

B. P. H. E. Society's
AHMEDNAGAR COLLEGE
AHMEDNAGAR(M.S.)



DEPARTMENT OF STATISTICS
Project on

“Analysis of Brand Preference of Smartphone Among Ahmednagar College Students”

Submitted to University of Pune for course T.Y.B. Sc (Statistics)

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Academic Year: 2019-2020

ROLL NO.

EXAM SEAT NO.

**B. P. H. E. Society's
AHMEDNAGAR COLLEGE
AHMEDNAGAR (M.S.)**



Department of Statistics

T.Y.B. Sc

CERTIFICATE

Date: /03/20

This is certify that partial fulfilment of curriculum T.Y.B.Sc. students *Kishor Lagad, Mahesh Punde, Manisha Borde, Shweta Patare, Harshal Chauhan, Ritesh Dangade, Abhijit Labade* have successfully completed the project work in the statistics entitled **“Analysis of Brand Preference of Smartphone Among Ahmednagar College Students by Using Statistical Technique.”** prescribed by Savitribai Phule Pune university during academic year 2019-2020.

Project Guide

Examiner

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ACKNOWLEDGEMENT

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Lastly, we would like to thank all those who directly or indirectly involved in completion of this project.

DECLARATION

We declare that this project work was carried out by us, in the Department of Statistics, B.P.H.E Society's Ahmednagar College, Ahmednagar under the supervision of Dr. Malati Yeola and Mr. Yogesh Yewale, and that no previous submission for a degree of this college or elsewhere has been made. Related work by others which served as a source of knowledge has been duly acknowledged or referenced.

Place: Ahmednagar

Date: / 03 / 2020

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OBJECTIVES

- *To study about number of active users of Smart phones.*
- *To know about the student's preference level associated with different mobile phones.*
- *To find whether income level and purchasing level are correlated or not.*
- *Understand their view on whether students make use of social media in their education or not.*
- *Factor that influence decision making in purchasing a mobile phone.*
- *To know which advertisement media puts more impact on the buying decision of students.*
- *Analysing the use pattern of Smartphones among male and female*

INRODUCTION

Though mobile company manufactures, regulatory, agency and service provider assure that mobile phones have best qualities. We tried to pick up us best mobile phone model chosen by male and female using statistical analysis in this project and finally we have suggested some suggestions.

Samsung was founded in 1977,43 years ago (as Telecommunication network) In Seoul, South Korea and headquarter in Suwon, South Korea. Samsung president is Choi Gee-sung mobile company founder is Pete Lau, Carl Pel W. industry in Futian District, Shenzhen, Guangdong Republic of china (Taiwan).

Redmi was founded on April 6,2010; 9 year ago, and this mobile company founder is Lei Jun. Redmi headquarters is in Haitians District, Beijing, China. The President of this mobile company President is Lin Bin and CEO is Lei Jun. Oppo mobile company was founded on Feb 2,2001; 19 years Ago (as legend) in Dongguan, Guangdong, China and the founder of this Oppo mobile company is Tony Chen. Oppo mobile company Headquarters is in the DongguanDistrict, Beijing, China & Morrisville, North Carolina, United States. This mobile company chairman and CEO are Tony Chen. Sony was founded On September 1,2001; 18 years ago. Sony company headquarter is located in Shinagawa, Tokyo, japan.

METHODOLOGY

It is casual study directed towards determining the mobile company which is most popular in the science faculty students of Ahmednagar College, Ahmednagar. The data have been collected is primary data by sample survey with the help of the structured questionnaire. The respondents have been choosen aged above 17 years of all faculties students from Ahmednagar College, Ahmednagar.

Questionnaire

Analysis of Brand Preference of Mobile Phones among Ahmednagar college, Ahmednagar Student by Using Statistical Technique.

Questionnaire

(Please fill this questionnaire to help us to identify students use and attitude towards smartpone. The aim of this questionnaire is to obtain information about how many students use Smartphone. All data provided will be confidential. Your participation is greatly appreciated.)

1) Age:

2) Gender:

a} Male b} Female

3) Faculty:

a} science b} commerce c} arts d) other

4) Occupation of father?

a} farmer b} service c} business d} other

5) Family income level (monthly)

a} less than 10,000 b} 10,000 to 20,000 c} 20,000 to 30,000 d} above 30,000

6) Are you using smart phone?

a} yes b}no

7) Which mobile you are using?

a} RED-MI b} ONE+ c} HONOR d} SONY
e} VIVO f} OPPO g} SAMSUNG h} OTHER

8) How long you are using the phone?

a} less than 1year b} 1 to 2year c} 2 to 3year d} above 3 year

9) You use mobile phone for:

a} look up your course timetable b} read lectures notes
c} watch lectures d} read syllabus related PDF's

10) Do you have any application related to education?

a} yes b} no

11) If yes, which application are most valuable for your studies?

a} you tube b} chrome c} UC-browser d} other

12) Do you think that social media is useful for your education?

a} yes b} no

13) What rating you will give to features of your current smart phone?

[(a)0 TO 1 –bad, b)1 to 2-average, c)2 to 3-good, e d)3 to 4-very good, e)4 to 5-excellent]

A} camera:	a}	b}	c}	d}	e}
B} speaker:	a}	b}	c}	d}	e}
C} processor:	a}	b}	c}	d}	e}
D} display :	a}	b}	c}	d}	e}

14) How often do you change your smart phone?

a} less than 1-year b} 1 to 2-year c} 2 to 3-year d} above 3 year

15) Are you willing to buy a new smart phone?

a} yes b}no

16) Why are you changing your current phone?

- a} broken or faulty b} not up to date
- c} less function d} better option available

17) Which is your favourite brand in smart phone available in market?

(1-most favourite, 2-favourite, 3-less favourite)

- a} REDMI 1] 2] 3]
- b} ONE+ 1] 2] 3]
- c} HONOR 1] 2] 3]
- d} SONY 1] 2] 3]
- e} VIVO 1] 2] 3]
- f} OPPO 1] 2] 3]
- g} SAMSUNG 1] 2] 3]
- h} OTHER 1] 2] 3]

18) How much you willing to pay for a new smart phone?

- a} less than 5,000 b} 5,000 to 10,000 c} 10,000 to 15,000 d} above 15,000

19) Where did you seen mobile advertisement?

- a} T.V b] newspaper c} social media d} other

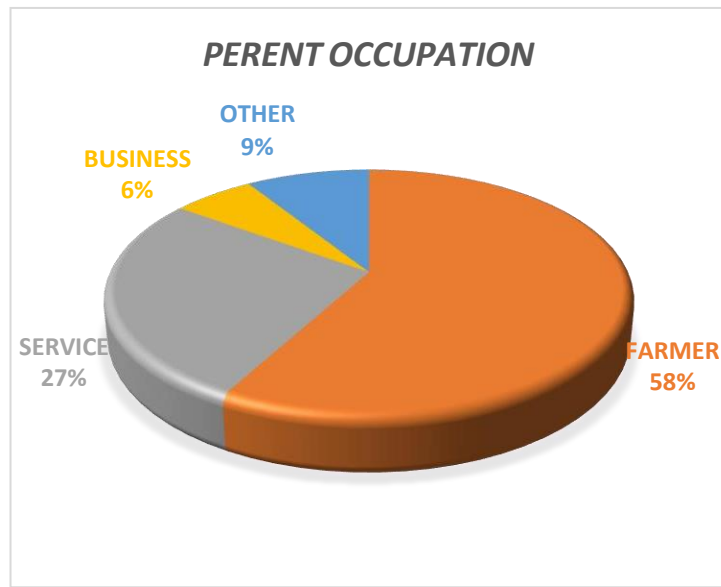
20) Which mobile company advertisement you like most?

- A} REDMI B} ONE+ C} HONOR D} SONY
- E} VIVO F} OPPO G} SAMSUNG H} OTHER

GRAPHICAL REPRESENTATION OF DATA: -

➤ PIE CHART FOR PARENT OCCUPATION: -

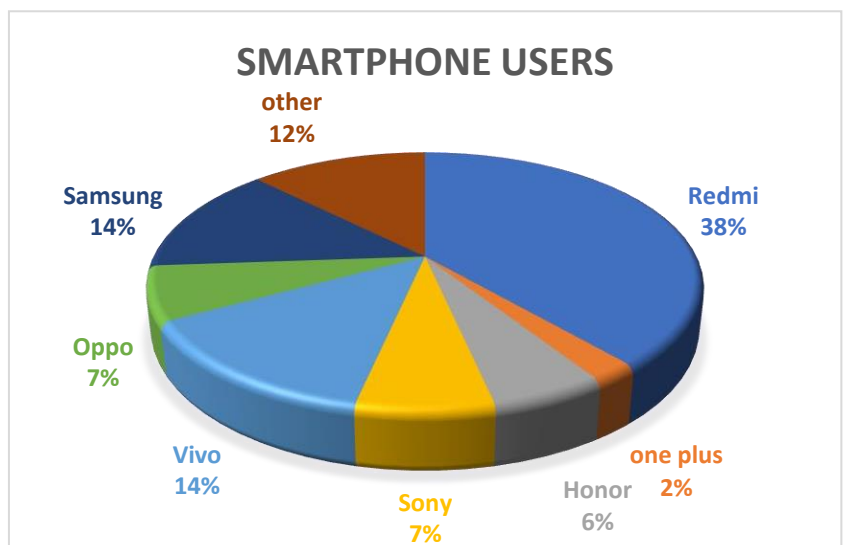
Occupation	Count
FARMER	58
SERVICE	27
BUSINESS	6
OTHER	9



Conclusion: The occupation of parents for 58 % of the participants in the survey is farming.

Pie chart for current Smartphone users: -

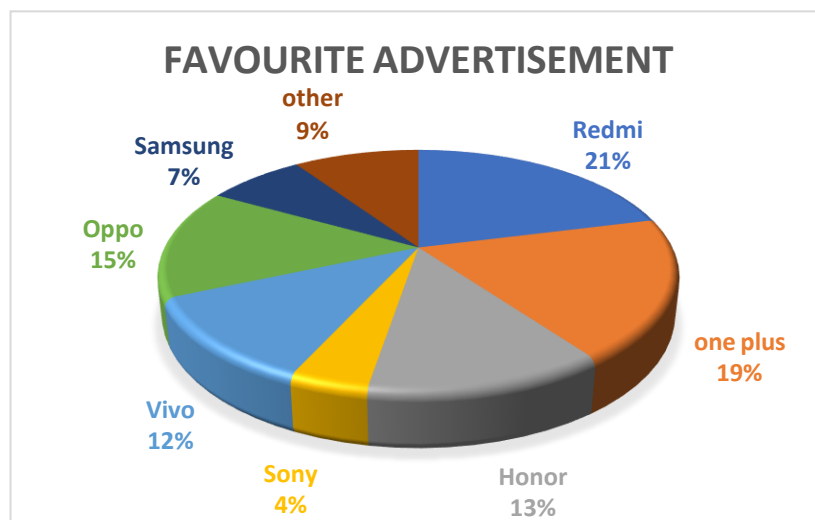
Brand	Count
Redmi	34
One plus	2
Honor	5
Sony	6
Vivo	12
Oppo	6
Samsung	12
Other	11



Conclusion: Most of the students use Redmi smartphone.

➤ Pie chart for favourite Advertisement: -

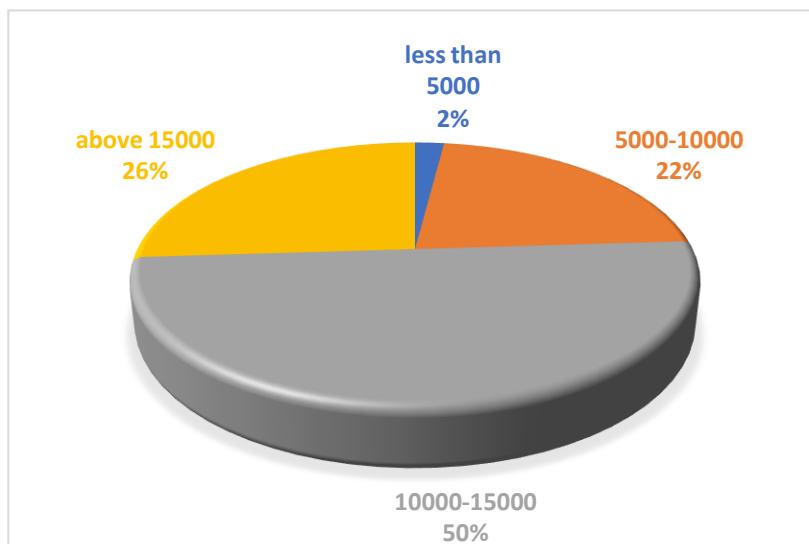
Brand	Count
Redmi	20
one plus	18
Honor	12
Sony	4
Vivo	11
Oppo	14
Samsung	7
Other	9



Conclusion: Redmi company advertisement is most favourite advertisement.

Pie chart for budget of new Smartphone: -

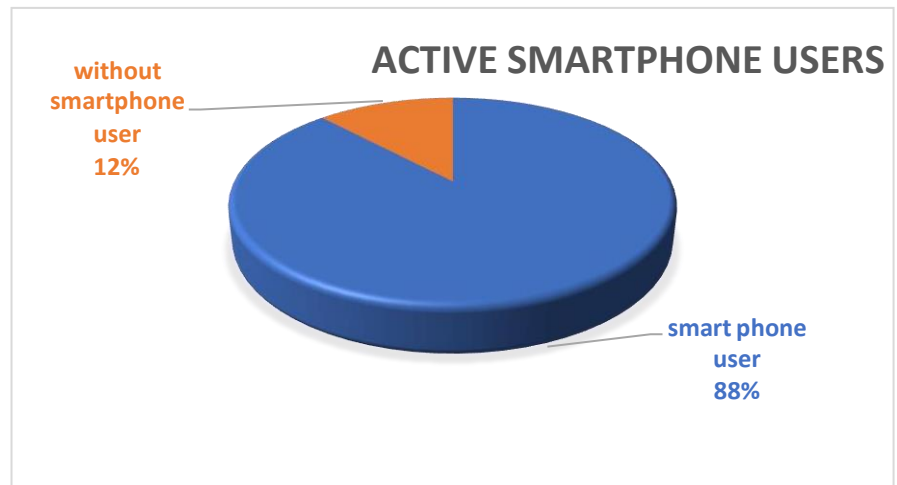
Income	Count
less than 5000	1
5000-10000	11
10000-15000	25
above 15000	13



Conclusion: most of the student have budget between 10000-15000

Pie chart for active smartphone user: -

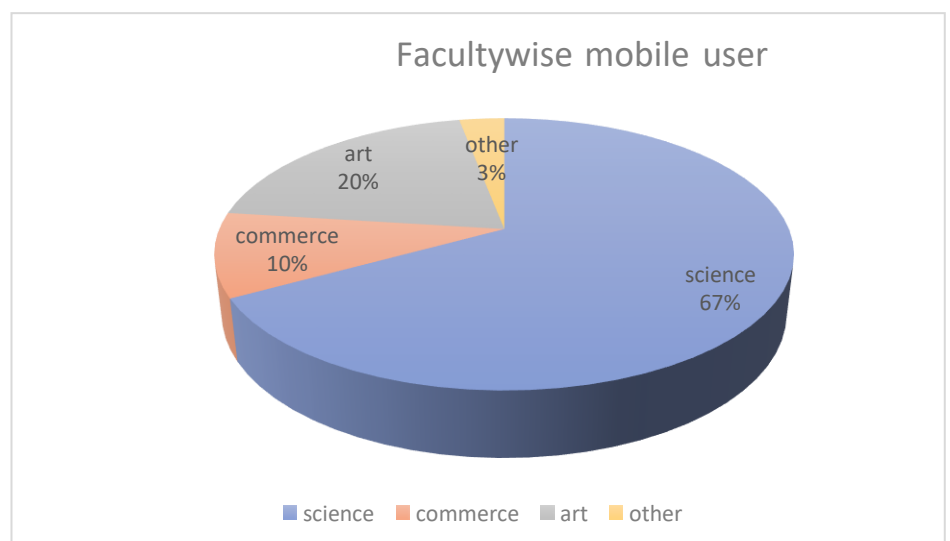
Smart phone user	88
Without smartphone user	12



Conclusion: 88% student use smartphone.

Pie chart for faculty wise mobile users: -

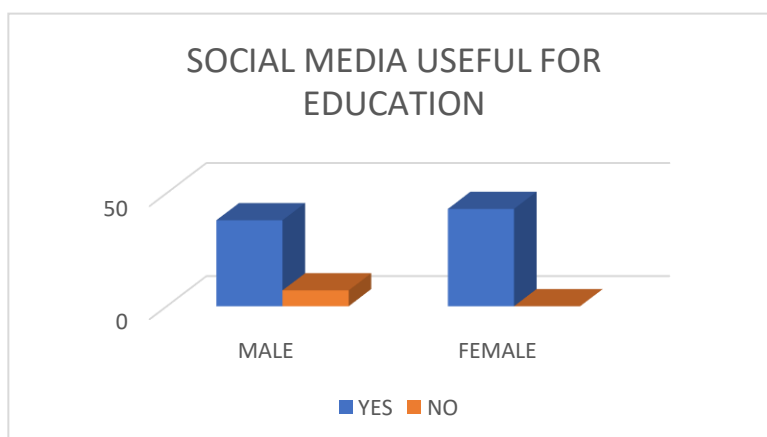
Faculty	Count
Science	67
commerce	10
Art	20
Other	3



Conclusion: 67% student of science faculty are used smartphone

➤ Multiple Bar diagram for social media useful for education: -

	MALE	FEMALE
YES	38	43
NO	7	0

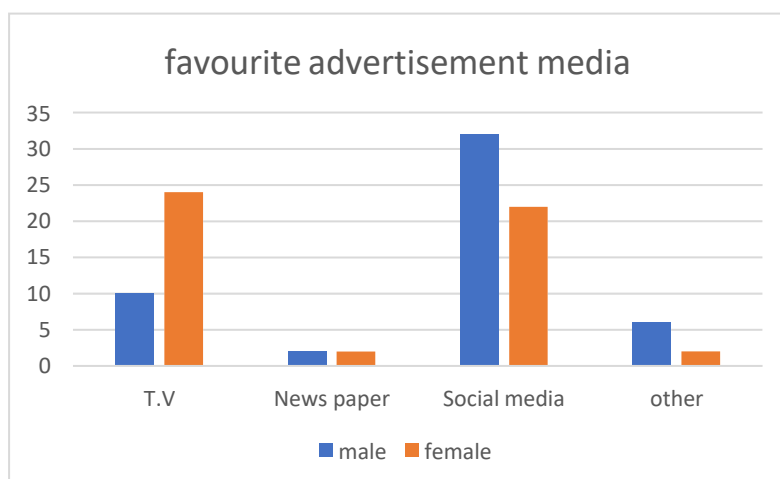


Conclusion:

In addition to social media, student uses different educational applications like you-tube, chrome, uc-browser etc.to improve their knowledge.

Multiple Bar chart for favourite advertisement media:

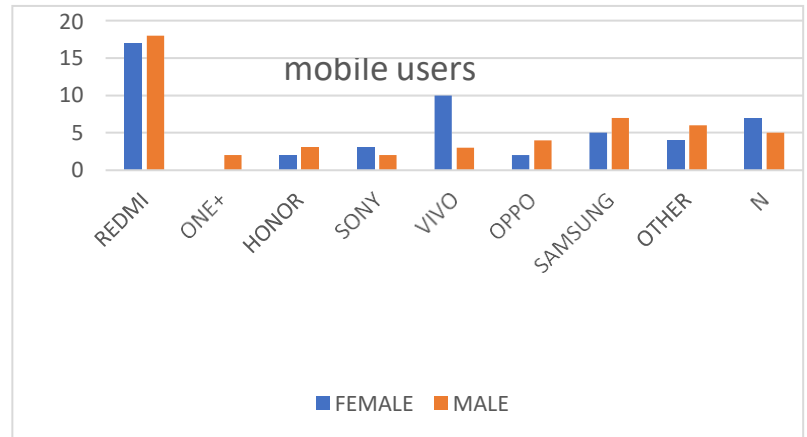
	Male	Female
T. V	10	24
News paper	2	2
Social media	32	22
other	6	2



Conclusion: - Social media is favourite advertisement media.

➤ Gender-wise Classification of Smartphone Users

Brand	FEMALE	MALE
REDMI	17	18
ONE+	0	2
HONOR	2	3
SONY	3	2
VIVO	10	3
OPPO	2	4
SAMSUNG	5	7
OTHER	4	6
N	7	5



Conclusion: From graph it can be concluded that male and female use Redmi phone more frequently.

Analysis Technique: -

Chi-square test for independent attributes (Theoretical Background)

H₀: Two attributes are independent.

Against

H₁: Two attributes are not independent.

Under H₀, Test statistic is

$$\chi^2_{(m-1)*(n-1)} = \sum_{i=1}^m \sum_{j=1}^n \frac{o_{ij}^2}{e_{ij}} - N \sim \chi^2_{(m-1)*(n-1)}$$

Where,

m=no. of rows

n= no. of columns

$$\chi^2_{tab} = \chi^2_{(m-1)*(n-1), \alpha}$$

If $\chi^2_{cal} < \chi^2_{tab}$, accept H₀ at α % level of significance.

Chi-Square Test For Annual Income And Smartphone Budget: -

H_0 : Income and budget are independent.

H_1 : Income and budget are dependent.

		BUDGET					Total
		LESS THAN 5000	5000-10000	10000-15000	ABOVE 15000	N	
INCOME	LESS THAN 10000	0	5	14	5	15	39
	10000-20000	1	2	7	1	6	17
	20000-30000	0	2	1	0	5	8
	ABOVE 30000	0	2	3	7	24	36
Total		1	11	25	13	50	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.414 ^a	12	0.033
Likelihood Ratio	22.935	12	0.028
N of Valid Cases	100		

Decision Rule:

Since p-value (Pearson Chi-Square = 0.033) is less than the α level of significance ($\alpha = 0.05$) we conclude that H_0 is rejected.

Conclusion: Variable Annual Income and budget are dependent.

Chi-Square Test for Independence Between Gender and Brand of Smartphone

H_0 = Gender and brand selection of smartphone are independent.

Vs

H_1 = Gender and brand selection of smartphone are not independent.

		WHICH_MOB_USE									Total
		Redmi	One-plus	Honor	Sony	Vivo	Oppo	Samsung	Other	N	
Gender	Female	17	0	2	3	10	2	5	4	7	50
	Male	17	2	3	3	3	4	7	6	5	50
Total		34	2	5	6	13	6	12	10	12	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.703 ^a	8	0.463
Likelihood Ratio	8.703	8	0.368
N of Valid Cases	100		

Decision Rule: Since p-value (Pearson Chi-Square = 0.463) is greater than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is accepted.

CONCLUSION: - Gender and brand selection of smartphone are independent.

Chi-Square Test For independence between Faculty and use of Smartphone Apps for Education: -

H_0 : Faculty and smartphone application related to education are independent.

Vs

H_1 : Faculty and smartphone application related to education are dependent.

		APP_RELATED_EDU			Total
		YES	NO	N	
FACULTY	SCIENCE	56	5	6	67
	COMMERCE	6	1	3	10
	ARTS	13	4	3	20
	OTHER	1	2	0	3
Total		76	12	12	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.329 ^a	6	0.018
Likelihood Ratio	11.257	6	0.081
N of Valid Cases	100		

Decision Rule: -

Since p-value (Pearson Chi-Square = 0.018) is less than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is rejected.

Conclusion: Faculty and use of smartphone apps for education are dependent

Chi-Square Test for Independence Between Occupation And Income: -

H_0 : Annual Income and occupation of father are independent.

H_1 : Annual Income and occupation of father are dependent

		INCOME				Total
		LESS THAN 10000	10000- 20000	20000- 30000	ABOVE 30000	
OCCUPATION	FARMER	30	13	7	8	58
	SERVICE	4	3	1	19	27
	BUSINESS	0	0	0	6	6
	OTHER	5	1	0	3	9
Total		39	17	8	36	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.857 ^a	9	0.000
Likelihood Ratio	42.657	9	0.000
N of Valid Cases	100		

Decision Rule:

Since p-value (Pearson Chi-Square = 0.000) is less than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is rejected.

Conclusion: Faculty and use of smartphone apps for education are dependent

Chi-Square Test for Independence Between Annual Income Level And Smartphone Use: -

H_0 : Mobile brand and family income level are independent

Vs

H_1 : Mobile brand are dependent on family income level.

		WHICH_MOB_USE									Total
		Red mi	One-Plus	Ho nor	Sony	Vivo	Oppo	Samsung	Other	N	
INCOME	LESS THAN 10000	16	0	3	2	2	2	3	3	8	39
	10000-20000	5	0	0	3	4	1	3	1	0	17
	20000-30000	3	1	1	0	0	1	0	1	1	8
	ABOVE 30000	10	1	1	1	7	2	6	5	3	36
Total		34	2	5	6	13	6	12	10	12	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.099 ^a	24	0.216
Likelihood Ratio	31.286	24	0.146
N of Valid Cases	100		

Decision Rule: Since p-value (Pearson Chi-Square = 0.216) is greater than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is accepted.

Conclusion: Faculty and use of smartphone apps for education are independent

Chi-Square Test for Independence Between Faculty And General Use of Smartphone

H_0 =Mobile use for study is independent on faculty.

Vs

H_1 = Mobile use for study is dependent on faculty.

		General USE of Smart Phone					Total
		LOOK UP COURSE TIMETABLE	READ LEC NOTES	WATCH LEC	READ SYLLABUS RELATED PDF'S	N	
FACU LTY	SCIENCE	15	11	9	26	6	67
	COMMERCE	3	3	1	0	3	10
	ARTS	5	3	2	7	3	20
	OTHER	1	0	2	0	0	3
Total		24	17	14	33	12	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.933 ^a	12	0.152
Likelihood Ratio	18.264	12	0.108
N of Valid Cases	100		

Decision Rule: Since p-value (Pearson Chi-Square = 0.152) is greater than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is accepted.

Conclusion: Faculty and general use of smartphone are independent.

Chi-Square Test for Independence Between Annual Income And Duration Of Switching To New Brand: -

H_0 : Duration of Switching To New Brand and family income level are independent.

V_s

H_1 : Duration of Switching To New Brand and family income level are dependent.

		CHANGING_DURATION					Total
		LESS THAN 1 YEAR	1 TO 2 YEAR	2 TO 3 YEAR	ABOVE 3 YEAR	N	
INCOME	< 10000	6	5	8	12	8	39
	10000-20000	2	4	9	2	0	17
	20000-30000	1	3	1	2	1	8
	> 30000	3	3	7	20	3	36
Total		12	15	25	36	12	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.023 ^a	12	0.020
Likelihood Ratio	24.361	12	0.018
N of Valid Cases	100		

Decision Rule: Since p-value (Pearson Chi-Square = 0.020) is less than the level of significance ($\alpha = 0.05$) we may conclude that H_0 is rejected.

Conclusion: The attributes Annual Income and Duration (years) Of Switching to New Brand are dependent.

Test for Equality of Proportion Between Two Populations (Theoretical Background)

The test statistics for testing the difference in two population proportion that is for testing the null hypothesis

$$H_0: P_1 = P_2 \quad \text{Vs} \quad H_1: P_1 \neq P_2$$

P_1 = Population Proportion for the first Population

P_2 = Population Proportion for the Second Population

$$Z = \frac{(p_1 - p_2)}{\sqrt{p * (1 - p) * (\frac{1}{n_1} + \frac{1}{n_2})}}$$

$$\text{Where } p = \frac{y_1 + y_2}{n_1 + n_2}$$

The proportion of “success” in two sample combined. A survey conducted in two distinct population will produce different result.

It often necessary to compare the survey response population between two population.

P_1 = Population of the first sample with the characteristics of interest

P_2 = Population of the second sample with the characteristics of interest

P = population of the combination of sample with the characteristic of interest

➤ 1] Proportion test for Redmi mobile users (male & female)

H_0 : Male & Female uses Redmi Smartphone in same proportion.

Vs

H_1 : Male & Female uses Redmi Smartphone is not in same proportion.

> x=c (17,17)

> n=c (34,34)

> prop.test(x, n)

2-sample test for equality of proportions without continuity
correction

data: x out of n

X-squared = 0, df = 1, p-value = 1

alternative hypothesis: two. sided

95 percent confidence interval:

-0.2376805 0.2376805

sample estimates:

prop 1 prop 2

0.5 0.5

Conclusion:

Male & Female uses Redmi Smartphone in same proportion.

➤ 2] Proportion test for vivo mobile users (male & female)

H_0 = Male & Female uses Vivo Smartphone in same proportion.

V_S

H_1 = Male & Female uses Vivo Smartphone is not in same proportion.

> x=c (10,3)

> n=c(13,13)

> prop.test (x, n)

2-sample test for equality of proportions with continuity correction

data: x out of n

X-squared = 5.5385, df = 1, p-value = 0.0186

alternative hypothesis: two. Sided

95 percent confidence interval:

0.1376401 0.9392829

sample estimates:

prop 1 prop 2

0.7692308 0.2307692

Conclusion:

Male & Female uses Vivo Smartphone is not in same proportion.

➤ 3] Proportion test for Samsung mobile users (male & female)

H_0 = Male & Female uses Samsung Smartphone in same proportion.

V_s

H_1 = Male & Female uses Samsung Smartphone is not in same proportion.

> x=c (5,7)

> n=c (12,12)

> prop.test (x, n)

2-sample test for equality of proportions with continuity correction

data: x out of n

X-squared = 0.16667, df = 1, p-value = 0.6831

alternative hypothesis: two. sided

95 percent confidence interval:

-0.6444802 0.3111469

sample estimates:

prop 1 prop 2

0.4166667 0.5833333

conclusion:

Male & Female uses Samsung Smartphone in same proportion.

LOGISTICS REGRESSION MODEL

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	17.909	10	0.057
Deviance	11.373	10	0.329

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[coding_education = 1.00]	17.854	1.359	172.577	1	.000	15.190	20.518
	[faculy_science=1.00]	14.219	1.179	145.572	1	.000	11.910	16.529
	[faculy_commerce=2.0]	16.490	1.332	153.189	1	.000	13.879	19.101
	[faculty_arts=3.00]	17.502	.000	.	1	.	17.502	17.502
	[faculty_other=4.00]	0 ^a	.	.	0	.	.	.
Location	[mobile_REDMI=1.00]	-.597	1.465	.166	1	.684	-3.467	2.274
	[mobile_ONE+=2.00]	-14.946	7659.415	.000	1	.998	-15027.123	14997.232
	[mobile_Honor=3.00]	-15.709	4288.822	.000	1	.997	-8421.646	8390.228
	[mobile_Sony=4.00]	.120	1.833	.004	1	.948	-3.472	3.712
	[mobile_Vivo=5.00]	-.969	1.689	.329	1	.566	-4.279	2.341
	[mobile_OPPO=6.00]	-16.129	2586.572	.000	1	.995	-5085.716	5053.458
	[mobile_SAMSUNG=7]	.306	1.522	.040	1	.841	-2.677	3.289
	[mobile_OTHER=8.00]	0 ^a	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

The model is,

$$Y = \left\{ \frac{\exp \{ \beta_0 + (\beta_{11}x_{11} + \beta_{12}x_{12} + \beta_{13}x_{13}) + (\beta_{21}x_{21} + \beta_{22}x_{22} + \beta_{23}x_{23} + \beta_{24}x_{24} + \beta_{25}x_{25} + \beta_{26}x_{26} + \beta_{27}x_{27} + \beta_{28}x_{28}) \}}{1 + \exp \{ \beta_0 + (\beta_{11}x_{11} + \beta_{12}x_{12} + \beta_{13}x_{13}) + (\beta_{21}x_{21} + \beta_{22}x_{22} + \beta_{23}x_{23} + \beta_{24}x_{24} + \beta_{25}x_{25} + \beta_{26}x_{26} + \beta_{27}x_{27} + \beta_{28}x_{28}) \}} \right\} + \epsilon$$

Where,

β_0 =Estimate of

β_{11} =Estimate of science faculty

β_{12} =Estimate of commerce faculty

β_{13} =Estimate of arts faculty

β_{14} =Estimate of another faculty

β_{21} = Estimate of Redmi mobile

β_{22} = Estimate of one+ mobile

β_{23} = Estimate of Honor mobile

β_{24} = Estimate of Sony mobile

β_{25} = Estimate of Vivo mobile

β_{26} = Estimate of Oppo mobile

β_{27} = Estimate of Samsung mobile

β_{28} = Estimate of other mobile

x_{11} = science faculty

x_{12} = commerce faculty

x_{13} = arts faculty

x_{14} = another faculty

x_{21} =Redmi

x_{22} =one+

x_{23} =Honor

x_{24} =Sony

x_{25} =vivo

x_{26} =oppo

x_{27} =Samsung

x_{28} =other

$$Y = \frac{\exp(a)}{1 + \exp(a)}$$

Where,

$$a = 17.854 + (14.219X_{11} + 16.490X_{12} + 17.502X_{13}) + (-0.597x_{21} - 14.946x_{22} - 15.709x_{23} + 0.120x_{24} - 0.969x_{25} + 16.129x_{26} + 0.306x_{27})$$

Therefore, the model from the given tabular data is,

$$a = 17.854 + (14.219 X_{11} + 16.490 X_{12} + 17.502 X_{13}) + (-0.597 X_{21} - 14.946 X_{22} - 15.709 X_{23} + 0.120 X_{24} - 0.969 X_{25} - 16.129 X_{26} + 0.306 X_{27})$$

Conclusion:

All Faculty are not significant & each brand of mobile company is significant

Redmi mobile brand is significant in social media.

One+ mobile brand is significant in social media.

Honor mobile brand is significant in social media.

Sony mobile brand is significant in social media.

Vivo mobile brand is significant in social media.

Oppo mobile brand is significant in social media.

Samsung mobile brand is significant in social media.

Conclusion:

1. Redmi Smartphone's advertisement is most favourite advertisement.
2. most of the student have budget between 10000-15000.
3. 88% student use smartphone & 21% students currently using the Smartphone of Redmi.
4. 67% student of science faculty are using smartphone.
5. In addition to social media, student uses different educational applications like you-tube, chrome, uc-browser etc. to improve their knowledge.
6. Social media is favourite advertisement media.
7. Income and budget are dependent.
8. Faculty and smartphone application related to education are dependent.
9. Mobile brand is dependent on family income level.
10. Mobile changing duration and family income level are dependent.
11. Gender and brand selection of smartphone are independent.

12.Income and occupation of father are independent.

13.Mobile brand use for study is independent on faculty.

14.Male & Female uses Redmi Smartphone in same proportion.

15.Male & Female uses Samsung Smartphone in same proportion.

16.All Faculty are not significant & each brand of mobile company is significant.

Reference

REFERENCE BOOK: -

- Applied Statistics
- Statistical Methods

STATISTICAL SOFTWARE: -

- SPSS SOFTWARE
- MICROSOFT EXCEL
- R-SOFTWARE

USE INTERNET WEBSITE: -

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