacting with their devices (Bicen and Kocakoyun 2013; Hintze et al. 2014). Concern is, however on characteristics of users' interactions with their devices (usage patterns), particularly by teachers who Alsubaie (2016) identified as central to any curriculum development effort.

Smartphone use and hence usage patterns within a school environment can be broadly categorized into two namely: socialization and communication, and academic purposes. Available literature shows that research on smartphone usage patterns is concentrated on learners whose main smartphone use falls under the socialization and communication category. Mwambakulu and Chikumba (2020) carried out a study on learners' smartphones usage patterns. They found that social networking dominated the pattern and that smartphone use was motivated by internet access, social media and communication, all accessible on the smartphone. A similar study by Sharma *et al.* (2019) yielded the same results that social networking dominates learners' smartphone usage pattern. On the other hand, literature on science teachers' smartphone use is limited and is concentrated on academic use only. Researchers such as Iqbal and Bhatti (2020) concentrated their studies on smartphone usage patterns for teaching and learning without exploring socialization and communication usage patterns. A similar study by Tami (2016) also studied patterns of mobile technology use in teaching, without considering the socialization and communication component of the usage pattern. A grey area therefore exists on science teachers' smartphone usage patterns where both socialization and communication, and academic use are simultaneously considered. The study was therefore carried out, aimed at addressing the grey area by establishing a comprehensive smartphone usage pattern for Zimbabwean science teachers. Two very important questions will be answered: (1) Between work related and unrelated activities, how do science teachers distribute their screen time? (2) How does smartphone use vary with age?

Theoretical framework: The Uses and Gratifications Theory (UGT)

To fully explore issues pertaining to the study in great depth, the work was founded on a comprehensive framework derived from the theory of Uses and Gratifications Theory (UGT). The UGT was preferred to guide the study over other theoretical frameworks that see users as passive, and not active, agents who have no control over their preferred media consumption. The UGT acknowledges that individuals use, with reasons, their preferred choice of media motivated by the need to gratify their own specific wants and needs. Although the UGT is often credited to Jay Blumler and Elihu Katz's work in 1974, its origins date back to the 1940s when scholars introduced it to study why people choose to consume various forms of media. According to Balakrishnan and Raj (2012) in Mwambakulu and Chikumba (2020), the UGT in relation to smartphone use is premised on four concepts that also agree with this study:

- Reasons for using smartphones: socialization and communication, and academic use as well as privacy among other factors.
- Smartphone usage pattern: usage frequency and type of accessed media.
- Behavior related issues: attention given to the smartphone against work or social interaction

- Purchasing factors: related to airtime, price and brand of smartphone, trends and usability.

Figure 1 is a schematic diagram showing how the concepts were used to explore issues pertaining to the study as guided by the UGT.

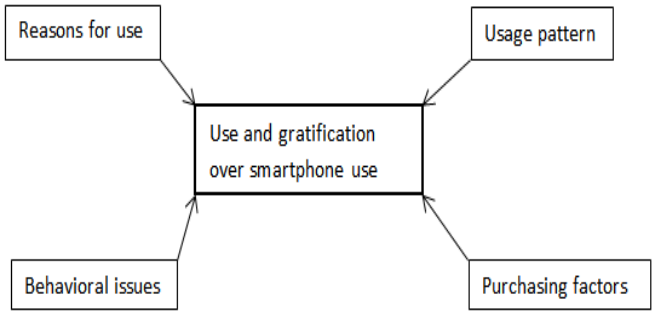

Figure 1: Theoretical framework for the study

According to the four UGT concepts summarized in Figure 1, the teacher's use and gratification over his/her use of the device is explained in terms of: reasons for use, usage pattern, behavioral issues and purchasing factors. The study therefore seeks to explore science teachers' smartphone usage patterns guided by the UGT concepts as: depending on the teacher's own wants and needs, s/he chooses a price and smartphone brand guided by market trends, his/her buying power and gadget usability. Reasons for use of the device thereafter depends on individual wants and needs where attention given to the smartphone against work or other attention seeking factors like social interaction, are behavioral issues that therefore defines the actual usage pattern that the study seeks to establish.

II. METHODOLOGY

A descriptive survey design from a quantitative research approach was adopted in collecting and analyzing data for this study. The approach was preferred due to its robustness in handling statistical data where the aim is to identify characteristics, frequencies, trends, and categories as was the case in this study. Data was obtained through online questionnaires that were distributed to secondary school science teachers through the Kobo Toolbox online survey application. This allowed for a wider spectrum of respondents from across the country to be reached, and also to minimize the risk of transmitting Covid-19 that is known to spread mainly between people who are in close contact (Bazant and Bush 2021), common with interviews and paper based questionnaires. A link to the online questionnaire was optimized for use on mobile phone, and ease of random distribution through online platforms such as e-mail, Whatsapp, Twitter and Facebook that are common with the TCDP candidates. The Teacher Capacity Development Program (TCDP) candidates are in-service teachers, drawn from different schools across Zimbabwe, who are currently upgrading their professional teaching diplomas to honours degrees at Bindura University of Science Education. A total of 20 TCDP candidates were chosen to initiate the snowball sampling exercise that was employed to access many subjects under the Covid-19 induced travel restrictions. Since candidates for the TCDP program are drawn from across the country, using them to initiate the snowballing exercise optimized spread of the questionnaire to various communities in the country, thereby giving researchers a rich insight into Zimbabwe's smartphone usage patterns for science teachers.

The questionnaire was designed with open-ended questions guided by the four UGT concepts in Figure 1. Reasons for using smartphones were grouped as: socialization and communication, and academic use. Basically, socialization and communication comprised of social networking (e.g Whatsapp, Facebook and Twitter use), reading news (current affairs) as well as playing games. On the other hand, academic use comprised of teaching (as an instructional interface device as well as accessing teaching aids) and career advancement (accessing subject content for self-capacitation for promotion purposes and change of career path). Respondents were then supposed to pick on the use, in which case users could pick on multiple uses depending on how they use the devices. In terms of behavioral issues, they were assumed to vary with age of the respondent hence the respondents were requested to identify themselves with an age group (in years) as; age group 1 (below 30, the early career science teachers), age group 2 (30 to 40, early mid-career science teachers), age group 3 (40 to 50, mid-career science teachers) and age group 4 (above 50, late career science teachers). Gender was assumed to be an insignificant variable hence ignored for the study.

The study focused on establishing the usage pattern irrespective of underlying purchasing factors that were conveniently assumed to be uniform among the respondents. Nonetheless, behavioral issues were included on the questionnaire for use as guide in analyzing statistical data where conclusions were basically inferential. That is, respondents were requested to provide information on frequency of use as either daily (regular or intermittent), or occasionally to cater for behavioral issues. The data was presented on bar graphs of smartphone use percentages against age, with trendlines included so as to gauge the overall direction of age variation with smartphone use. In other words, graphs of smartphone use for socialization and communication percentages against age as well as academic use against age were plotted and correlations were tested in Excel.

III. RESULTS AND DISCUSSION

A total of 179 subjects participated in the survey, and this corresponded to a 56% response rate. Most of the subjects constituting the remaining 46% cited discomfort with the online type of questionnaire as they preferred traditional face-to-face interviews or paper based questionnaires, that were in breach of covid-19 restrictions on social distancing. Statistical data from the study is summarized in Table 1;

Table 1: Tabulated values pertaining to teachers' smartphone usage patterns

Age range (Years)		Age ≤ 30	$30 < Age \leq 40$	$40 < Age \leq 50$	$50 < Age$	Average (%)
Number of respondents		86	59	24	10	56
Frequency of smartphone use	Daily (%)	100	95	61	38	57
	Occasionally (%)	0	5	39	62	43
Type of use (%)	Social media	98	83	79	50	87
	Current affairs	24	59	79	70	47
	Teaching	43	58	38	20	51
	Advancement	85	76	54	10	74
	Leisure	100	81	50	10	82
	Average	71	68	49	26	62

Most science teachers use smartphones daily as evidenced by data in Table 1 showing that an average of 56% use smartphones daily compared to 43% who use them occasionally. The usage varies with age with the early career science teachers being more active relative to their late career counterparts. To fully explore the dependence on age of smartphone use, trendline analysis is thus presented.

Trend analysis of usage against age

Frequency of smartphone use

Variation of usage (y-variable) with age (x-variable) is quadratic. That is, usage varies quadratically with age as shown by the trendlines in Figure 2;

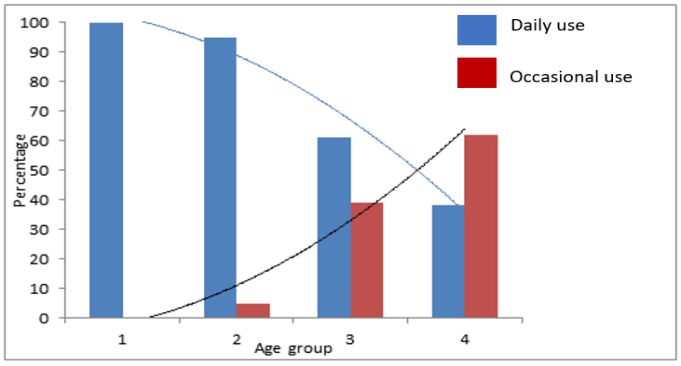

Figure 2: Bar graph with trendlines for variation of frequency of use with age

Trendlines for both daily (blue) and occasional (red) use are quadratic, showing that smartphone usage is quadratically age dependent where young teachers (age group 1, below 30 years) dominate the statistics. These findings agree with the work by Czaja *et al.* (2006) who also found that older adults were less likely than younger adults to use technology. Daily use of smartphones quadratically increases with age while the opposite is true for occasional use against age. The quadratic variation is portrayed in Figure 3, a plot of the average smartphone use for all activities against age of the teachers.

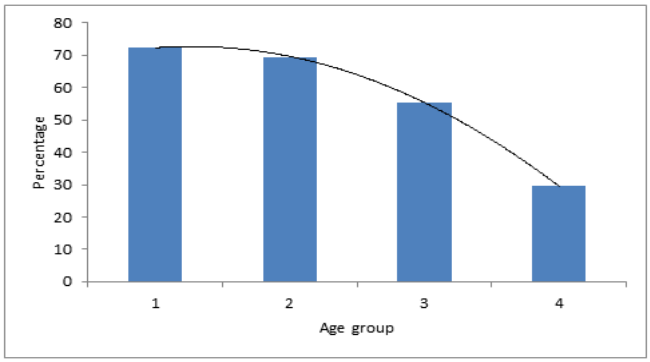

Figure 3: Plot of average smartphone use for all activities against age

Average smartphone use, also translated as average online activity, quadratically decreases with age from age group 1 (less than 30 years) to age group 4 made up of the later career teachers above 50 years (Figure 3). This shows that early career science teachers spent more time on their smartphones compared to late career science teachers. Excessive screen time by younger teachers is best explained in terms of psychosocial maturation from a developmental perspective that; whilst in the process of maturation, younger teachers may be confronted with more anxiety that eventually evens out as they become older and more mature (Kuss et al. 2018), hence the quadratic variation between usage and age. The quadratic variation is a maximum that peeks on age group 1, showing that the young teachers are the greatest smartphone users. Such high use is associated with repetitive and obsessive use that may lead to habituation thereby making smartphone use more pervasive in curriculum implementation efforts, a view also shared by Oulasvirta *et al.* (2012). To fully explore the characteristics of the usage, hence establish the usage pattern, trend analysis of the different activities by the teachers on their smartphones thus follows.

Social media use

Social networking is highest with the young generation teachers, and it gradually decreases with age. Figure 4 shows the variation of smartphone use for accessing social media with age.

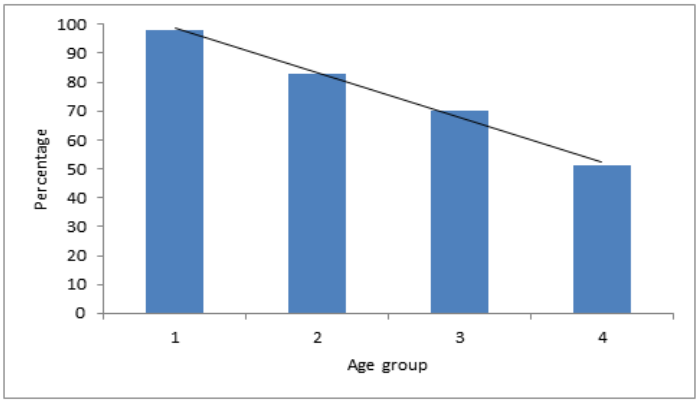

Figure 4: Bar graph showing variation of smartphone use for accessing social media with age

The trendline is linear with a negative gradient showing that smartphone use is extensive in age group 1 and gradually falls to age group 4, the later career teachers. Extensive smartphone use for social purposes is flagged as an accelerant to habituation that, may in turn lead to addictive behavior (Van Deursen et al. 2015). Therefore, younger generation teachers' use of smartphones for accessing social media is high and this can be an impediment to curriculum implementation efforts as teachers will have divided attention over social media and teaching due to habituation.

Reading current affairs

Age group 4 is the biggest user of smartphones for reading news and other media as a way of keeping up-to-date with current affairs.

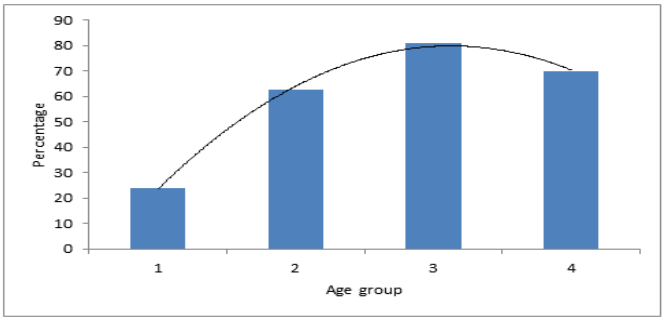

Figure 5: Bar graph showing variation of smartphone use for updating on current affairs

Figure 5 shows that smartphone use for accessing current affairs skews towards the later career teachers. Thus, the later career teachers use smartphones for accessing current affairs more than the young ones, with the age variation being quadratic also. Extrema for the variation exists on age group 3 (40 to 50 years), where age group 1 is the lowest. This agrees with findings by Busch *et al.* (2021), that news reading is among the most common smartphone uses by older adults, a view also shared by Mitchell, Rosenstiel and Christian (2012).

Teaching

Variation of smartphone use for teaching purposes against age is again quadratic, peeking on age group 2 as shown on Figure 6.

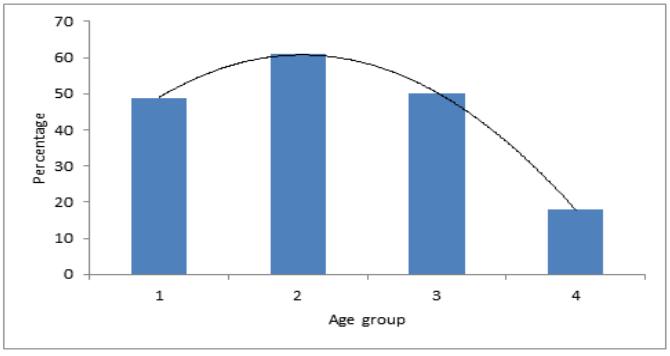

Figure 6: Graph showing variation of smartphone use for teaching as a function of age

This means, the 30 to 40 years teachers dominate statistics of teachers using smartphones for teaching followed by age groups 1 and 3 both with an average of 50%, and the later career teachers (above 50) coming a distant last at 18%. The low use of smartphones by the later career teachers, considered as digital immigrants, for teaching purposes, can be attributed to their contentment with knowledge borne of the vast experience gained during their long careers in teaching. Such teachers are generally resistant to new innovations that they despise/view as cumbersome and inferior to their traditional approaches they credit for the successes defining their careers. Such resistance to new innovations by later career teachers is attributed to social or political nostalgia. Goodson et al. (2006) in Snyder (2017) defined these two forms of nostalgia as fear to negatively impact on existing relationships or fear to decrease their autonomy respectively.

Career advancement

The young professionals are ready to use smartphones as compared to their later career counterparts as evidenced shown in Figure 7.

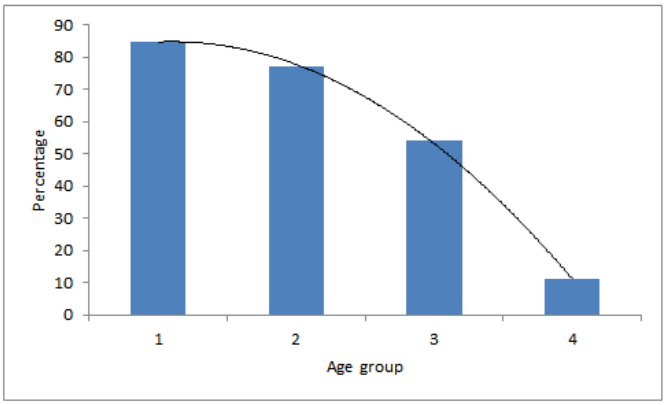

Figure 7: Graphical representation of the percentage using smartphones for career advancement percentage as a function of age

The trend for teachers using smartphones for career advancement peeks with 85% at age group 1. This shows that, teachers below the age of 30, who are considered to still have the academic edge to reshape their career paths, are the greatest users of smartphones to access study materials, also termed 'pocket libraries' by one responded. Age group 4 are reaching the twilight of their careers, hence no reason to intensely use smartphones as 'pocket libraries', thus explaining the low percentage of 11% on Figure 7.

Leisure use

Smartphone use for leisure, that basically included watching videos, playing music and playing games, also trends quadratically with age as shown on Figure 8.

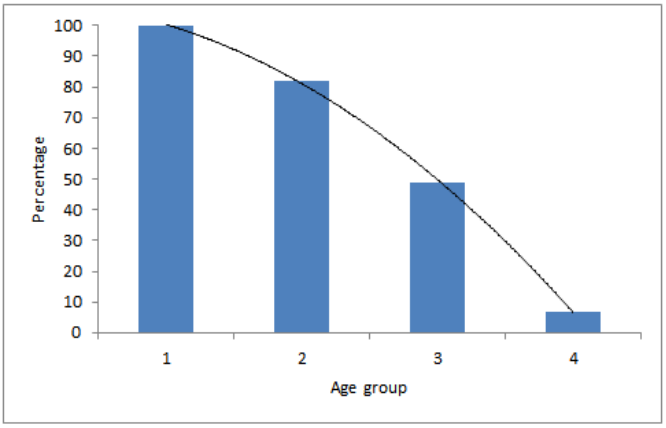

Figure 8: Variation of smartphone use for other purposes as a function of age

Early career teachers dominate statistics with 100% confirming use of smartphones for leisure purposes where the statistics quadratically decays to 7% for the later career teachers. This shows that besides intensely using smartphones for career advancement, the younger generation teachers also use smartphones to access leisure material. However, one can realize that such use of smartphones for leisure purposes are a distraction and renders the teacher ineffective due to idleness and perceived timelessness while the teacher will be physically immobile during use, a view also shared by Irimiás *et al.* (2021).

Overall use

Accessing social media is the most popular use of smartphones by the respondents. Figure 9 summarises the statistical distribution of the motives as per the findings;

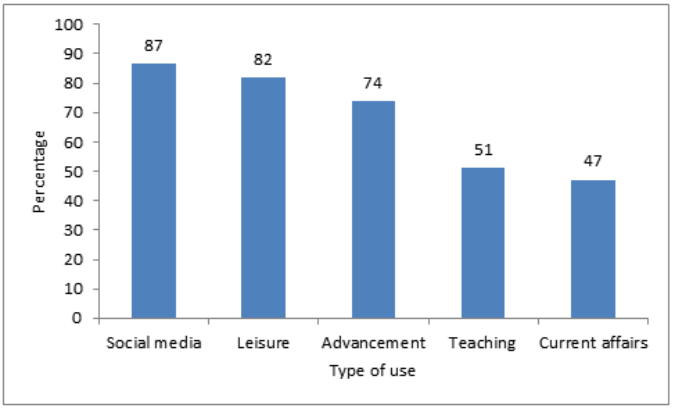

Figure 9: Graph showing smartphone use distribution for Zimbabwean teachers

In the order of popularity shown in Figure 9, social media access is the highest at 87%, followed by leisure (82%), career advancement (74%), teaching (51%) and, lastly reading current affairs (47%). The average percentage for socialization and communication is therefore 72% while for academic use it is 63%. This shows smartphones in Zimbabwe are more popular for socialization and communication than they are for teaching and career development among teachers. These findings are in line with wider literature on uses and gratifications of smartphones especially in developing countries where smartphones are popular for socialization and communication (Mwambakulu and Chikumba 2021; Shava, Chinyamurindi, and Somdyala 2016).

IV. CONCLUSION

Findings from the study show that smartphone usage patterns for Zimbabwean science teachers vary with age of the user, with science teachers under the age of 30 years being the most active users and the late career users (above 50) being the least active. Late career teachers use smartphones mainly for socialization and communication while the early and mid-career teachers use smartphones for both socialization and communication, and academic purposes. Accessing social media and leisure material are very popular uses with the early career teachers who constituted 48% of the respondents. The uses are ranked as; social media access at 87%, leisure (82%), career advancement (74%), teaching (51%) and lastly, reading current affairs at 47%. Smartphones are popular with science teachers below the age of 30 as 'pocket libraries' for accessing study material while their late career counterparts commonly use smartphones more for reading news. This shows that smartphones in Zimbabwe are more popular for socialization and communication than they are for teaching and career development among science teachers as they spend less of their time on the smartphone doing work related activities.

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