

## CHAPTER IV

### RESULTS AND FINDINGS

#### 4.1: Introduction

The data analysis is defined as “a body of methods that help to describe facts, detect patterns, develop explanations and test hypotheses” according to Levine (2007). The purpose of this quantitative study was to determine the level of users' awareness of smartphone security threats and features. On the other hand, it explored the relationship between independent variables (gender, age, educational level, academic specialization and smartphone experience) and dependent variables (level of users' awareness of smartphone security threats and features). The findings of the study are presented in this chapter. First, the descriptive statistical analysis of respondents' distributions is presented. The survey instrument is then evaluated for internal consistency. Then the users' awareness level was measured by using a descriptive analysis (Mean). The hypotheses and corresponding research questions are then evaluated using Pearson correlation. Finally, a summary of the findings is provided.

## 4.2: Descriptive analysis

This section includes the respondent demographics such as gender, age, academic years, academic specializations, as well as smartphone experience, number of smartphones owned, and smartphone network connection capability, how the respondents constantly use their smartphone, and smartphones operating systems. This information was important because it provided detailed data about the smartphone users.

### 4.2.1: Sample Composition by Gender

The gender of the respondents which reported in this research is plotted as shown in Figure 3; males comprise 42% (126 respondents) from the whole sample, While the Female comprise 58% (174 respondents) of the sample, most students at Zawia University are females as Grasgreen (2013) affirmed that more females attend college than males. The representation of sample gender is important because it shows different gender experience on smartphones and the influences associated with the level of security awareness.

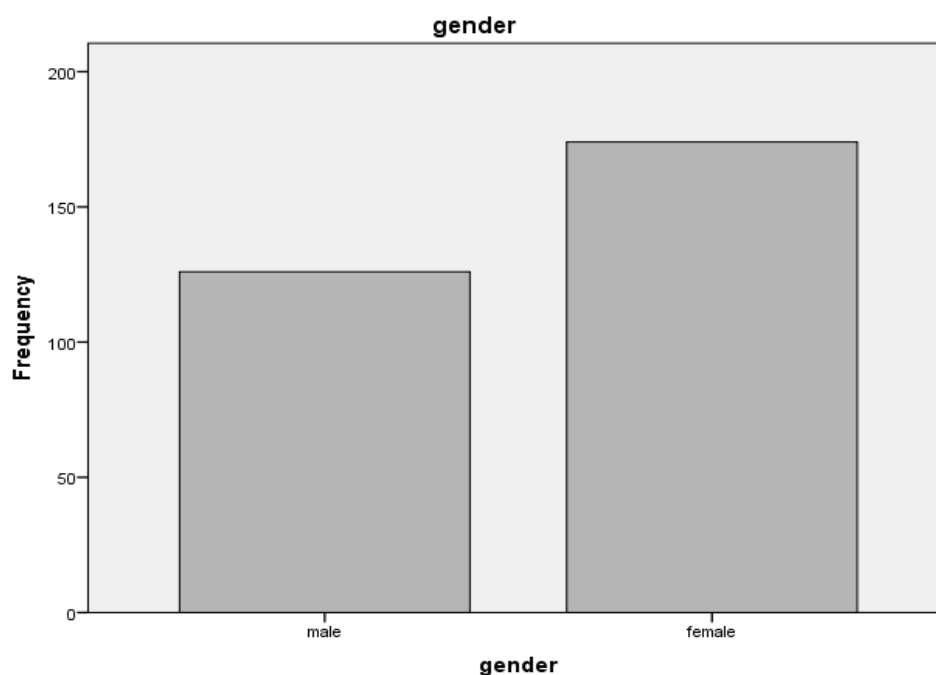


Figure 3: Gender Frequencies of the Respondents (x= gender, y= number of respondents)

#### 4.2.2: Users' Age

The age of smartphone users among Zawia University is reported in Figure 4. Users between the ages of 18-22 years were the highest age group using smartphones with 253 students (84.3%), followed by ages 23- 27 years by 22 students (7.3%), then 28-32 years by 13 students (4.3%), 33 and above years by 12 students (4%) respectively. The results demonstrate that those in the 18-22 age group have the highest percent of smartphone users.

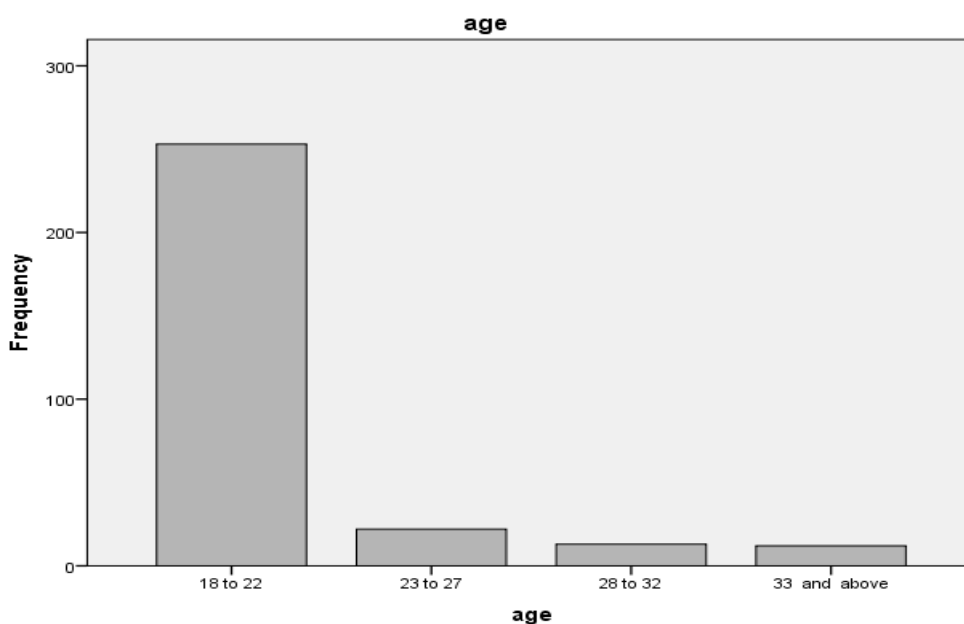


Figure 4: Age Frequencies of the Respondents (x= age group, y= number of respondents)

#### 4.2.3: Educational Level of the Respondents

The education level of the respondents in this research is divided to four academic years. The academic year of the respondents is plotted as shown in Figure 5; the students who study in the first year were 167 students (55%), followed by second year 47 students (15.7%), then a third year comprise 52 students (17.3%), finally the fourth year comprise 36 students (12%) of the respondents. The education level of the respondents is important because it explores the influences of education on the level of smartphone awareness.

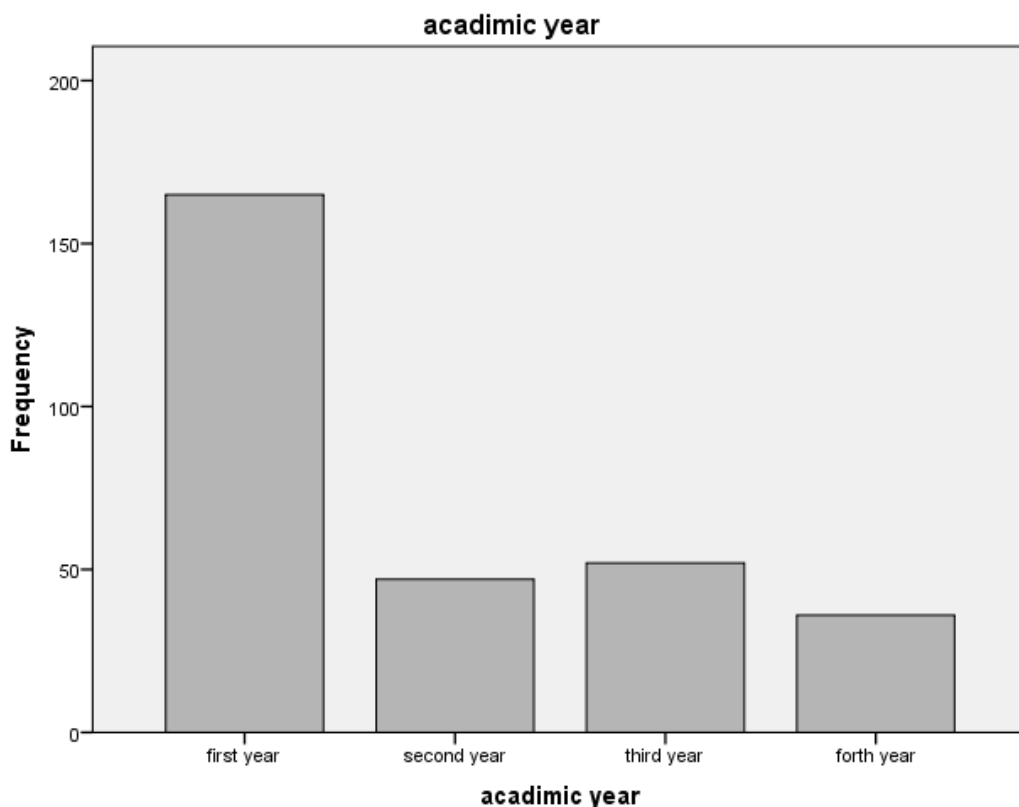


Figure 5: Academic Year Distributions (x= academic year, y= number of respondents)

#### 4.2.4: Academic Specialization of the Respondents

The respondents in this research study in two departments (science and literature). The academic specialization is plotted as shown in Figure 6; the literature department consists of 163 students (54.3%) and the science department consists of 137 students (45.7%). The academic specialization is important because it determines if the respondents majoring in one specialization have a higher level of security awareness than respondents in the other specialization.

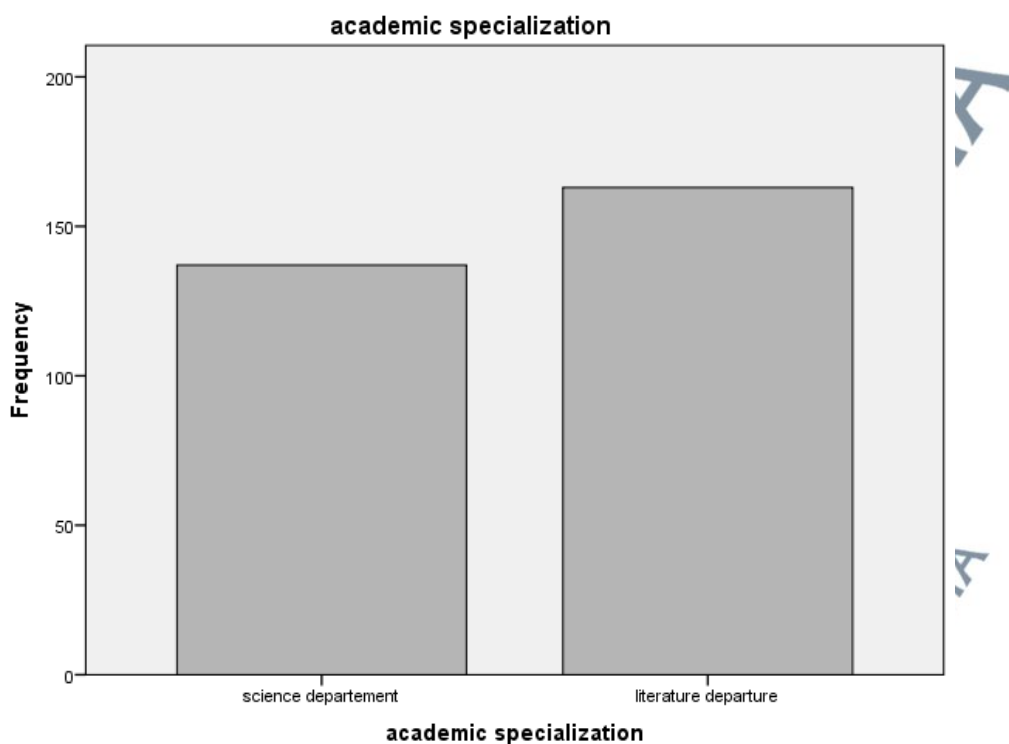


Figure 6: Academic Specialization Frequencies of the Users ( $x$ = specialization,  $y$ = number of respondents)

#### 4.2.5: Smartphone Experience

Smartphone experience section has two questions. The first question queried on years number of smartphone usage, while the second question queried the number of smartphones owned. Results, as shown in Figure 7; show that 30% (90) of the respondents have used smartphones for one year, then 25% (75) of the respondents have used smartphones for two years, 18.3% (55) for three years, 15.3% (46) for four years, lastly the percent of those who used smartphones for five or more years was 11.3% (34) of the respondents.

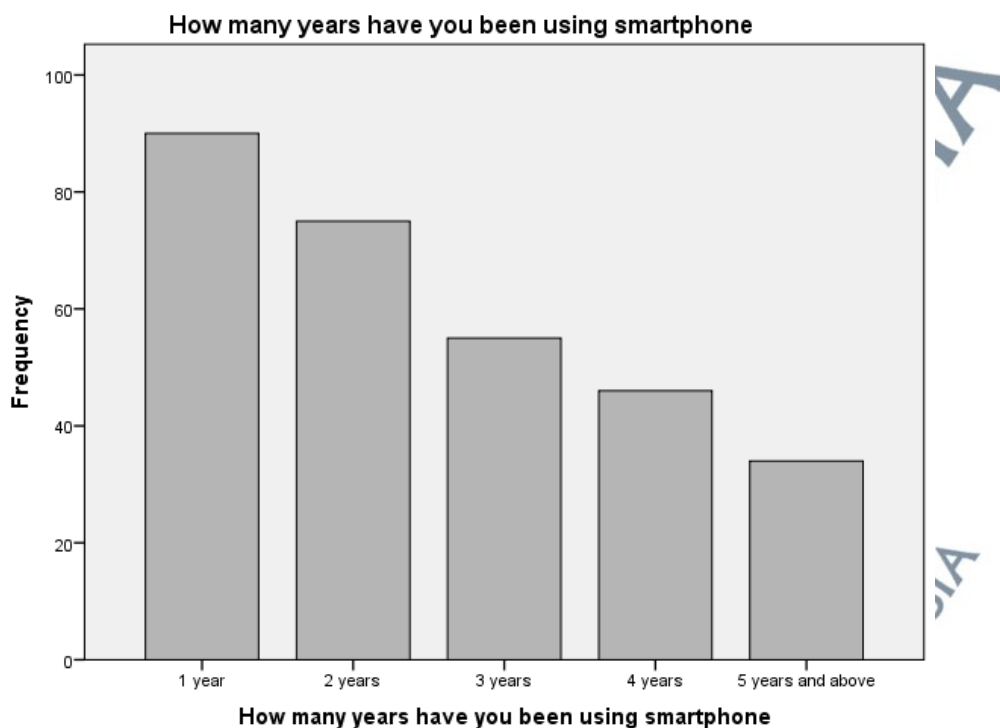


Figure 7: Frequencies of Experience Usage (x= years, y= number of respondents)

The results in the second question were shown in Figure 8; the respondents who have one smartphone are 220 (73.3%) from the whole sample followed by 74 (24.7%) have two smartphones, lastly 6 (2%) of the respondents have three smartphones. These questions are important because they explore the influence of the years of smartphone usage and number of smartphone owned on the level of smartphone security awareness.

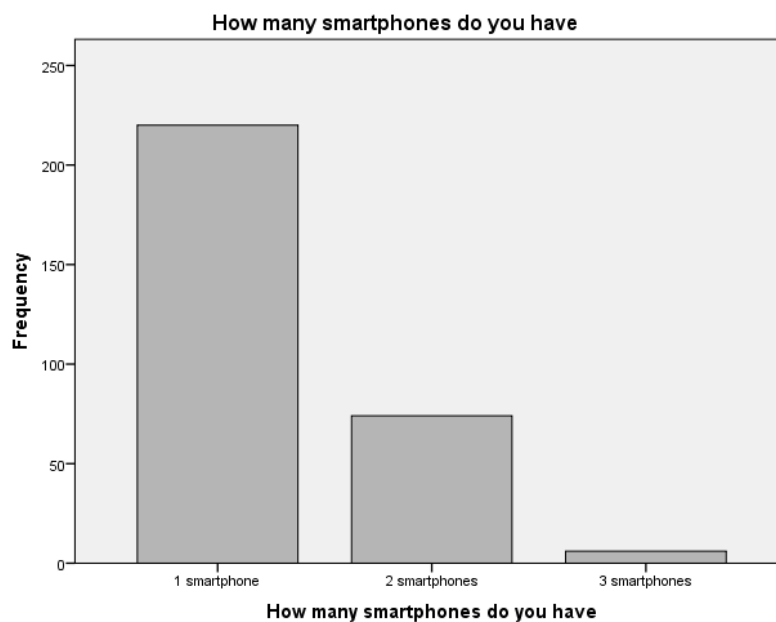


Figure 8: Frequencies of Smartphone Owned (x= number of smartphone, y= number of respondents)

The respondents' smartphone network connection capability was queried in this research, the result is plotted in Figure 9; 57.7% of the respondents has the GPS feature on their device. Then 85.3 % have the WI-FI feature, followed by 69.7% who have the Bluetooth feature, and 71.3 % have mobile networks, finally 3.3% of the respondents were not sure about their smartphone connection capability. The smartphone connection query in this research was important because it explores whether the respondents' exposure to the security threats through their connection to the internet.

The smartphone can transmit voice and data using wireless networks (Wi-Fi), and the Wi-Fi is transmitted through open airwaves and is susceptible to interception because the open airwaves are not entirely secure (Kizza, 2013). The cyber criminals exploit this vulnerability by hacking or breaking into transmissions which lead to

malware infections and data tampering. Cybercrime continues to increase and smartphone users remain vulnerable, when they are not following the information security best practices (CSI, 2013)

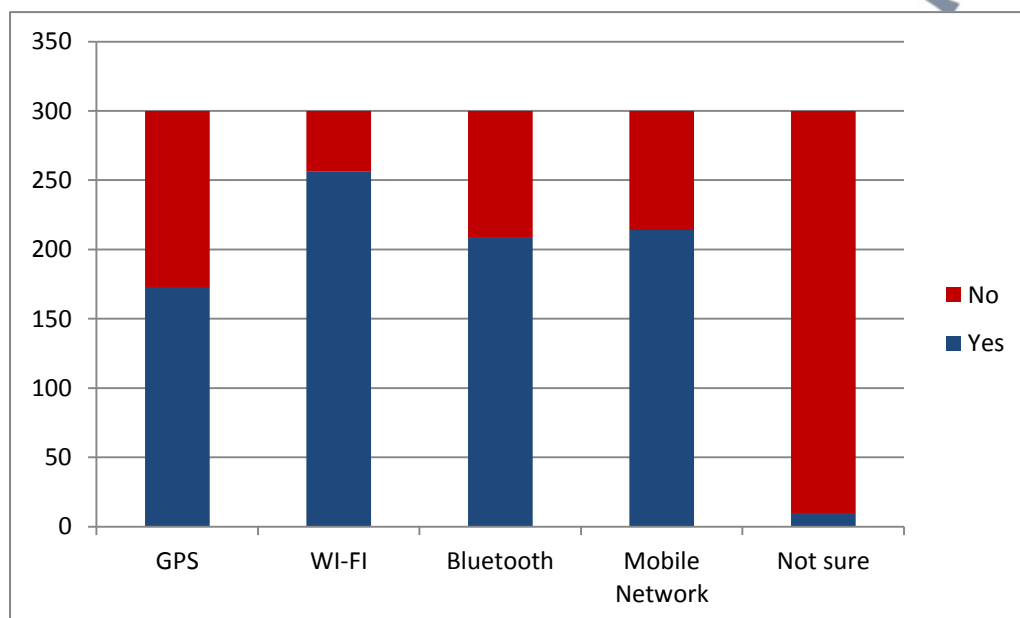


Figure 9: Frequencies of Respondents' Smartphone Network Capabilities (x= network capabilities, y= number of respondents)

#### 4.2.6: Smartphone Usage

The respondents' smartphone usage was queried in this research, the result is plotted as shown in Figure 10, browsing the internet was the most commonly used by the users; where the 279 (93%) of the respondents were using their devices for Browsing the Internet. Followed by Social Networking 250 (83.3%) of the respondents, Taking Pictures 246 (82%) of the respondents, SMS 239 (79.7%) of the respondents, then the Watching Video 203 (67.7%) of the respondents, Playing Games 185 (61.7%), After that Taking Note 179 (59.7%) of the respondents, and the E-mail 169 (56.3%) of the respondents, GPS 102 (34%), then the Preparing Documents 80

(26.7%), and Online Transaction 53 (17.7%) of the respondents. Lastly, three of the respondents mentioned other usage of their smartphones like listening to music and reading the Quran.

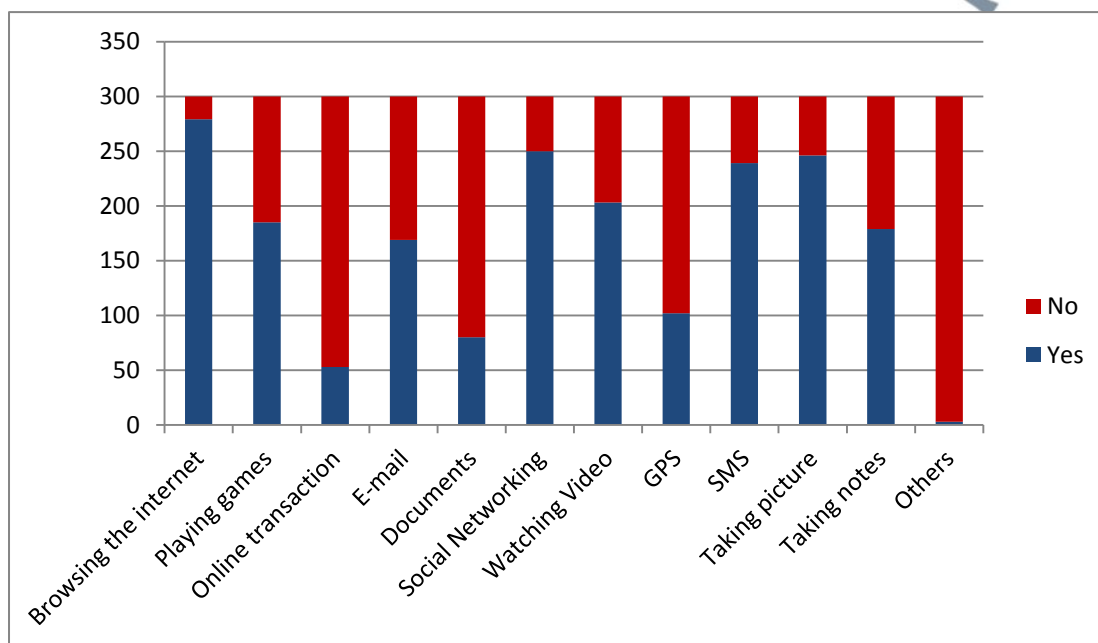


Figure 10: Frequencies of Smartphone Respondents' Usage (x= smartphone usage, y= number of respondents)

#### 4.2.7: The Respondents' Operating System

The operating system of the respondents is plotted as shown in Figure 11, The Android operating system was the most commonly used by the users; 272 (90.7%) of the respondents were using the Android. As Engineers Garage affirmed that Android operating system is one of the most widely used mobile operating system these days. Followed by 14 (4.7%) of the respondents who were using the IOS operating system, Then Symbian, Windows Phone and Rim operating system accounted for (0.7%) of the respondents. 22 (7.3%) of the respondents were not sure about their operating systems.

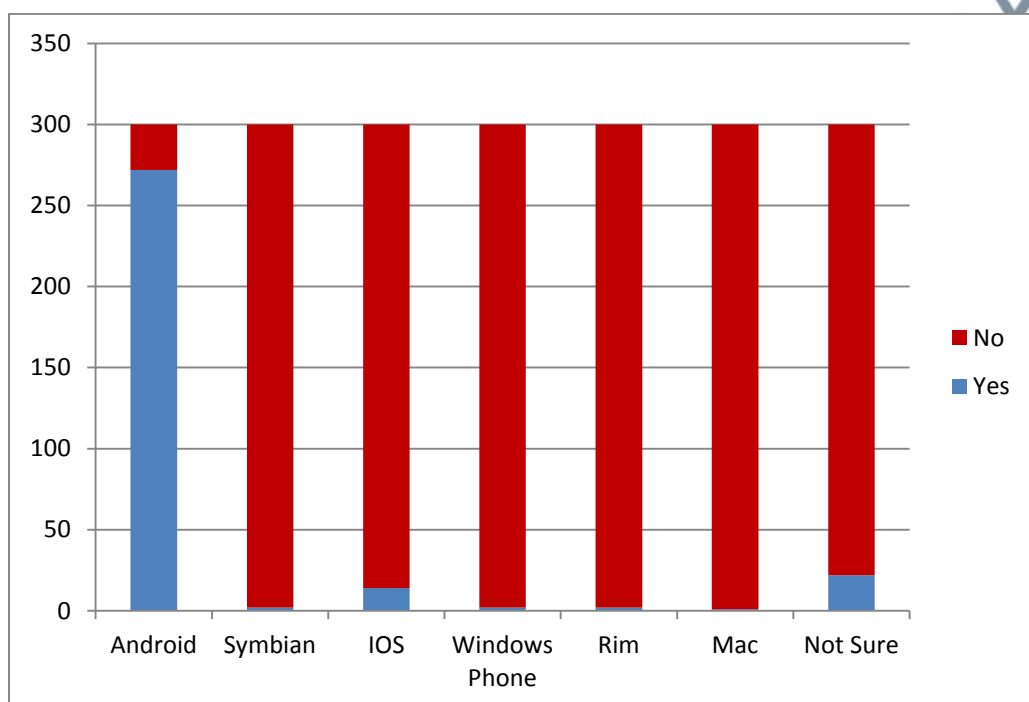


Figure 11: Frequencies of Respondents' Smartphone Operating System (x= operating system, y= number of respondents)

### 4.3: Reliability

There are two main concerns for research studies. There are validity and reliability. The study tested the reliability to ensure the questions were clear, according to Creswell (2008). Neuman (2006) defines reliability, as the consistency or dependability.

The reliability measurement tested the internal consistency of the questionnaire items. This result was extracted by using SPSS 22 software. The reliability of this study calculated by Cronbach's Alpha value of the participants' responses. Using the sample population (N= 300), this measure was 0.781; this has

shown a strong internal consistency. Also cronbach alpha was tested on all parts of the instrument. All of the parts were found to have alpha coefficient values of greater than 0.7, which is an acceptable level of reliability (Hair et al., 2006) as shown in the Table 6.

Table 6: Instrument Reliability

Construct	N of Items	Alpha	Description
All Parts A, B,C	46	.781	The instrument
Part B	25	.762	Security awareness on smartphone features
Part C	10	.748	Security awareness on smartphone threats

#### 4.4: Users' Awareness Level on Smartphone Security Threats

To answer the first research question; **what is the level of students' awareness on smartphone security threats and security features?**, the descriptive analysis (mean) was conducted to come up with the level of users' awareness on smartphone security threats and features. The mean of the respondents' awareness level on smartphone security threats is shown in the Table 7 and Figure 12. The mean was 3.33 and this showed a moderate level of security awareness. It seems that, smartphone users are still not fully aware about the damage that security threats can cause on their personal information. The result in Section (5.2) showed that 44.3% of the respondents still store their personal data on their Smartphone. This situation puts

the educational organizations at risk. As poor security awareness not only exposes an organization to threats, but the entire internet can be compromised (Chen et al, 2006).

Table 7: The Mean of Security Awareness of Smartphone Threats

Statistics		
AThreats		
N	Valid	300
	Missing	0
Mean		3.33
Std. Deviation		.573

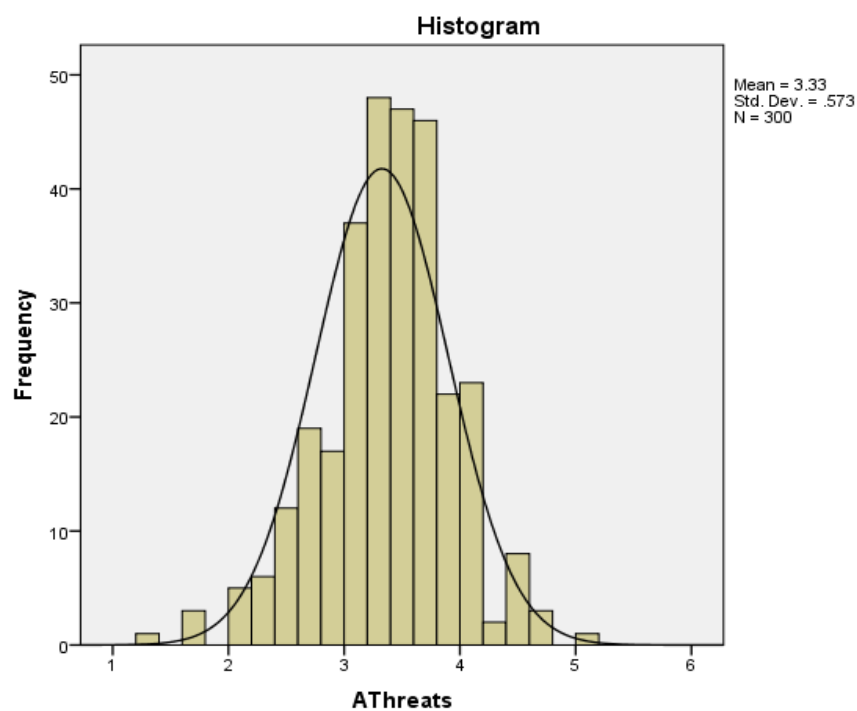


Figure 12: Histogram of awareness level of smartphone threats

#### 4.5: Users' Awareness Level on Smartphone Security features

The descriptive analysis (mean) was conducted to come up with the level of users' awareness of smartphone security features. The mean of the respondents' awareness level on smartphone security features is plotted as shown in Table 8 and in Figure 13. The mean analysis was 3.70 and this showed a moderate level of security awareness. It seems that, the smartphone users do not have sufficient knowledge about the security features on their smartphone which leads to lower the security awareness level on the smartphones. Androulidakis and Kandus (2010) found that that 20% of Smartphone users were aware of anti-virus products, but only half of them use those products. This means that just 10% of users use the security anti-virus. Also, 13% of users were not aware of the feature for data encryption. This makes them more vulnerable to attacks, 25% of males and 30% of females don't know about the PIN feature on their Smartphones.

Table 8: The Mean of Awareness Level on Smartphone Security Features

Statistics		
AFeatures		
N	Valid	300
	Missing	0
Mean		3.70
Std. Deviation		.721

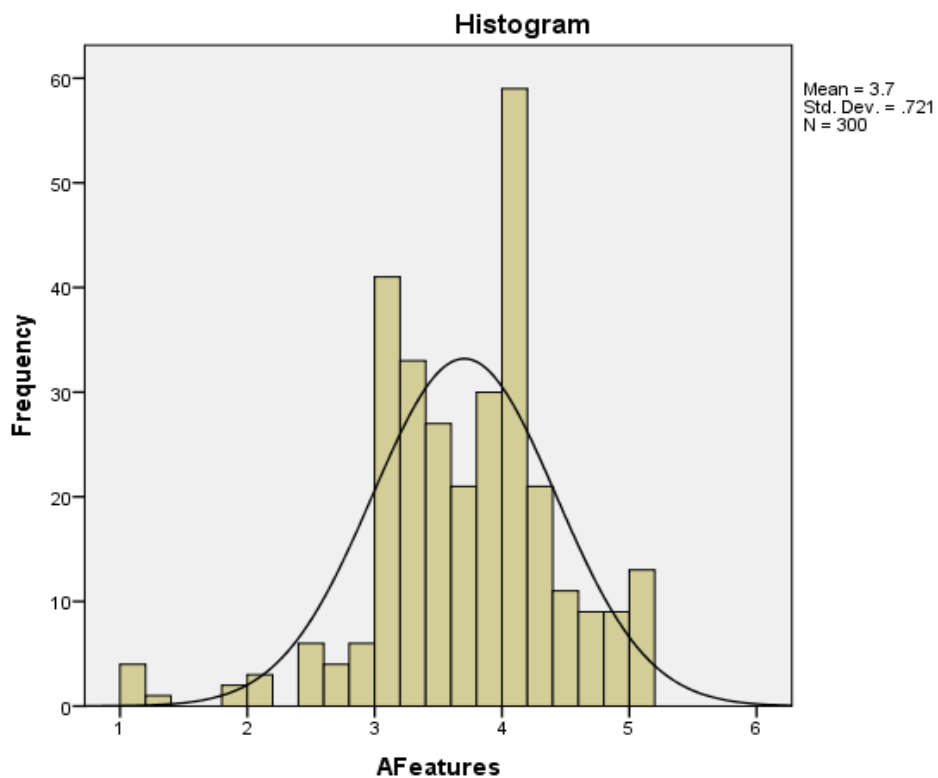


Figure 13: Histogram of Awareness Level of Smartphone Features

#### 4.6: Hypotheses Testing

In order to investigate and answer the second question; **which factor (gender, age, educational level, academic specialization and smartphone experience) that effect on students' awareness of smartphone security threats?**, Pearson correlation was conducted to investigate the relationship between the factors and level of awareness. Furthermore, the One-Way ANOVA was used to validate the hypotheses and to test the level of significance for the factors of the awareness level on smartphone security threats at the significant level of 0.01. These statistical tools were considered suitable because they provided a clear understanding of the influences that constrained awareness level based on its reliability. The second research question has six sub hypotheses as follows:

Q2- Which factors (gender, age, educational level, specialization and smartphone experience) that affect the students' awareness level on smartphone security threats?

H<sub>10</sub>: There is no relationship between gender and users' awareness level on smartphone security threats.

H<sub>11</sub>: There is a relationship between gender and users' awareness level on smartphone security threats.

The Pearson correlation two-tailed analysis were conducted to determine the relationship between the gender and level of user awareness on smartphone security threats. The awareness level shows a significance value of .453 and correlation of -.044. This is a slight negative correlation. And the relationship is so small as to be

negligible, according to Table 9. However, the  $p$ -value for this correlation was  $p = .01$ . Since the  $p$ -value  $> .01$ , there does not appear to be a correlation between the awareness level and gender. The null hypothesis was not rejected.

Some studies showed a difference in awareness level between males and females (Androulidakis and Kandus, 2010). Based on the results, the gender factor does not affect awareness level. This may be due to the increase of the Internet and smartphone usage among females. Also increase the participation of females in business activities in Libyan society. These reasons lead to an increase in the level of awareness among females.

Table 9: Remarks on the Degree of Correlation Coefficient (Burn, 2000)

Absolute Value of Correlation Coefficient	Remarks on Correlation	Nature of Relationship
0.90-1.00	Very high correlation	Very strong relationship
0.70- 0.90	High correlation	Marked relationship
0.40- 0.70	Moderate correlation	Substantial relationship
0.20- 0.40	Low correlation	Weak relationship
Less than 0.20	Slight correlation	Relationship so small as to be negligible

For further analysis, one-way ANOVA was used to explore if there is difference between the mean of the participants' responses, depending on the gender. The (ANOVA  $p = .453$ ) then conclude that there are no differences between the mean of the participants' responses, depending on the gender of the users.

This aligns with Riola (2014) that affirmed there was no correlation between the gender and security level. If gender influences the security awareness, then training programs could be adjusted accordingly. Some studies identified females to be more conservative in their security (Jones, et al., 2012) while other studies identified males as more conservative security practitioners (Mensch, et al., 2011).

H<sub>20</sub>: There is no relationship between age and users' awareness level on smartphone security threats.

H<sub>21</sub>: There is a relationship between age and users' awareness level on smartphone security threats.

The research is inconclusive regarding a correlation between age and security (Mensch et al., 2011 and Riola, 2014). The Pearson correlation two-tailed analysis was conducted to determine the relationship between the age and level of user awareness on smartphone security threats. The awareness level shows a significance value of .017 and correlation of  $-.137^*$ . This is a slight negative correlation. And the relationship is so small as to be negligible. However, the p-value for this correlation was  $p = .01$ . Since the  $p$ -value  $> .01$ , there does not appear to be a correlation between the awareness level and age. The null hypothesis was not rejected.

One-way ANOVA is used to explore if there is a difference between the mean of the participants' responses, depending on the age. The (ANOVA  $p = .025$ ) concludes that there are differences between the mean of the participants' responses, depending on the age of the users. This may be due to differences in security knowledge between target age groups. It may affect their security awareness level.

H3<sub>0</sub>: There is no relationship between educational level and users' awareness level on smartphone security threats.

H3<sub>1</sub>: There is a relationship between educational level and users' awareness level on smartphone security threats.

The Pearson correlation two-tailed analysis was conducted to determine the relationship between the educational level and level of user awareness on smartphone security threats. The awareness level shows a significance value of .327 and correlation of -.057. This is a slight negative correlation. And the relationship is so small as to be negligible. However, the  $p$ -value for this correlation was  $p = .01$ . Since the  $p$ -value  $> .01$ , there does not appear to be a correlation between the awareness level and age. The null hypothesis was not rejected.

For further analysis, one-way ANOVA was used to explore if there is difference between the mean of the participants' responses, depending on the educational level factor. The (ANOVA  $p = .342$ ) then conclude that there are no differences between the mean of the participants' responses, depending on the gender of the users.

H4<sub>0</sub>: There is no relationship between academic specialization (major) and users' awareness level on smartphone security threats.

H4<sub>1</sub>: There is a relationship between academic specialization and users' awareness level on smartphone security threats.

The studies were inconclusive regarding a correlation between the specialization and smartphone security. Some studies found a correlation between the major and smartphone security (Androulidakis, et al., 2010) (Mensch, et al., 2011). On the other hand, other studies found no correlation between major and smartphone security (Grajek, 2013). The Pearson correlation two-tailed analysis was conducted to determine the relationship between the specialization and level of user awareness on smartphone security threats. The awareness level shows a significance value of .663 and correlation of -.025. This is a low negative correlation. And the relationship is weak. The  $p$ -value for this correlation was  $p = .01$ . Since the  $p$ -value  $> .01$ , there does not appear to be a correlation between the awareness level and specialization. The null hypothesis was not rejected.

The (ANOVA  $p = .663$ ) concludes that there are no differences between the mean of the participants' responses, depending on the specialization of the users. A summary of one-way ANOVA test is included in Appendix B.

H5<sub>0</sub>: There is no relationship between smartphone experience and users' awareness level on smartphone security threats.

H5<sub>1</sub>: There is a relationship between smartphone experience and users' awareness level on smartphone security threats.

The Pearson correlation two-tailed analysis was conducted to determine the relationship between the smartphone experience and level of user awareness on smartphone security threats. The awareness level shows a significance value of .013 and correlation of .143\*. This is a slight positive correlation. And the relationship is so small as to be negligible. However, the  $p$ -value for this correlation was  $p = .01$ . Since the  $p$ -value = .01, there does appear to be a correlation between the awareness level and smartphone experience. The null hypothesis was rejected.

For further analysis, one-way ANOVA was used to explore if there is difference between the mean of the participants' responses, depending on the smartphone experience factor. The (ANOVA  $p = .005$ ) then conclude that there are differences between the mean of the participants' responses, depending on the smartphone experience of the users.

#### **4.7: Correlation between Students' Awareness level on Smartphone Security Features and Students' Awareness Level on Smartphone Security Threats**

In order to investigate and answer the third question; there are relationship between the students' awareness level on smartphone security threats and their awareness level on smartphone security features?. The Person correlation (two-tailed) was conducted to measure the relationship between them. The result showed a significance value of .000 and the Person correlation of .587\*\*. This showed a moderate correlation and substantial relationship.

#### 4.8: Research Findings

From the questionnaire of the study some findings were extracted. Summary of research finding as showed in the Table 10.

Table 10 : Sammary of research finding

Finding No	
Finding 1 Q11 and Q 27	62% of the respondents know feature of smartphone password, But 41% don't willing to use of this feature.
Finding 2 Q12 and Q 29	59.3% of the respondents know the SIM PIN code on their smartphones, But 48.6% do not willing to use this feature.
Finding 3 Q13, Q19 and Q28	66.6% of the respondents know the existence of Smartphone security software, But just 51.4% use these softwares. Also, 33.4% of them do not willing to use these security softwares.
Finding 4 Q14	55.3% of the respondents do not know the Smartphone's speak password.
Finding 5 Q15 and Q 31	76.3% of the respondents know the screen lock of their smartphone, But 33.4% do not willing to use this feature.
Finding 6 Q16 and Q 30	60.4% of the respondents know the SIM card lock on their Smartphones. But 44.7% do not willing to use this feature.
Finding 7 Q17 and Q 22	60% of the respondents know the existence of Smartphone malicious software. And 23.7% of them were attacked by malicious programs.
Finding 8 Q18 and Q 20	70.4% do not know the term of phishing means, Also, 54.3% of the respondents consider applications in the official application repository to be secure for installation on their Smartphones.

Finding 9 Q21 and Q 26	57.3% of the respondents were concerned about their personal data. But still 44.3% of the respondents store their personal data on their Smartphone.
Finding 10 Q 23 and Q 25	36.3% of the respondents do not know the privacy setting on their Smartphone. Also, 78.7% do not know the IMEI number of their smartphones.
Finding 11 Q24 and Q 32	52 % of the respondents do not willing to use the file encryption mechanism. Although 50.3% of the respondents do not know the Smartphone protection mechanisms such as file encryption, remote file deletion.
Finding 12 Q33 and Q 34	69.4% of the respondents consider the awareness campaigns very important for smartphone users. And 60.3% of them ready to attend awareness campaign programs.
Finding 13 Q35 and Q 36	72.7% of the respondents eager to improve their knowledge about security and privacy and how to protect their smartphone. And 65% of the respondents ready to use the new security features available on their smartphone.
Finding 14 Q 37	70% of the respondents willing to acquire new smartphone increases with new technological properties.

#### 4.9: Evaluation of Findings

It was observed that four independent variables, gender, age, educational level and academic specialization, showed no significant correlation to awareness level on smartphone threats.

To further explore the negative correlation uncovered by the Pearson correlation test for gender, the histograms were examined by gender. Figures 14 and 15 are scatter plots depicting the relationship between gender and security awareness on smartphone security threats.

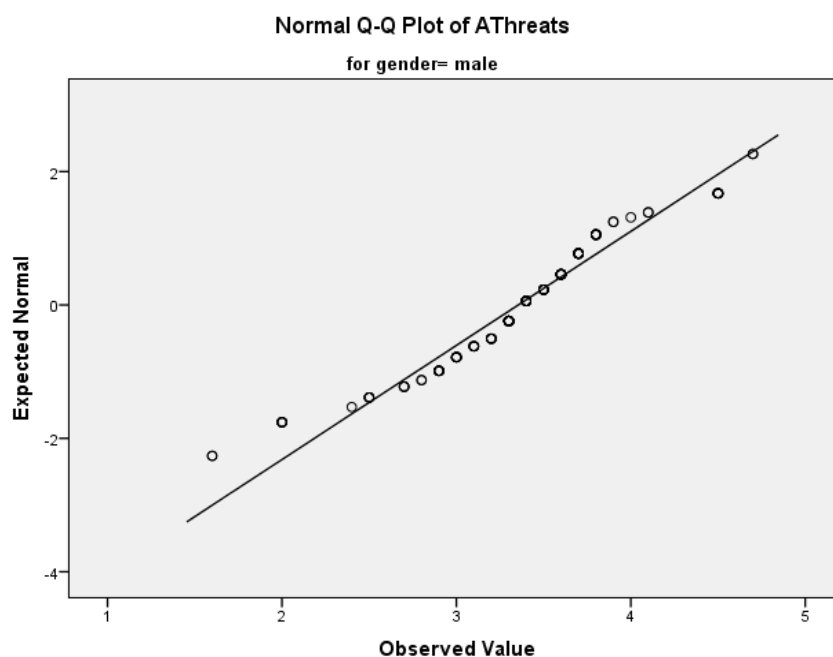


Figure 14: Correlation between security awareness level on smartphone threats

and Males

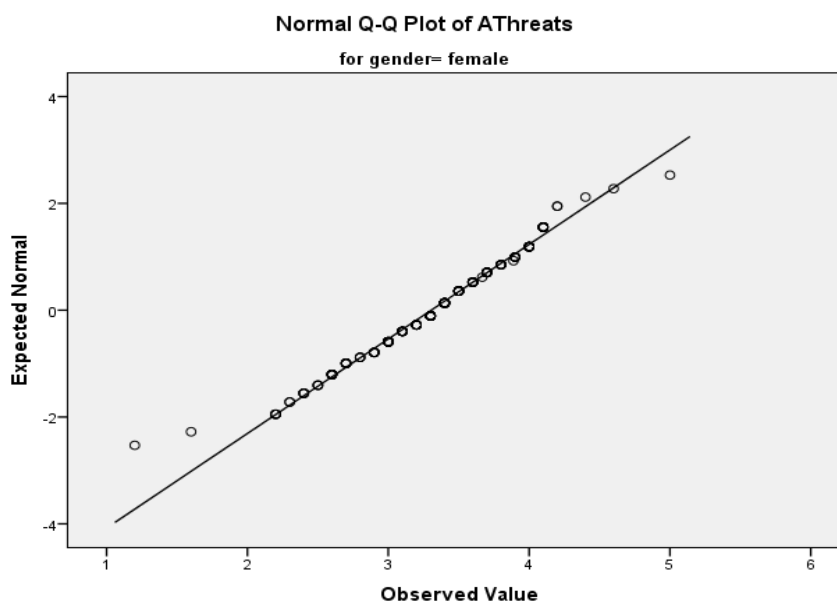


Figure 15: Correlation between security awareness level of smartphone threats and Females

The second independent variable, age group, is not correlated to the security awareness level of smartphone threats. The Pearson correlation test yielded a p-value of .017, which indicates no significant correlation between age group and security awareness level. For further information, the histogram for each group was evaluated in the Figure 16, Figure 17, Figure 18 and Figure 19. Also the histograms of age groups were normally distributed. It is apparent that some age groups had a higher normal distribution than other age groups. The normal distribution has the same overall shape, differing only in mean  $\mu$ . It also ensures that there is no bias to one age group.

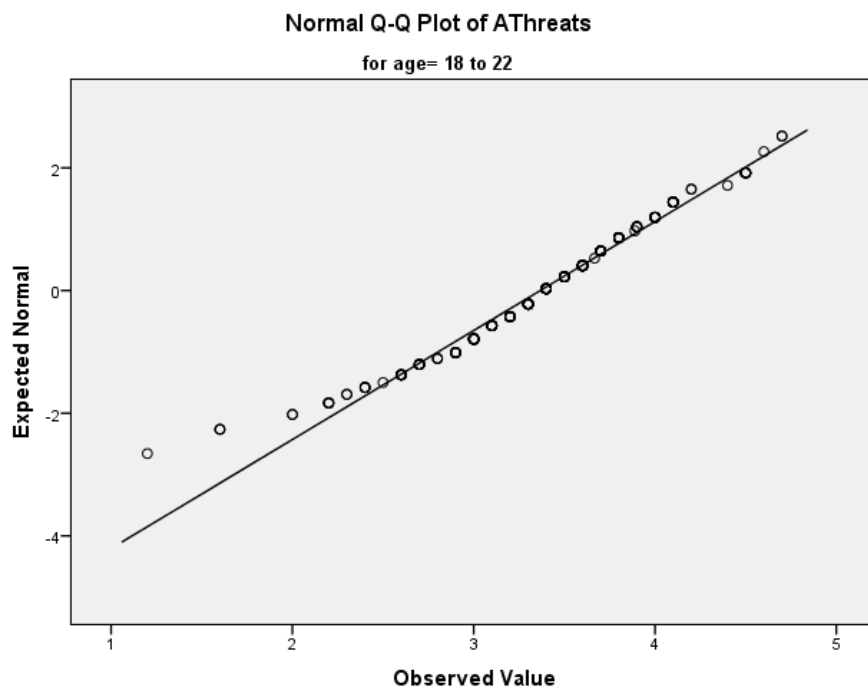


Figure 16: Security awareness &amp; age 18-22

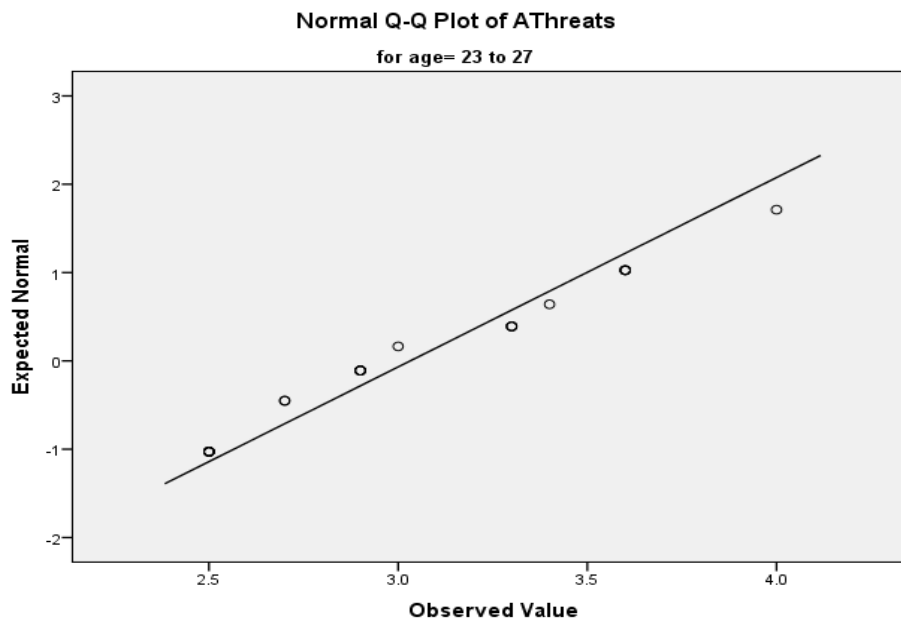


Figure 17: Security awareness &amp; age 23-27

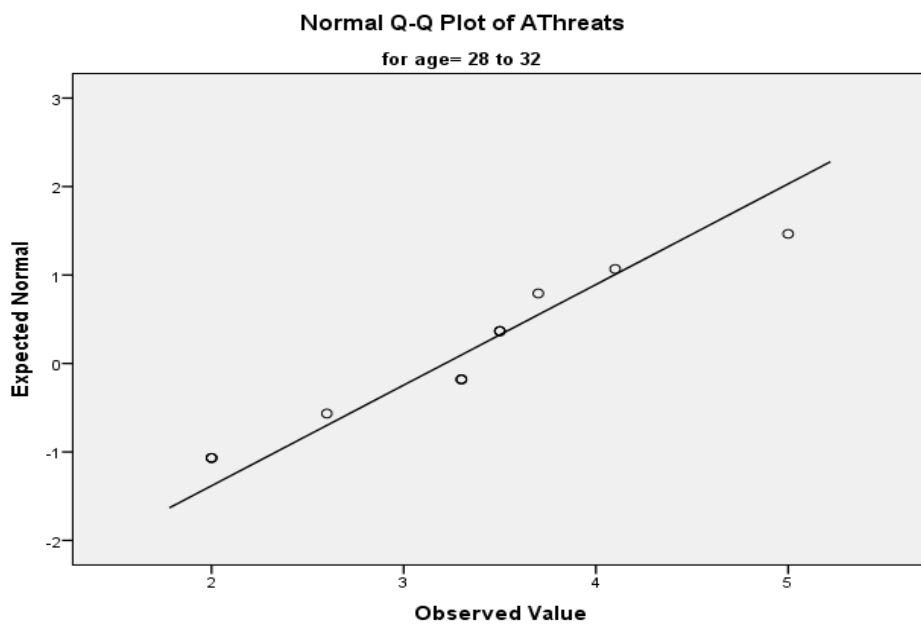


Figure 18: Security awareness & age 28-32

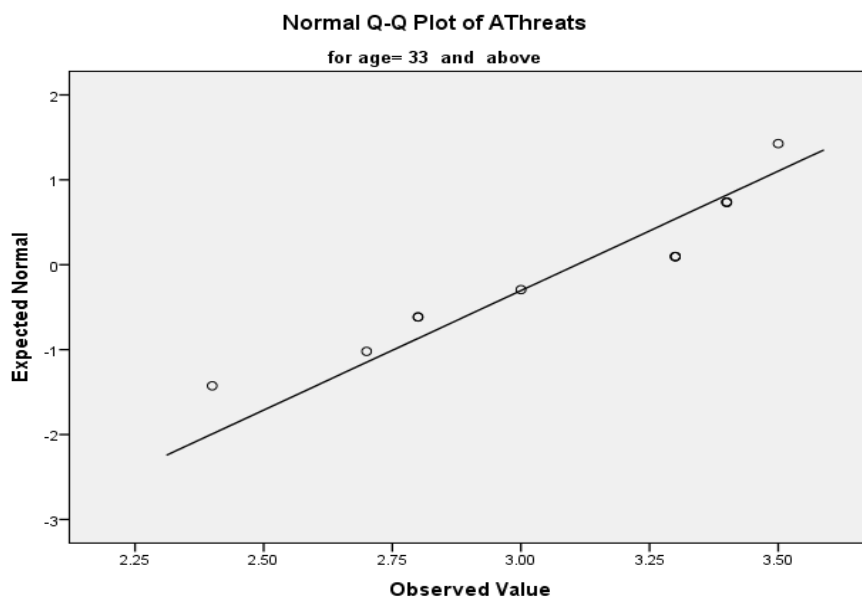


Figure 19: Security awareness & age 33 and above

The third independent variable, educational level, is not correlated to the security awareness level of smartphone threats. The Pearson correlation test yielded a p-value of .327, which indicates no significant correlation between educational level and security awareness level. For further information, the histogram for each level was evaluated in the Figure 20 , Figure 21, Figure 22 and Figure 23. Also the histograms of educational level were normally distributed.

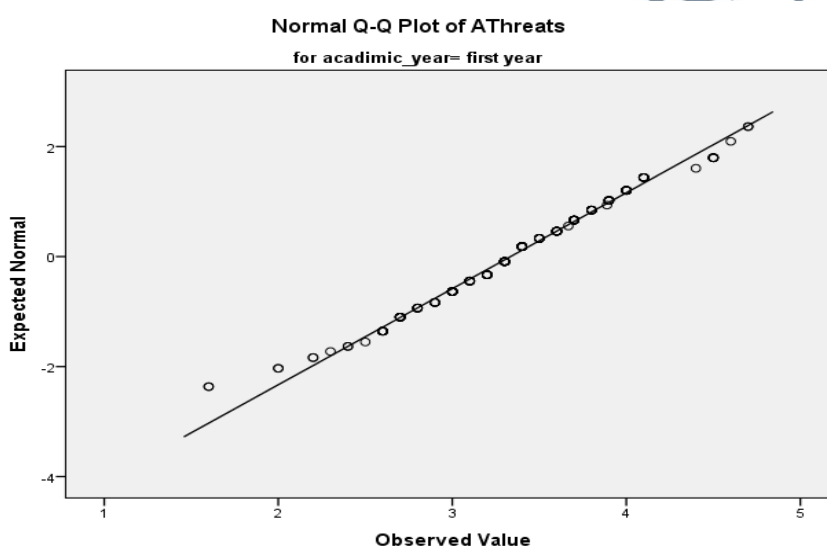


Figure 20: Security awareness & First year

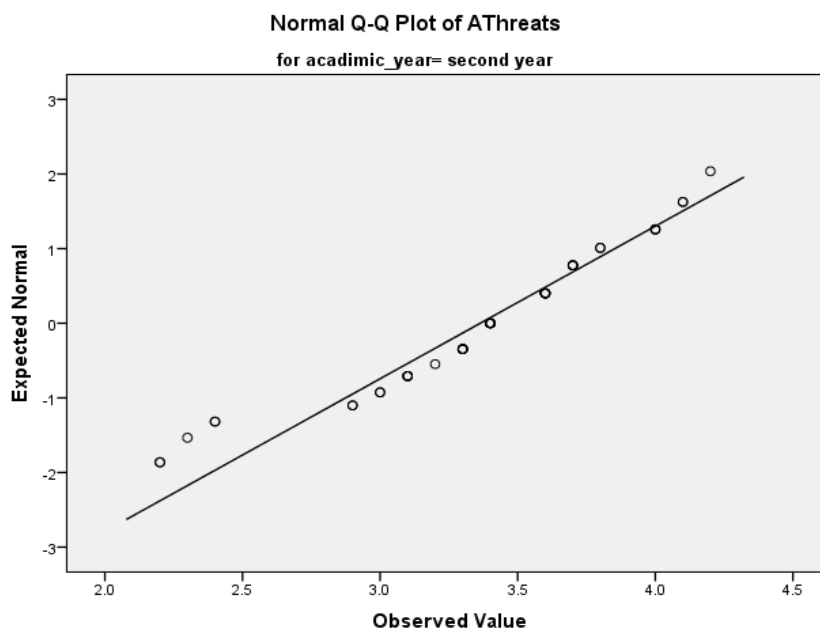


Figure 21: Security awareness &amp; Second year

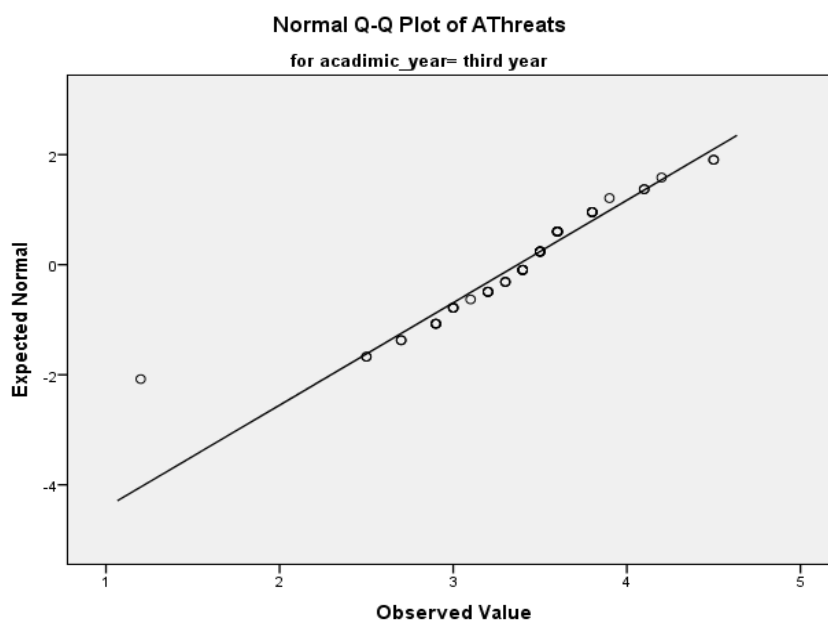


Figure 22: Security awareness &amp; Third year

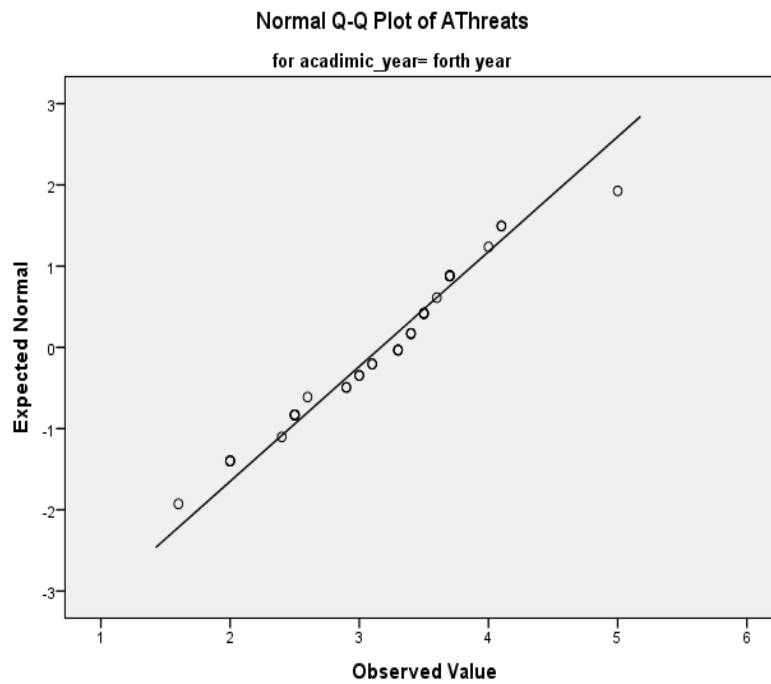


Figure 23: Security awareness & Fourth year

Similarly, there was no correlation found between academic specialization and security awareness level of smartphone threats. Figures 24 and 25 showed the responses on the academic specialization which were normally distributed.

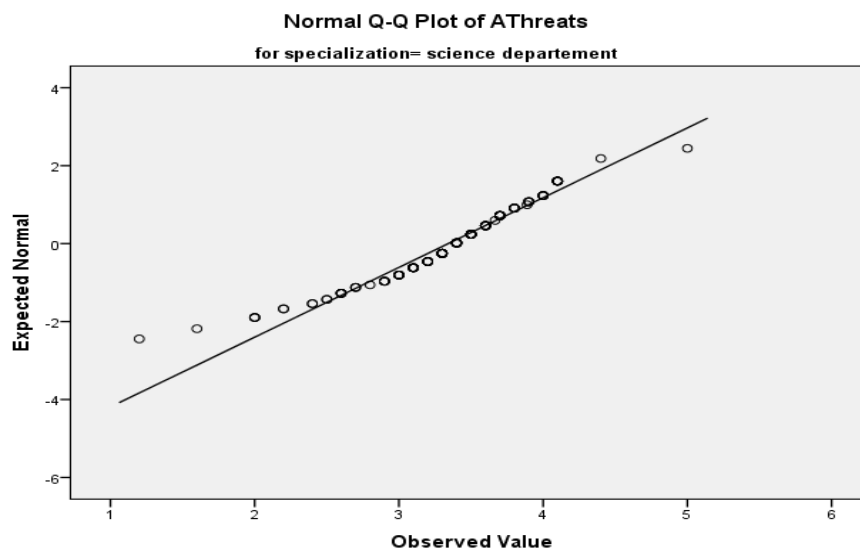


Figure 24: Security awareness & Science specialization

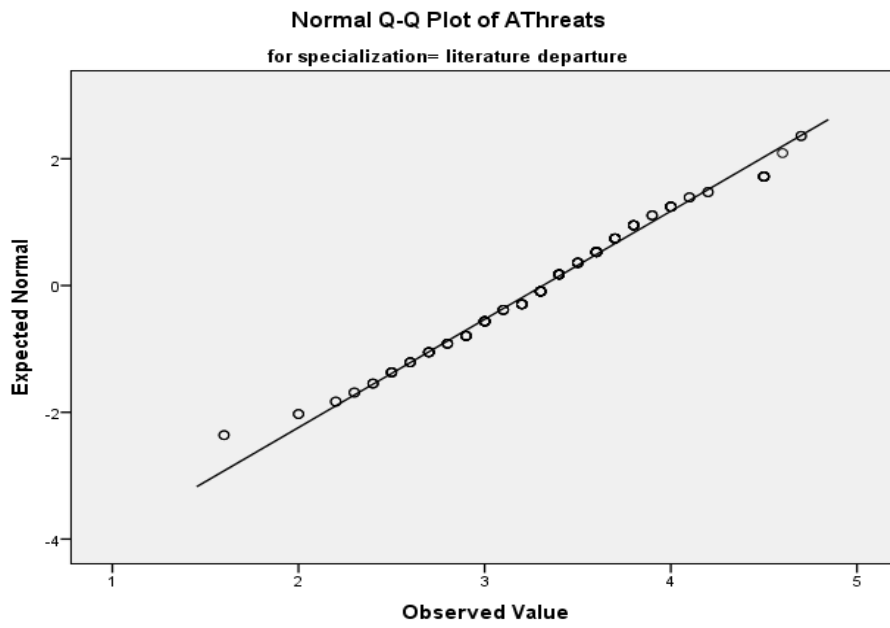


Figure 25: Security awareness & Literature specialization

#### 4.9: Summary

This chapter discusses the results of the data that were drawn from smartphone users in Libya. The analysis of Mean was conducted to measure the students' awareness level on smartphone security threats and security features. The Mean analysis showed a moderate level of users' awareness of smartphone security threats. Also, the awareness level of smartphone security features was a moderate level. The hypotheses were validated and the relationship between variables was determined. The results showed no relationship between (gender, age, educational level and specialization) and awareness level of smartphone security threats. While there was a relationship between smartphone experience factor and awareness level of smartphone security threats. Finally, measure the relationship between (the students' awareness level of smartphone security features and their awareness level of smartphone security threats), the result showed that, there is a substantial relationship between them. And conclude there are a high effect of students' awareness level of smartphone security features on their awareness level of smartphone security threats.