International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 03 - Issue 03 || March 2018 || PP. 57-63

Information Dissemination in an Electronic World - Towards Users' Preference

Samuel King Opoku[1], Dr. D. Subba Rao[2]
[1](Computer Science Department, Kumasi Technical University, Ghana)
[2](Professor, Computer Science, Centurion University, India)

Abstract: Transmission of information has been a predominant feature of our era. However, the overwhelming information received by users of especially mobile devices compels them to selectively decide which type of electronic message to receive or prefer. This study determines whether there is a significant difference between the rankings of the electronic messages received and preferred by users. It also determines whether for any category of electronic message there is a significant difference between the received category and the preferred category. A Friedman's test complemented with Bonferroni test was used to determine whether there existed a significant difference between received category and preferred category of electronic messages. Friedman's test followed by Wilcoxon signed rank test were used to determine whether for any category of electronic message there existed a significant difference between the received category and preferred category. The work revealed that mobile device users significantly receive different categories of messages and they also prefer different categories of messages. The levels of messages received regarding advertisement, entertainment and occupation are significantly different from the levels of messages preferred. There is no significant difference between the levels of messages received and preferred by users regarding news, sports, finance, medical, religious and family issues. The work concluded that mobile device users are not the same and thus certain users' preferences cannot be used to make generalization for every mobile device user.

Keywords: Electronic Messages, SMS, Activity Context, Users' Preference, Friedman's test

I. INTRODUCTION

Information has become the driven force of today's economic, social and political life due to the explosion of mobile communication devices and seemingly uncountable communication channels. Users, therefore, tend to over rely on these electronic messages, especially text messages [1] having the potential to affect emotions [2]. However, there is the need to ascertain whether the dissemination of information is tailored toward users' preference. According to [3], users' preferences affect the choice of activities undertaken. Users usually classify electronic messages as junks [4] when they are not interested. Many research works have been conducted into ranking electronic messages through threshold scoring [4], Naïve Bayes classifier and Apriori Algorithm [5] and machine learning [6].

Notwithstanding the above research efforts, there is the need to assess the categories into which electronic messages could be ranked from users' perceptive. Thus there is the need to obtain answers to the following three questions. Firstly, to what extent do the common categories of messages received by mobile device users differ? Secondly, to what extent do the common categories of messages preferred by mobile device users differ? Finally, for any category of electronic message, to what extent do user's preference levels differ from the received levels? According to [7] the various categories of electronic messages are news, entertainment, sports, finance, business, technology and science. Since religion and family play significant roles in our daily life [8], data regarding them are usually shared. Thus the study concluded that the categories of electronic messages to work with are news, entertainment, sports, finance, occupation, medical, advertisement, religious issues and family issues.

II. METHODOLOGY

A quantitative study employing a total of 1645 valid Ghanaian respondents was carried out. Respondents were asked to rank the categories of electronic messages as they receive them and as they prefer them 1st, 2nd, 3rd to 9th. A rank of 1st represented theelectronic message with the modal receiving rate. Similarly, a rank of 1st represents the most preferred category of message in the preference section. A nominal or categorical data was therefore collected.

A descriptive statistics was employed to get the general picture of the data. However, inferential statistics was used to ensure generalization of results from the sample to the entire population. Though ranking questionnaire is very useful when collecting data about preference [9], the ranking order (such as 1^{st}, 2^{nd}, etc) cannot be determined quantitatively through inferential statistics since they give no idea about the "distance" between them [10]. Any mechanism to quantify them and use inferential statistics to determine the ranks will be

deceiving. However their association with other variables and the significant difference between them can be determined [11].

This study employed Friedman's test for equality to answer the first and second questions. The questions were:

(1) To what extent do the common categories of **messages received** by mobile device users differ?
(2) To what extent do the common categories of **messages preferred** by mobile device users differ?

Though Friedman test is often used to determine repeated measure across multiple test attempts of the same dependent variable in natural science, Ref [11] and [12] demonstrated that it can be used to determine differences when a number of respondents rank a number of variables in social science.Traditional Chi-Square ($\chi 2$) test ignores the ranks and thus it cannot be used to test for equality. For categorical data (since distance between the ranks could not be determined), non-parametric test has to be used. Friedman's test is very useful for n x m table for detecting differences. Other methods include Spearman's Rank correlation coefficient which is only suitable for two variables, Mann-Whitney U test and Kruskal-Wallis test used to test for independent samples, Cochran's Q test for binary variables, McNemar's testfor 2x2 table and Wilcoxon signed-rank test for 2 x m table. Thus the only suitable test for the study was Friedman's test.Nevertheless, Friedman's test only tells the existence of overall differences but does not identify the groups that differ from the others. It sometimes results in type 1 error (false positive) when the $0< p$ value < 0.05. This is handled by using Bonferroni correction which modifies the confidence level [13], [14]. The null hypothesis, $H_{0,}$ tests for equality between the variables. Variables ranked were News, Advertisement, Entertainment, Occupation,Finance,Sports, Religious Issues, Medical Issues and Family Issues. Each respondent ranked the categories of messages from 1st to 9th given 9x9 table.

The third question, "For any category of message, to what extent do user's preference levels differ from the received levels?" resulted in 2x9 table. Friedman's test is very useful for n x m table for detecting differences and was used whereas Wilcoxon signed-rank test is used for 2 x m table was also employed. Thus the results from the two tests provided valid and reliable results for comparison. The null hypothesis, H_o, tests for equality between the paired variables, for example Received News and Preferred News.

III. ANALYSIS OF THE RESULTS

The data obtained has to be presented and analysed so that deductions can be made. To analyse the data, section 3.1 looks at the demography of the respondents. Section 3.2 focuses on the ranked data. However, to generalize the outcome, inferential statistics is required. This is handled in section 3.3

3.1 Descriptive Statistics of Demographic Data

The respondents were scattered across all the regions in Ghana. Table 1 below depicts the gender distribution of the respondents.

Table 1: Gender Representation

	Frequency	Percent	Valid Percent
Male	872	53.0	53.0
Female	773	47.0	47.0
Total	1645	100.0	100.0

From Table 1, 872 representing 53% of the respondents were male whiles 773 representing 47% of the respondents were female. Though there were more males than females, the difference in number is 99 representing only 6%. Thus the outcome of the analysis can be generalized for both genders

The responds were obtained from respondents with varying ages. Table 2 below shows the age distribution of the respondents

Table 2: Respondents' Age Distribution

	Frequency	Percent	Valid Percent
18-25	634	38.5	38.5
26-35	473	28.8	28.8
36-45	336	20.4	20.4
46-55	202	12.3	12.3
Total	1645	100.0	100.0

From Table 2, 634 respondents representing 38.5% were between the ages of 18 and 25 yearsinclusively. 473 respondents representing 28.8% were between the ages of 26 and 35 years inclusively. Also 336 respondents representing 20.4% were between the ages of 36 and 45 years inclusively and 202 respondents representing 12.3% were between the ages of 46 and 55 years inclusively. The modal age group was between 18 and 25 years. However, the total number of respondents in this group is less than half of the total number of respondents and therefore, the outcome of the analysis cannot be inferred on this group alone.

The educational levels of the respondents were also captured and analyzed. Table 3 below depicts the educational levels of the respondents

Table 3: Respondents' Educational Level

	Frequency	Percent	Valid Percent
Elementary	328	19.9	19.9
Secondary	615	37.4	37.4
Tertiary	702	42.7	42.7
Total	1645	100.0	100.0

From Table 3, the educational levels were elementary, secondary and tertiary. 328 respondents representing 19.9% obtained elementary school certificate as the highest qualification. 615 respondents representing 37.4% have secondary educational level certificate as their highest qualification. Finally 702 respondents representing 42.7% have tertiary educational certificate as their highest qualification. More than 80% of the respondents had received basic level of education. The outcome of the analysis, therefore, can be generalized for educated people.

Table 4 below illustrates the number of years the respondents had used mobile device.

Table 4: Years of Phone Usage

	Frequency	Percent	Valid Percent
0-2	241	14.7	14.7
3-4	594	36.1	36.1
5 or more	810	49.2	49.2
Total	1645	100.0	100.0

From Table 4, 241 respondents representing 14.7% had used mobile device for at most two years. Between 3 and 4 years of mobile device usage, there were 594 respondents, representing 36.1%. 810 respondents representing 49.2% had used mobile device for at least 5 years. Less than 15% of the respondents had used mobile device for two years or less and thus the majority of the respondents are experienced mobile device users. The outcome of the analysis can be inferred on experienced mobile device users.

There was the need to deduced whether years of mobile device usage commensurate the level of acquaintance with mobile devices. Table 5 below depicts the distribution of respondents' acquaintance with smart phones

Table 5: Respondents' Acquaintance with smart phone

	Frequency	Percent	Valid Percent
Yes	1565	95.1	95.1
No	80	4.9	4.9
Total	1645	100.0	100.0

From Table 5, 1565 of the respondents representing 95.1% indicated that they were acquainted with smart phones. Only 80 respondents representing 4.9% indicated that they were less acquainted with smart phones. The outcome of the analysis can be generalized for well acquainted mobile device users

From the demographic data, the respondents were matured in age, have necessary educational background and were acquainted with mobile device usage.

3.2 Descriptive Statistics of Ranked Data

The first part of the questionnaire captured personal data and has been dealt with in the preceding section. The other two sections of the questionnaire hadto do with the ranking of electronic messages. The second part of the questionnaire asked respondents to rank electronic message according to the level at which

they received them. Respondents ranked a category of an electronic message 1st when it is the highest level of message received. Table 6a illustrates the number of respondents that ranked the various categories of messages received. Table 6b shows the percentage occurrences of the values associated with Table 6a.

Table 6a: Ranking of the Various Categories of Electronic Messages Received

Ranks	News	Advert	Entertainment	Occupation	Finance	Sports	Religious	Medical	Family
1st	400	134	365	133	106	133	174	64	136
2nd	354	193	268	106	134	221	173	116	80
3rd	273	204	278	164	96	161	198	141	130
4th	289	214	186	258	181	119	118	206	74
5th	106	251	182	255	205	166	164	156	160
6th	73	180	125	187	307	220	122	256	175
7th	40	144	102	205	259	159	269	276	191
8th	68	150	52	213	174	247	190	280	271
9th	42	175	87	124	183	219	237	150	428

Table 6b: Percentage Ranking of the Various Categories of Electronic Messages Received

Ranks	News	Advert	Entertainment	Occupation	Finance	Sports	Religious	Medical	Family
1st	24.3	8.1	22.2	8.1	6.4	8.1	10.6	3.9	8.3
2nd	21.5	11.7	16.3	6.4	8.1	13.4	10.5	7.1	4.9
3rd	16.6	12.4	16.9	10.0	5.8	9.8	12.0	8.6	7.9
4th	17.6	13.0	11.3	15.7	11.0	7.2	7.2	12.5	4.5
5th	6.4	15.3	11.1	15.5	12.5	10.1	10.0	9.5	9.7
6th	4.4	10.9	7.6	11.4	18.7	13.4	7.4	15.6	10.6
7th	2.4	8.8	6.2	12.5	15.7	9.7	16.4	16.8	11.6
8th	4.1	9.1	3.2	12.9	10.6	15.0	11.6	17.0	16.5
9th	2.6	10.6	5.3	7.5	11.1	13.3	14.4	9.1	26.0

From Tables 6a and 6b, a greater proportion of the respondents numbering 400 which represents 24.3% ranked news 1st. A closely ranked message as 1st after news was entertainment having 365 respondents representing 22.2%. Interestingly, news was also highly ranked as 2nd with 354 respondents representing 21.5%. Similarly, the closely ranked message as 2nd after news was entertainment having 268 respondents representing 16.3%. The third highly ranked message was entertainment having 278 respondents representing 16.9%. Closely ranked message as 3rd after entertainment was news having 273 respondents representing 16.6%. The 4thhighly ranked message was news having 289 respondents representing 17.6%. Closely ranked message as 4thafter news was occupation having 258 respondents representing 15.7%. 5thon the list was occupation having 255 respondents representing 15.5%. Closely ranked as 5th after occupation, was advertisement having 251 respondents representing 15.3%. Finance was the 6thhighly ranked message with 307 respondents representing 18.7%. Medical issue was closer to finance as the 6th highly ranked message with 256 respondents representing 15.6%. The7th highly ranked message was medical issue having 276 respondents representing 16.8%. Religious issue was closer to medical issue as far as 7th position was concerned having 269 respondents representing 16.4%. Medical issue was ranked again as 8th highly ranked message having 280 respondents representing 17.0%. Family issue was highly ranked 8th after medical issue having 271 respondents representing 16.5%. The 9thhighly ranked message was family issue with 428 respondents representing 26.0%. The 9th highly ranked message after family issue was religious issue with 237 respondents representing 14.4%. Sports had no place in the highly ranked messages on the list.

The third part of the questionnaire focused on ranking electronic messages as preferred by the respondents. For instance, a respondent might receive messages about entertainment very often than others. Thus the respondent would rank entertainment as 1st in the second part of the questionnaire. However, if the respondent preferred getting messages about sports to the others, then in the third part of the questionnaire, the respondent would rank sports 1st. Table 7a illustrates the number of respondents that ranked the various

categories of messages preferred. Table 7b shows the percentage occurrences of the values associated with Table 7a

Table 7a: Ranking of the Preferred Categories of Electronic Messages

Ranks	News	Advert	Entertainment	Occupation	Finance	Sports	Religious	Medical	Family
1st	410	85	193	348	96	156	198	51	108
2nd	344	110	302	203	129	152	193	107	105
3rd	263	134	283	203	163	156	164	177	102
4th	215	171	243	228	190	218	107	172	101
5th	144	169	169	162	258	194	182	173	194
6th	94	339	109	184	277	140	139	205	158
7th	78	222	174	147	199	177	218	234	196
8th	58	215	83	88	185	179	227	321	289
9th	39	200	89	82	148	273	217	205	392

Table 7b: Percentage Ranking of the Preferred Categories of Electronic Messages

Ranks	News	Advert	Entertainment	Occupation	Finance	Sports	Religious	Medical	Family
1st	24.9	5.2	11.7	21.2	5.8	9.5	12.0	3.1	6.6
2nd	20.9	6.7	18.4	12.3	7.8	9.2	11.7	6.5	6.4
3rd	16.0	8.1	17.2	12.3	9.9	9.5	10.0	10.8	6.2
4th	13.1	10.4	14.8	13.9	11.6	13.3	6.5	10.5	6.1
5th	8.8	10.3	10.3	9.8	15.7	11.8	11.1	10.5	11.8
6th	5.7	20.6	6.6	11.2	16.8	8.5	8.4	12.5	9.6
7th	4.7	13.5	10.6	8.9	12.1	10.8	13.3	14.2	11.9
8th	3.5	13.1	5.0	5.3	11.2	10.9	13.8	19.5	17.6
9th	2.4	12.2	5.4	5.0	9.0	16.6	13.2	12.5	23.8

From Tables 7a and 7b, 410 respondents representing 24.9% ranked news 1st. A closely ranked message as 1st after news was occupation having 348 respondents representing 21.2%. Comparing tables 6a with 7a indicated that respondents prefer occupation to entertainment after news. Remarkably, news was also highly ranked as 2nd with 344 respondents representing 20.9%. Similarly, the closely ranked message as 2nd after news was entertainment having 302 respondents representing 18.4%. Comparing tables 6a with7a indicated that respondents' preference and message received were similar. The 3rdhighly ranked message was entertainment having 283 respondents representing 17.2%. Closely ranked preferred message as 3rd after entertainment was news having 263 respondents representing 16.0%. This is similar to what occurred in table 6a. The 4thhighly ranked message was entertainment having 243 respondents representing 14.8%. Closely ranked message as 4thafter entertainment was occupation having 228 respondents representing 13.9%. Comparing tables 6a with7a indicated that entertainment is more preferred to news at the 4thposition. 5thon the list was finance having 258 respondents representing 15.7%. Closelyranked as 5th after finance were sports and family issue having 194 respondents representing 11.8%. This ranking was totally different from what occurred in table 6a at the 5th position. Advertisement was the 6thhighly ranked message with 339 respondents representing 20.6%. Finance was closer to advertisement as the 6th highly ranked message with 277 respondents representing 16.8%. Comparing tables 6a with7a indicated that respondents prefer advertisement to medical issue at the 6th position. The 7th highly ranked message was medical issue having 234 respondents representing 14.2%. Advertisement was closer to medical issue as far as 7thposition is concerned having 222 respondents representing 13.5%. Advertisement was therefore preferred to Religious issue at the 7th position when compared with table 6a. Medical issue was ranked again as 8th highly ranked message having 321 respondents representing 19.5%. Family issue was highly ranked 8th after medical issue having 289 respondents representing 17.6%. There is greater similarity between the rankings at the 8thposition when table 6a is compared with table 7a. The 9th highly ranked message was family issue with 392 respondents representing 23.8%. The 9th highly ranked message after family issue was sports with 273 respondents representing 16.6%. Comparing the rankings

at the 9th position indicated that respondents prefer sports to religious issues.Thus religious issues had no place in the highly ranked messages on the list unlike sports in table 6a.

3.3 Inferential Statistics

This was carried out according to the research questions. Regarding research question 1: "To what extent do the common categories of **messages received** by mobile device users differ?" Friedman's test at 0.05 confidence level complemented with Bonferroni correction was calculated to test the null hypothesis, **H_0: There is no difference between the rankings of the messages received by users.**Friedman's test with $\chi2(8)=1628.813$ and p=0.00 rejected the null hypothesis. Thus there is a significant difference between the rankings of the various categories of messages received by mobile device users.

Similarly, the second question "To what extent do the common categories of **messages preferred** by mobile device users differ?" was handled usingFriedman's test at 0.05 confidence level complemented with Bonferroni correction to test the null hypothesis, **H_0: There is no difference between the ranking of the messages preferred by users.**The result produced byFriedman's test with $\chi2(8)=1630.714$ and p=0.00 rejected the null hypothesis and thus there is a significant difference between the ranking of the various categories of messages preferred by mobile device users

The final research question, "For any category of message, to what extent do user's preference levels differ from the received levels?"produced interesting results. Friedman's test$\chi2(df=1)$ followed by Wilcoxon signed-rank (Z) test at 0.05 confidence level was used to test the null hypothesis, **H_0: There is no difference between the rankings of the various categories received and preferred by users**. **$H_0$was rejected** for the following pairs: advertisement, entertainment and occupation and **accepted** for the following pairs: news, sports, finance, medical, religious issues and family issues. Thus there is ***a significant*** difference between the rankings of advertisement ($\chi2(1)=68.541$, p=0.00; Z=-9.190, p=0.00), entertainment ($\chi2(1)=25.424$, p=0.00; Z=-5.427, p=0.00) and occupation ($\chi2(1)=126.799$ p=0.00; Z=-13.070, p=0.00) received and preferred messages by users. Besides, there is ***no significant*** difference, between the rankings of news ($\chi2(1)=0.295$, p=0.587; Z=-1.351, p=0.177), sports ($\chi2(1)=0.250$, p=0.874; Z=-0.188, p=0.851), finance ($\chi2(1)=3.619$, p=0.057; Z=-2.668, p=0.008), medical ($\chi2(1)=1.102$, p=0.294; Z=-1.727, p=0.084), religious issues ($\chi2(1)=0.202$, p=0.653; Z=-0.824, p=0.410) and family issues ($\chi2(1)=1.499$, p=0.221; Z=-0.495, p=0.621) received and preferred by users

IV. DISCUSSION AND CONCLUSION

Empirical studies concerning users' preferences regarding the various categories of electronic messages have been conducted in this study. According to [3], users' preferences affect the activities they engage in. This study confirmed that users have different preferences in choosing electronic messages. The study revealed that mobile device users significantly receive different categories of messages and similarly, mobile device users significantly prefer different categories of messages. The levels of messages received regarding advertisement, entertainment and occupation are significantly different from the level of messages preferred. There is no significant difference between the levels of messages received and preferred by users regarding news, sports, finance, medical, religious and family issues. Practically, users of mobile devices should be made to select their preferences in context-aware applications and the settings interface should be made readily available for update. Recommended activities should not be made to consume resources of the users lest they will get bored if not preferred. Theoretically, all mobile device users are not the same and thus certain users' preferences should not be used to generalize for all.As a policy, the telecommunication organizations should control electronic messages sent to their clients. If a client receives a particular category of message and deletes or sends STOP, the organization should comply immediately. The "allow 7 or 30 days to take effect" should be abolished. Future work should consider longitudinal research to determine whether users' preferences change over time.

REFERENCES

[1] R. A. Davis, A cognitive-behavior model of pathological internet use. *Computers in Human Behavior*, 17, 363-388, 2001

[2] E. Boan, J. Edwards, J. Ratliff, and A. Waller, Know What I Mean? Perception of Emotional Content in Email, Notes, and Text Messages, Retrieved in 2018

[3] S. K. Opoku, and S. Appiah, Automating students' activities in Higher Educational Institutions, *International Journal of Computer Applications Technology and Research*, 5(11), 693 – 697, 2016

[4] R. Parimala, and R. Nallaswamy, A Study on Analysis of SMS Classification Using Document Frequency Threshold. *International Journal of Information Engineering and Electronic Business*, 4(1), 44, 2012

[5] I. Ahmed, D. Guan, and T. C. Chung, SMS classification based on naive bayes classifier and apriori algorithm frequent itemset. *International Journal of machine Learning and computing,* 4(2), 183, 2014

[6] G. V. Cormack, J. M. G. Hidalgo, and E. P. Sánz, Feature engineering for mobile (SMS) spam filtering. *In Proceedings of the 30th annual international ACM SIGIR conference on Research and development in information retrieval* (pp. 871-872). ACM. July, 2007

[7] Yahoo.com. Available at https://www.yahoo.com (Last access: 6th March, 2018)

[8] J. Battle, A. J. PastranaJr, and A. Hams, *Family Life. In An Examination of Asian and Pacific Islander LGBT Population Across the United States* (pp. 43-54). Palgrave Macmillan US, 2017

[9] A. Burke, J. Smyth., and K. Olson, The effect of ranking questions format on data quality in mail surveys, *MAPOR Conference, Chicago, IL, 2015*

[10] R. Geert van den Berg, SPSS Chi-Square Test Tutorials, June 8, 2017 [online Blog] https://www.spss-tutorials.com/spss-chi-square-independence-test/

[11] S. Abeyasekera, Quantitative analysis approaches to qualitative data: why, when and how? 97-106, 2005

[12] W. J. Conover, *Practical non-parametric statistics* (3rd Edition, Wiley, New York, 1999)

[13] M. Saunders, P. Lewis and A. Thornhill, *Research methods for business students* (6th Edition, Pearson Education Limited, 2012)

[14] N. Bajpai, *Business research methods*, (Pearson Education, 2011)