5. Analysis of Data (Content of Paragraph 5.3, Chapter 5)

5.3 Analysis

In total, all 33 learners (100%) of class 2011, and 46 out of a possible 48 learners (96%) of class 2012 completed the pre- and post-m-learning questionnaires. The two years are analysed together, as well as separately. The reporting will include both years, however all statistics for the separate analysis will be presented in Appendix K (see CD-ROM: Supporting Data). The different questionnaires are merged by means of an ID number. Variable names for all questionnaires can be found within the ambit of Appendix J. The items (statements) in the questionnaires will be tested for reliability in the following paragraph.

5.3.1 Reliability of the research instrument

The reliability test (Cronbach's Alpha coefficient) was executed on all the items (statements), which represent the measuring instrument of this survey, with regard to the responses rendered in these questionnaires. It is of importance to note that the 2011 and 2012 surveys were merged to execute the reliability testing displayed in this paragraph. The testing was also separately executed for the two surveys. Due to the voluminous nature of the data the results, as well as the results not discussed, are contained within the ambit of Appendix K (see CD-ROM: Supporting Data).

5.3.1.1 Pre-mobile learning questionnaire

For some of the questions the responses had no variability, and as a result were excluded from the reliability testing. For instance, question A10 had only "Yes" responses and thus is excluded from the Cronbach Alpha test. The results, as represented in Table 5.1 (Appendix H) and Appendix K (see CD-ROM: Supporting Data), indicate that the Cronbach's Alpha coefficients for all the items serving as measuring instrument in the pre-questionnaire, and with the items with no variability excluded are:

- 0.6885 for raw variables, and
- 0.7361 for standardised variables,

which were less than the acceptable level of 0.70 (Nunnally, 1978:248-292). These items are proven not to be reliable and consistent.

The Cronbach Alpha tests indicate the correlation between the respective item and the total sum score (without the respective item), and the internal consistency of the scale (coefficient alpha) if the respective item would be excluded. Therefore, by individually excluding the items (statements) with the highest Cronbach Alpha value, the Alpha value will increase. For example, the reliability of the scale would increase to 0.7123 if for instance question A21 is excluded (see “Alpha” column for Raw Variables in Appendix K (CD-ROM: Supporting Data) for row A21). As a result, the test was executed again with question A21 excluded. Results are shown in Table 5.1 (see Appendix H) and Appendix K - CD-ROM: Supporting Data). Due to the voluminous nature of the data, Table 5.1 is contained within the ambit of Appendix H.

The Cronbach’s Alpha coefficients (Appendix K - CD-ROM: Supporting Data) for all the items serving as measuring instrument in the questionnaire after question A21 was deleted from the analysis are:

- 0.7123 for raw variables, and
- 0.7483 for standardised variables,

which are more than the acceptable level of 0.70 (Nunnally, 1978:248-292). These items are therefore proven to be reliable and consistent.

By excluding for instance question A44 from this analysis, the scale for the pre-m-learning questionnaire (2011 and 2012) becomes more reliable with a Cronbach Alpha coefficient of:

- 0.7290 for raw variables, and
- 0.7563 for standardised variables,

The results of the test are contained within the ambit of Appendix K (see CD-ROM: Supporting Data).

5.3.1.2 First post-mobile learning (post 1) questionnaire

The Cronbach’s Alpha coefficients (see Table 5.2 (Appendix H) and Appendix K - CD-ROM: Supporting Data) for all the items serving as measuring instrument in the questionnaire are:

- 0.9331 for raw variables, and
- 0.9418 for standardised variables,

which are more than the acceptable level of 0.70 (Nunnally, 1978:248-292). These items are therefore proven to be reliable and consistent. Due to the voluminous nature of the data, Table 5.2 is contained within the ambit of Appendix H.

Due to the fact that the items in the first post-m-learning (post 1) questionnaire represent certain latent variables as per the headings, they are each tested for reliability (represent one construct). Table 5.3 shows the Cronbach Alpha values for each of these latent variables.

Table 5.3: Cronbach's Alpha Coefficients for survey measuring instrument of the first post-mobile learning (post 1) questionnaire (2011 and 2012)

Latent variable	Items/Statements included for latent variable	Cronbach's Alpha Coefficient
PERCEIVED USEFULNESS (PU)	P102-P110	0.8172
PERCEIVED MOBILITY VALUE (PMV)	P111-P112	N/A
PERCEIVED SOCIAL INTERACTION VALUE (PSIV)	P113- P114	N/A
PERCEIVED ENJOYMENT (PE)	P115-P117	0.7932
PERCEIVED EASE OF USE (PEOU)	P118-P123	0.7720
ATTITUDE (ATT)	P124-P130	0.7500
PERCEIVED ACCESS BARRIERS (PAB)	P131-P132	N/A
BEHAVIOURAL INTENTION TO USE (BI)	P133	N/A
PERCEIVED OUTPUT QUALITY (POQ)	P134-P140	0.8692

The Cronbach Alpha coefficient was only calculated for those latent variables where there were more than two items, as some of these latent variables were only represented by one or two items.

The Cronbach Alpha coefficient was more than 0.70 for the latent variables with more than one or two items representing them. These items are therefore proven to be consistent. The post-m-learning (post 1) questionnaire has proven to be a reliable measuring instrument.

5.3.1.3 Second post-mobile learning (post 2) questionnaire

The Cronbach's Alpha coefficients (see Table 5.4 (Appendix H) and Appendix K - CD-ROM: Supporting Data)) for all the items serving as measuring instrument in the questionnaire are:

- 0.8453 for raw variables, and
- 0.8796 for standardised variables,

which are more than the acceptable level of 0.70 (Nunnally, 1978:248-292). These items are therefore proven to be reliable and consistent. Due to the voluminous nature of the data, Table 5.4 is contained within the ambit of Appendix H.

Due to the fact that the items in the second post-m-learning (post 2) questionnaire represent certain latent variables as per the headings, they are each tested for reliability (represent one construct). Table 5.5 shows the Cronbach Alpha values for each of these latent variables.

Table 5.5: Cronbach's Alpha coefficients for survey measuring instrument of the second post-mobile learning (post 2) questionnaire (2011 and 2012)

Latent variable	Items/Statements included for latent variable	Cronbach's Alpha Coefficient
USE	P202a-P213h	0.8487
PERCEPTION	P214-P216h	0.6053
ATTITUDE	P217-P225	0.5641

It is evident from the Cronbach Alpha coefficient (Table 5.5) that the 'Use' variable is consistent, however the 'Perception' and 'Attitude' variables are not. After excluding the items with the highest Cronbach Alpha coefficients for the 'Perception' variable (P214, P216b, P216c, P216d and P216h), the resulting Alpha is 0.6508. It therefore seems that the 'Perception' variable is not consistent. After excluding the items with the highest Cronbach Alpha coefficients for the 'Attitude' variable (P223, P224 and P225), the resulting Alpha is 0.7562. The resulting items in the 'Attitude' variable are therefore proven to be consistent.

To examine construct validity of measures adopted in this research study, a principal factor analysis were performed in Paragraph 5.3.5 to assess the underlying structure for the items in both the post 1- and post 2 m-learning questionnaires.

5.3.2 Descriptive statistics

Table 5.6 reflects the descriptive statistics for all the categorical variables in the pre-, post 1- and post 2 m-learning questionnaires for both years (2011 and 2012), measuring respondent perceptions with regard to whether m-learning can bridge the existing learning gap to facilitate technology-based learning in tertiary institutions in developing countries, with the frequencies in each category and the percentage out of the total number of the specific questionnaires completed. It is of importance to note that the descriptive statistics are based on the total sample. In some cases, no answers were supplied, and are reflected as

'unknown' in the descriptive statistics. Due to the voluminous nature of the data, Table 5.6 is contained within the ambit of Appendix I, and the descriptive statistics are contained in Appendix L and Appendix M (see CD-ROM: Supporting Data). It is of importance to note that partially shaded questions in Table 5.6 appeared only in the 2011 survey, shaded questions only in the 2012 survey, and those questions that are not shaded appeared in both the 2011 and 2012 surveys.

The 2011 and 2012 surveys are compared in further paragraphs, and items that resulted in being statistically significant different between these surveys, are then analysed separately in further analysis. The separate sample descriptive statistics (2011 and 2012) are provided in Appendix L (see CD-ROM: Supporting Data).

Table 5.7 shows the descriptive statistics for all the entries made in the learner journals completed by the respondents during 2012. It therefore counts the entries the learners have made, and not the number of respondents. Due to the voluminous nature of the data, Table 5.7 is contained within the ambit of Appendix I.

Table 5.8 shows the descriptive statistics (number of responses, mean, standard deviation, median and range) for all the continuous variables or categorical variables that is ordinal of nature. Due to the voluminous nature of the data, Table 5.8 is contained within the ambit of Appendix I.

5.3.3 Univariate graphs for first and second action research cycles (2011-2012)

5.3.3.1 Pre- and post-mobile learning questionnaires

Learners were required to complete three m-learning questionnaires during the course of their studies with one prior to the implementation of m-learning, and two after the implementation of m-learning. Questionnaires were distributed online and response rates were high (98% for the pre- and post 2 m-learning questionnaires, and 96% for the post 1 m-learning questionnaire). Questions were simple, unambiguous and had a consistent style and consisted of multiple-choice, closed- and open-ended questions (Appendix A, Appendix B and Appendix C). The attention of the reader is drawn to the fact that within a South African context, a mobile phone or smart phone is commonly referred to as a 'cell phone'. Not to deviate from the local (South African) terminology when referring to a mobile phone or smart phone as a 'cell phone', the term 'cell phone' will be retained as not to create confusion with questionnaire respondents and will be used interchangeably with the terms mobile phone and smart phone.

5.3.3.1.1 Pre-mobile learning questionnaire (2011 - 2012)

Prior to being exposed to m-learning in both formal and informal learning contexts during 2011 - 2012, learners (n = 81) were requested to complete an online questionnaire of which some of the questionnaire items were partially adapted from Kreutzer (2009:Online), to gather demographic data, as well as learner responses about their current daily utilisation of mobile technology (mobile phones) and computers both on and off-campus. The current study indicates (as was expected), that nearly all participants had used a mobile phone previously. Overall results obtained from the pre-m-learning questionnaire indicate that the majority of the learners own a mobile phone (92.4%) and/or laptop computer (57.0%), and would like to be able to use mobile technology both inside (on campus - 86.1%) and outside (off-campus - 100%) the classroom as a tool to help them with their tertiary work, as well as that it will make a difference to the quality of their tertiary work both on (78.5%) and off-campus (87.3%). Despite the high percentage of mobile phone owners, none of them (100%) have utilised any form of mobile technology in the past for teaching and learning purposes, and it was therefore their first attempt at a non-traditional mode of teaching and learning. It is also clear that learners are equally comfortable with the use of desktop and mobile technologies to go online/access the Internet, communicate, and perform certain tasks/activities.

- **Demographic information:** Learners come from different backgrounds, e.g. gender, age group, first language, race etc. Each of these is discussed in more detail below.

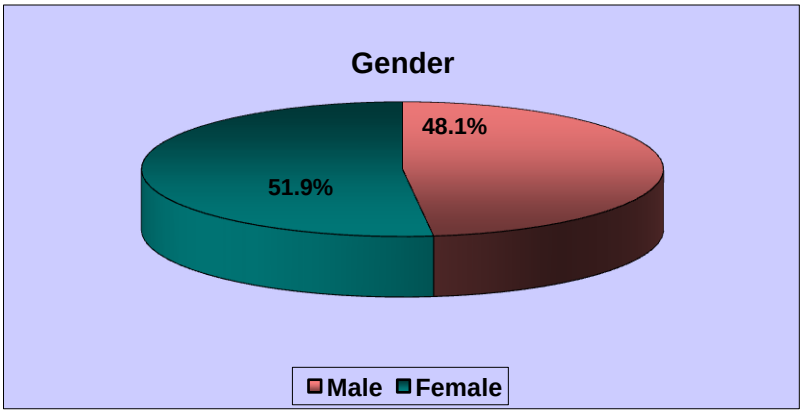


Figure 5.2: Gender distribution

The gender distribution is equal with 51.9% of the respondents being female and 48.1% of the respondents being male (Figure 5.2).

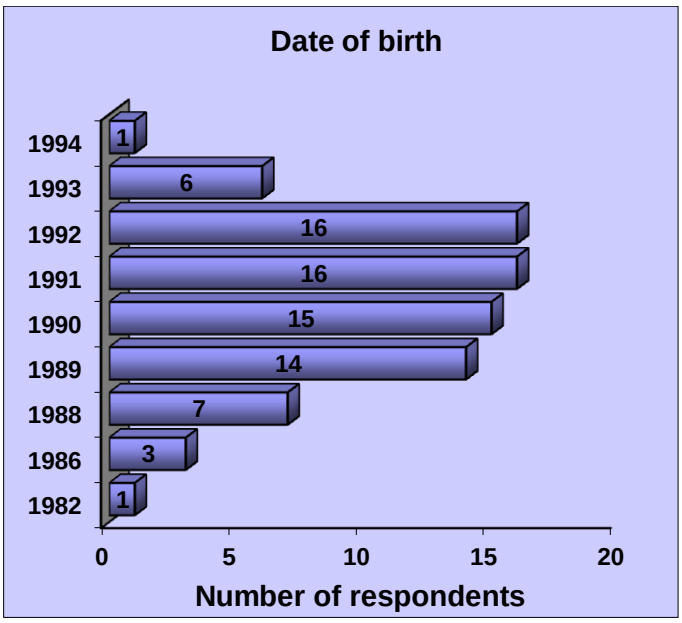


Figure 5.3: Date of birth

Most of the respondents were born in 1992, 1991, 1990 and 1989 (Figure 5.3).

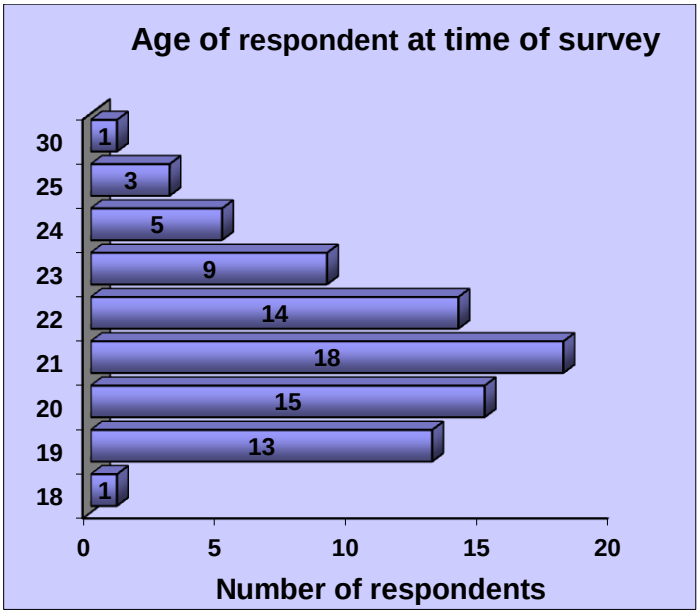


Figure 5.4: Respondent age

Most of the respondents were 21, 20, 22 and 19 years old at the time of the survey (Figure 5.4).

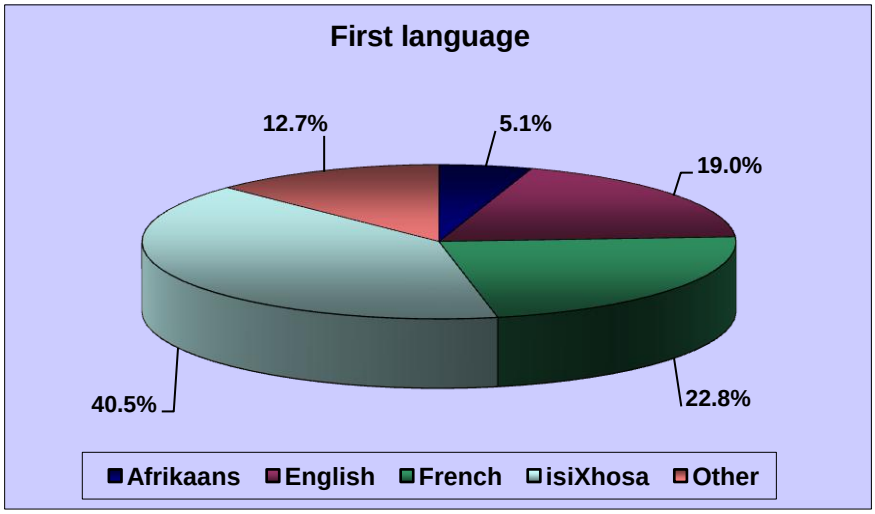


Figure 5.5: First language distribution

Most of the respondents' first language is isiXhosa (40.5%), followed by French (22.8%) and English (19.0%). The 'Other' category consists out of the following languages: Chinese, Igbo, Kimbundo, Portuguese, Sesotho and Zulu. Furthermore, either one or two respondents indicated that their first language is one of the aforementioned languages (Figure 5.5).

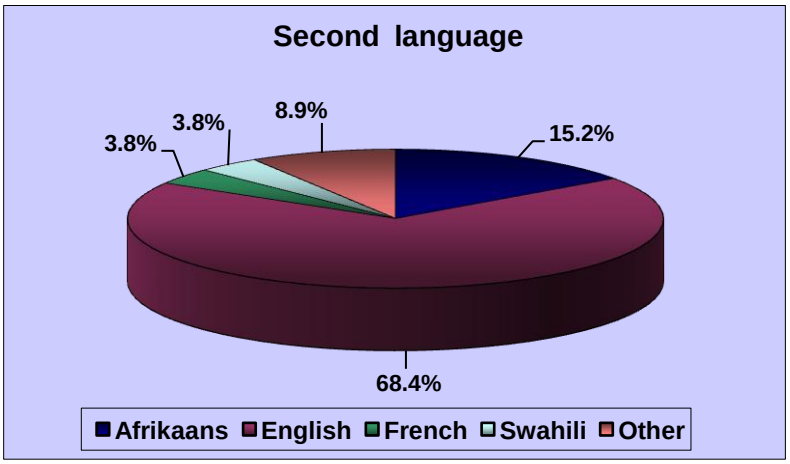


Figure 5.6: Second language distribution

Most of the respondents' second language is English (68.4%) and then Afrikaans (15.2%), followed by 3.8% for both French and Swahili respondents. The 'Other' category consists out of the following languages: Fang, Kigongo, Kimbundo, Lingala, Portuguese, Venda and Zulu.

There were only one respondent each whose second language was indicated as one of the aforementioned languages (Figure 5.6).

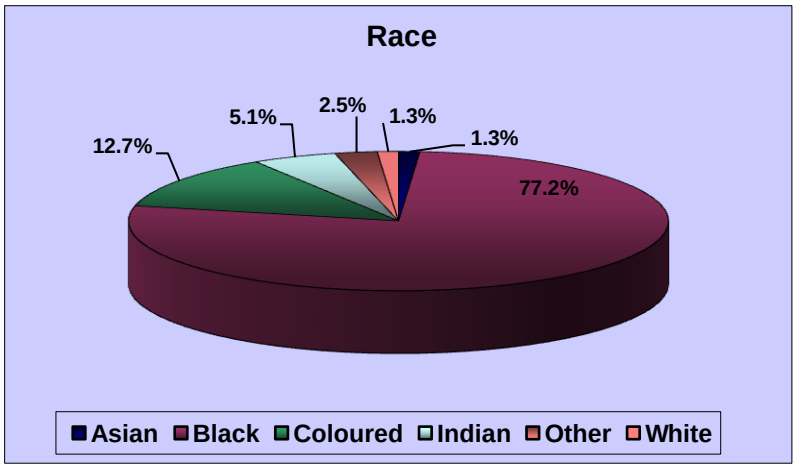


Figure 5.7: Race distribution

Most of the respondents are Black (77.2%), followed by 12.7% Coloured, 5.1% Indian, 1.3% Asian and 1.3% White respondents (Figure 5.7).

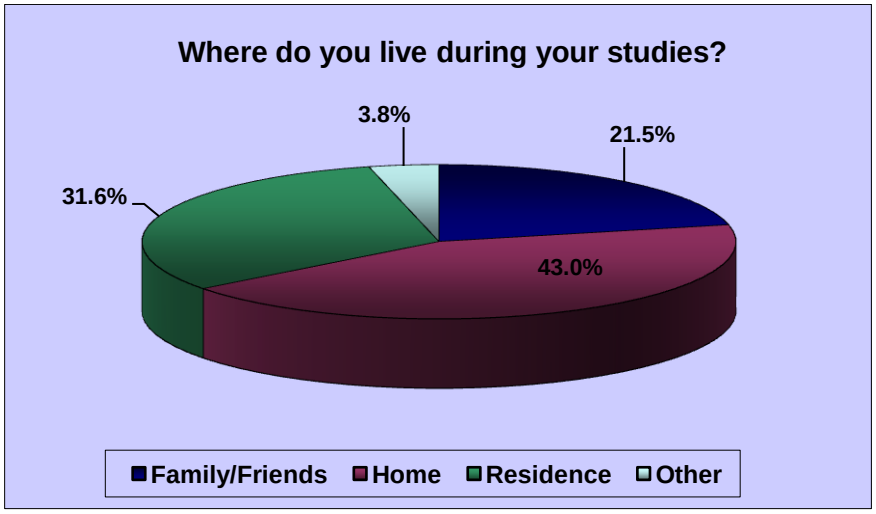


Figure 5.8: Distribution of residence location during studies

Most of the respondents are staying at home (43.0%) or in a university residence (31.6%) during the course of their studies. The remaining respondents are staying with family/friends (21.5%) and 3.8% indicated that they reside at 'Other' locations (Figure 5.8).

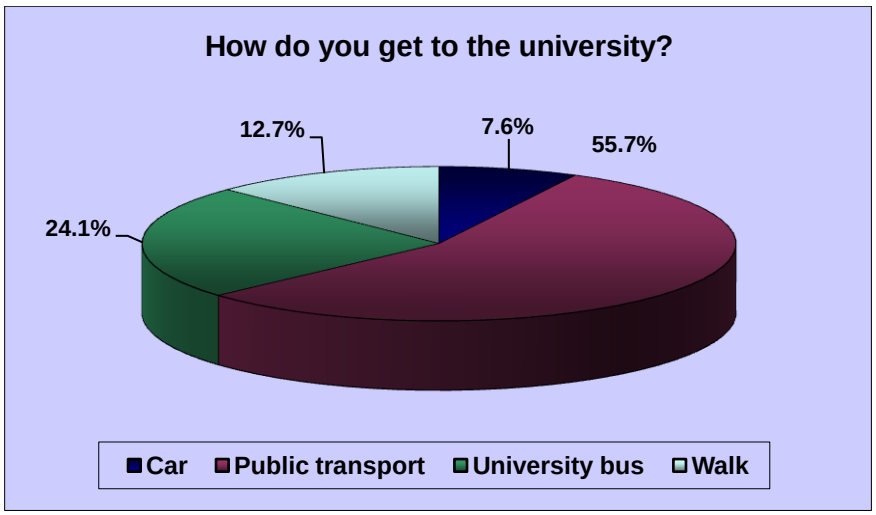


Figure 5.9: Means of commuting to university

Most of the respondents make use of public transport to travel to the university (55.7%) and 24.1% of the respondents make use of a bus supplied by the university (Figure 5.9).

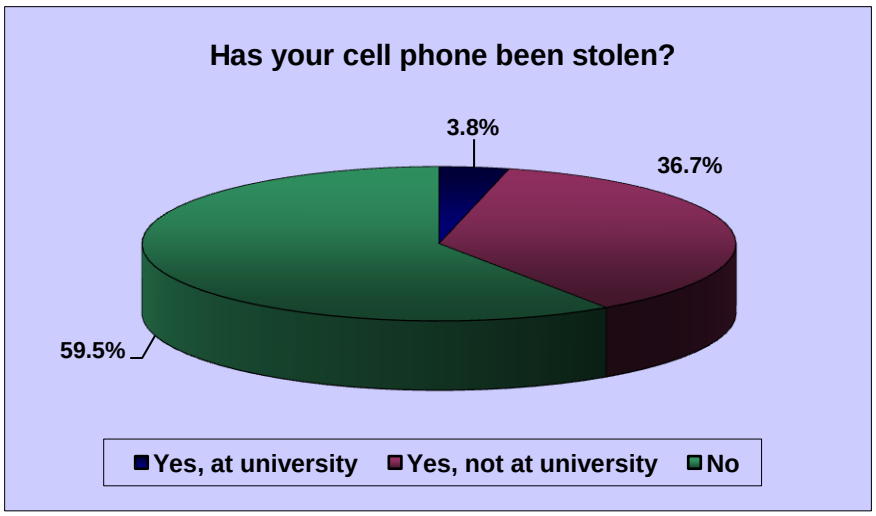


Figure 5.10: Pie chart indicating whether respondent cell phone has been stolen

Most of the respondents indicated that their cell phone has never been stolen (59.5%), however those respondents who indicated that their cell phone has been stolen, it was mostly stolen outside the boundaries of the university (36.7%) (Figure 5.10).

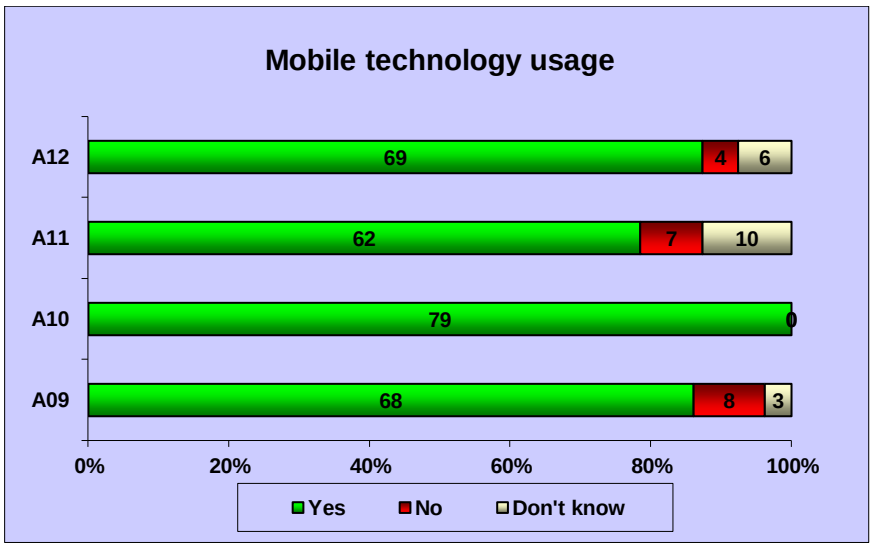


Figure 5.11: Mobile technology usage

In terms of the data reflected in Figure 5.11:

- Of the respondents, 87.3% believe that the use of mobile technology as a tool at home/residence will make a difference to the quality of their university work (A12).
- Of the respondents, 78.5% believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of their university work. It is of importance to note that 12.7% did not know (A11).
- All (100%) of the respondents indicated that they would like to be able to use mobile technology at home/residence as a tool to help them with their university work (A10).
- Of the respondents, 86.1% reported that they would like to be able to use mobile technology in the classroom as a tool to help them with their university work (A09).

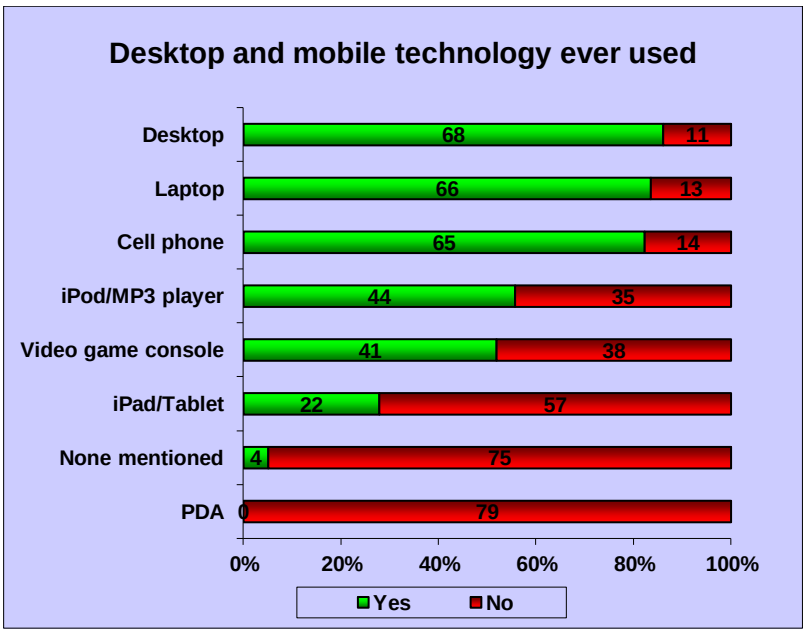


Figure 5.12: Desktop and mobile technology ever used

When the respondents were asked, which desktop and mobile technologies they have used before, the following were indicated (Figure 5.12):

- Desktop computer (86.1%), Laptop computer (83.5%), Cell phone (82.3%), iPod/MP3 player (55.7%), Video game console / handheld gaming device (51.9%), iPad/Tablet (27.8%), and PDA (0%).

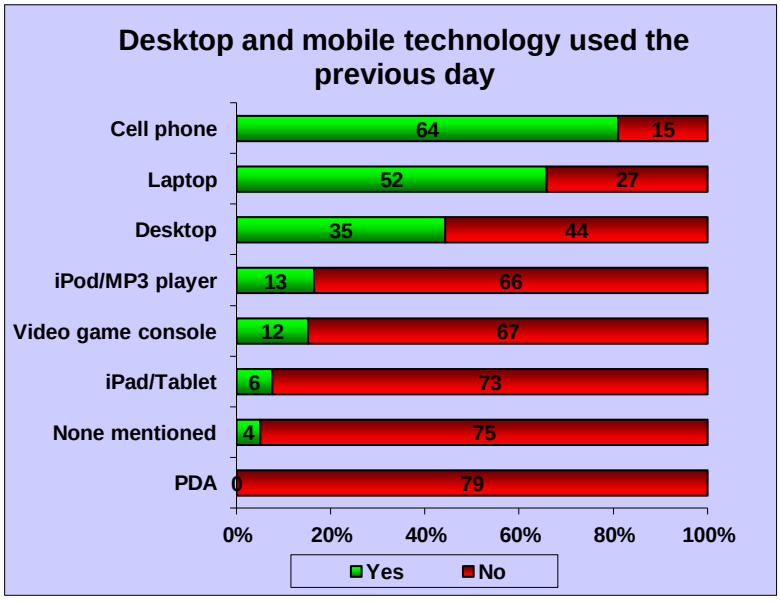


Figure 5.13: Desktop and mobile technology used the previous day

When the respondents were asked, which desktop and mobile technologies they have used the previous day, the following were indicated (Figure 5.13):

- Cell phone (81.0%), Laptop computer (65.8%), and Desktop computer (44.3%).

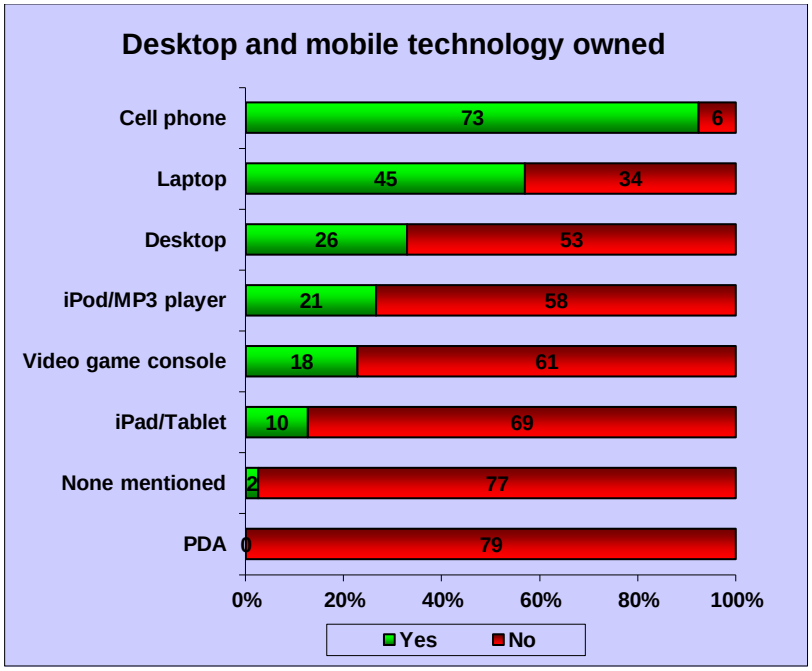


Figure 5.14: Desktop and mobile technology owned

The following desktop and mobile technologies are owned by the respondents (Figure 5.14):

- Cell phone (92.4%), Laptop computer (57.0%), Desktop computer (32.9%), iPad/Tablet (12.7%), and PDA (0%).

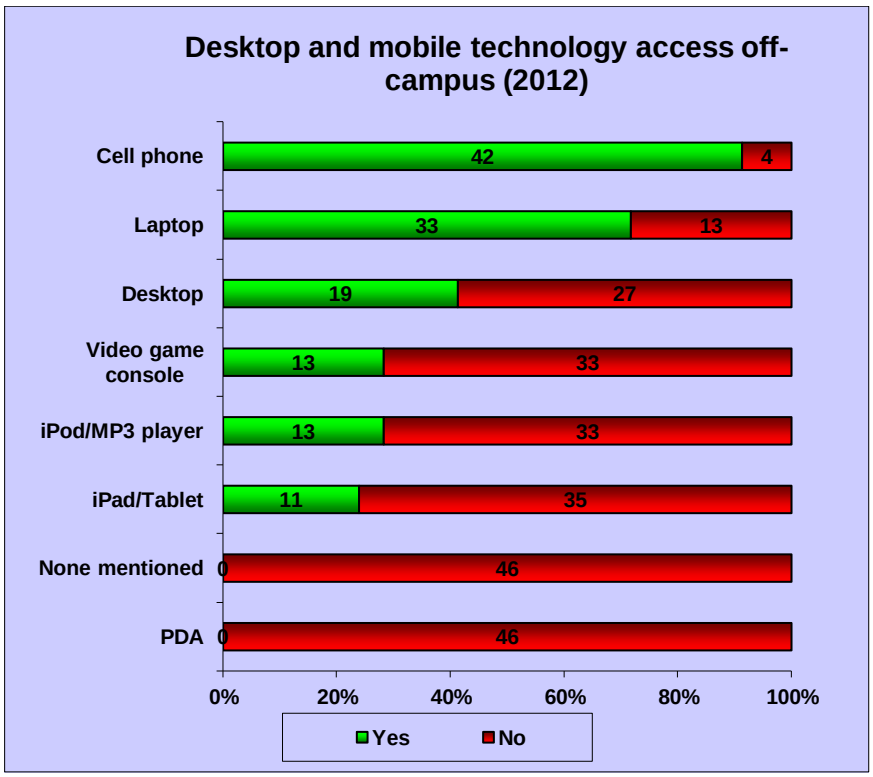


Figure 5.15: Desktop and mobile technology access off-campus (2012)

Respondents from the 2012 m-learning group had access to the following desktop and mobile technologies off-campus (Figure 5.15):

- Cell phone (91.3%), Laptop computer (71.7%), Desktop computer (41.3%), iPad/Tablet (23.9%), and PDA (0%).

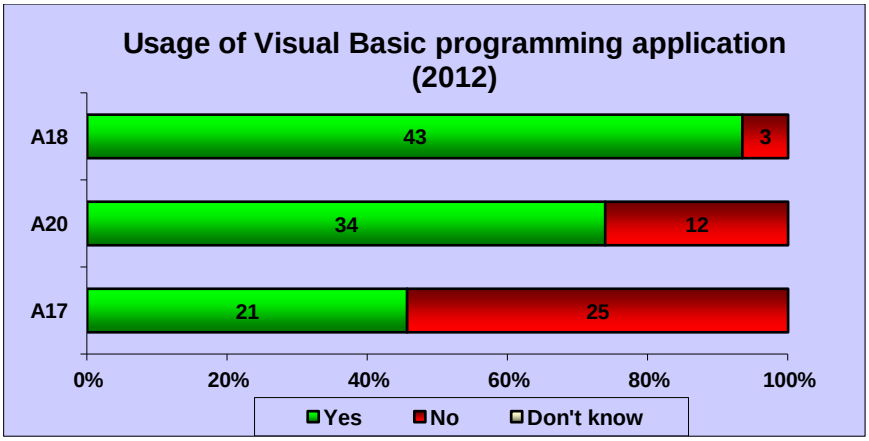


Figure 5.16: Usage of Visual Basic programming application (2012)

In terms of the data depicted in Figure 5.16:

- Of the respondents, 93.5% indicated that off-campus access to Visual Basic computer programming application is important to them (A18).
- Of the respondents, 73.9% indicated that they found it difficult to access university computer laboratories outside Visual Basic computer programming class times (A20).
- Of the respondents, 45.6% indicated that they have access to the Visual Basic programming application off-campus, however upon further investigation it was determined that these were all illegal copies mainly distributed by two learners within the class. This was however of no use to learners, since they were instead using the mobile Basic4PPC software application for the purpose of this research study. This then implies that all learners (100%) are unable to design, compile and execute, as well as electronically submit programming assignments off-campus and are as a result, dependent on campus computer laboratories whose access are not always practical due to time, distance and location constraints (A17).

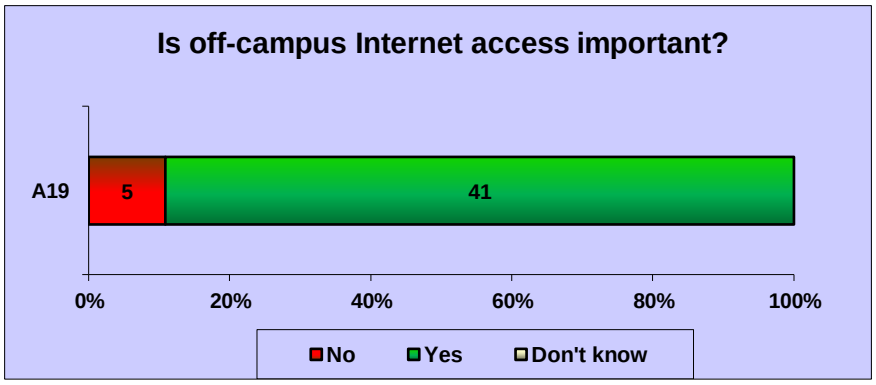


Figure 5.17: Importance of Internet access off-campus

Of the respondents, 89.1% indicated that Internet access off-campus is important to them (Figure 5.17) (A19).

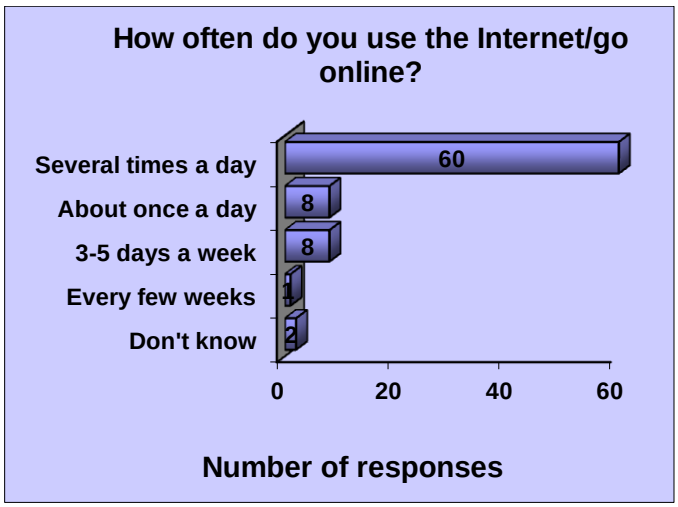


Figure 5.18: Frequency of Internet usage

Of the respondents, 76% use the Internet/go online several times a day. Of the respondents, 10.1% use the Internet about once a day, and 10.1% go online three to five days a week (Figure 5.18).

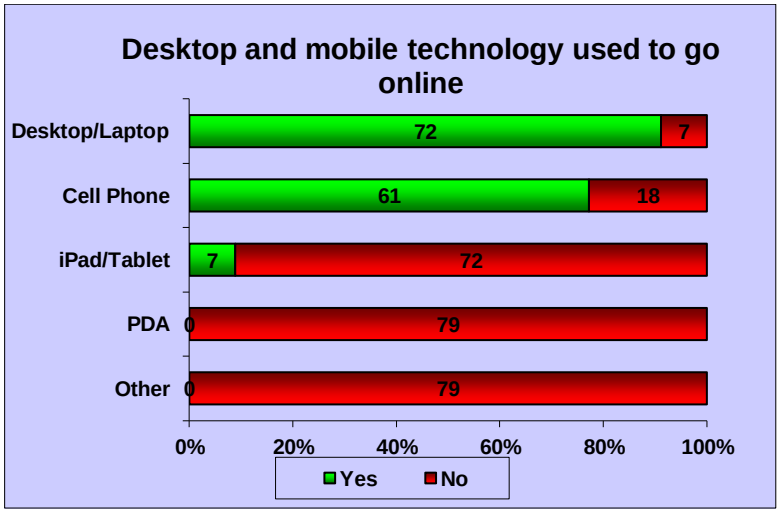


Figure 5.19: Desktop and mobile technology used to go online

The following desktop and mobile technologies are used by respondents to go online (Figure 5.19):

- Desktop computer/Laptop computer (91.1%), Cell phone (77.2%), and iPad/Tablet (8.9%).

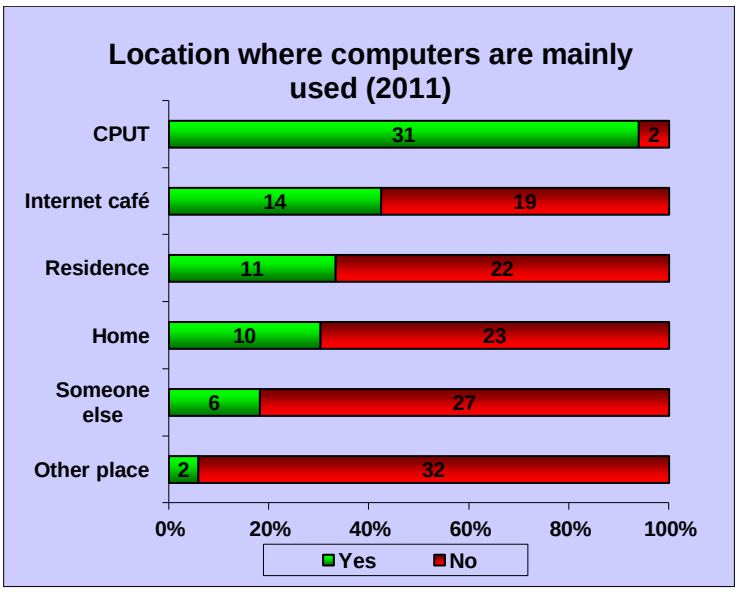


Figure 5.20: Location where computers are mainly used (2011)

Figure 5.20 reflects the location where computers were mainly used during 2011:

- CPUT or library (93.9%), Internet café (42.4%), Residence (33.3%), and Home (30.3%).

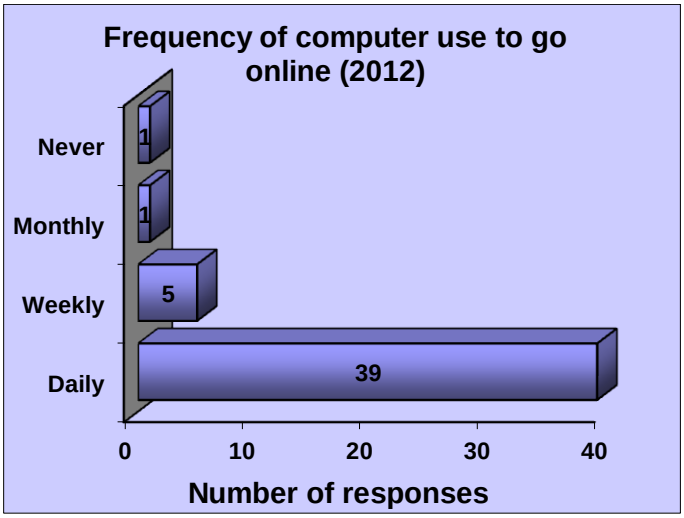


Figure 5.21: Frequency of computer use to go online (2012)

Of the 2012 respondents, 84.8% make use of a computer to go online on a daily basis, 10.9% of the respondents use it weekly, and 2.2% use it on a monthly basis or never (Figure 5.21).

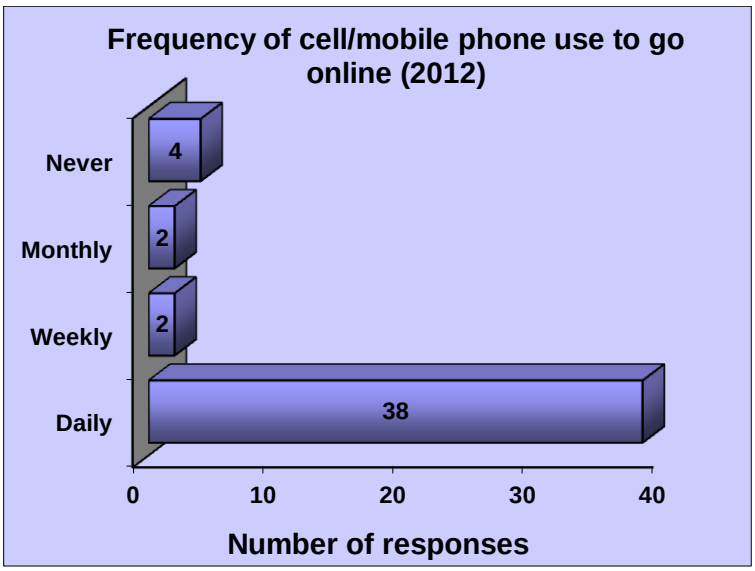


Figure 5.22: Frequency of cell phone use to go online (2012)

Of the 2012 respondents, 82.6% make use of a cell phone on a daily bases, 4.4% of the respondents uses it weekly or monthly, while 8.7% never use a cell phone to go online (Figure 5.22).

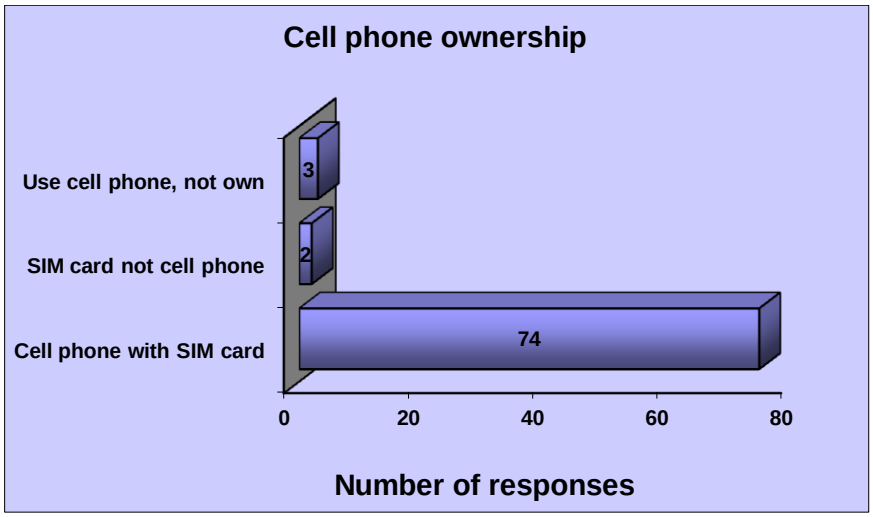


Figure 5.23: Cell phone ownership

Of the respondents, 93.7% own a cell phone with a SIM card, 2.5% own a SIM card, but not a cell phone, and 3.8% make use of a cell phone, but they do not own either a cell phone or a SIM card (Figure 5.23).

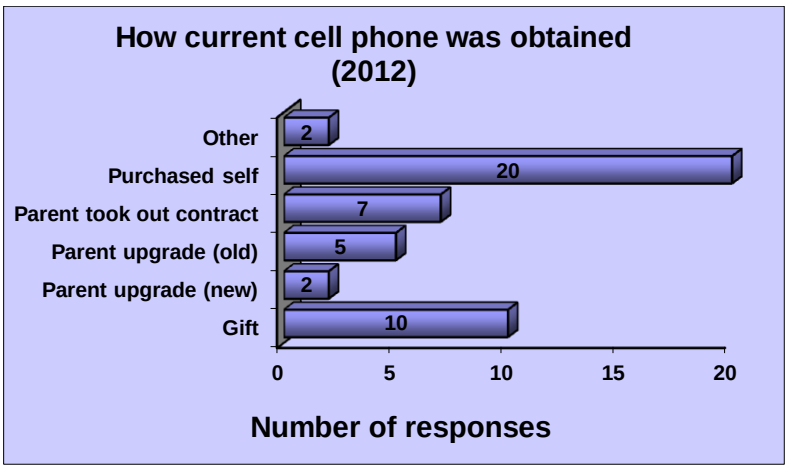


Figure 5.24: Method of how a respondent's cell phone was obtained (2012)

Of the 2012 respondents, 43.5% obtained their cell phone by purchasing it themselves, 21.7% were obtained as a gift, and 15.22% of the respondents' parents took out a contract for them. Furthermore, 15.22% of the respondents obtained their cell phones from their parents after they upgraded their cell phones (this includes the parents' old (10.9%) or new (4.35%) upgrades) (Figure 5.24).

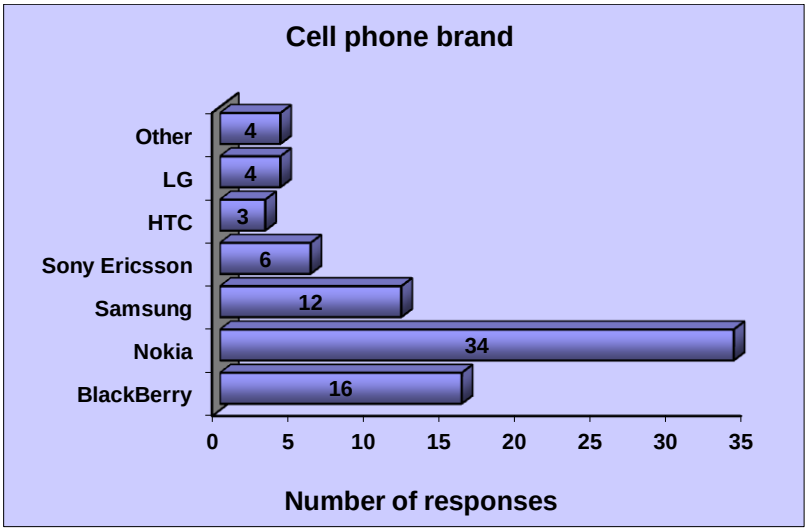


Figure 5.25: Cell phone brand

Figure 5.25 reflects that the majority of the respondents preferred a Nokia cell phone (43.0%), followed by BlackBerry (20.2%), Samsung (15.2%) and Sony Ericsson (7.6%).

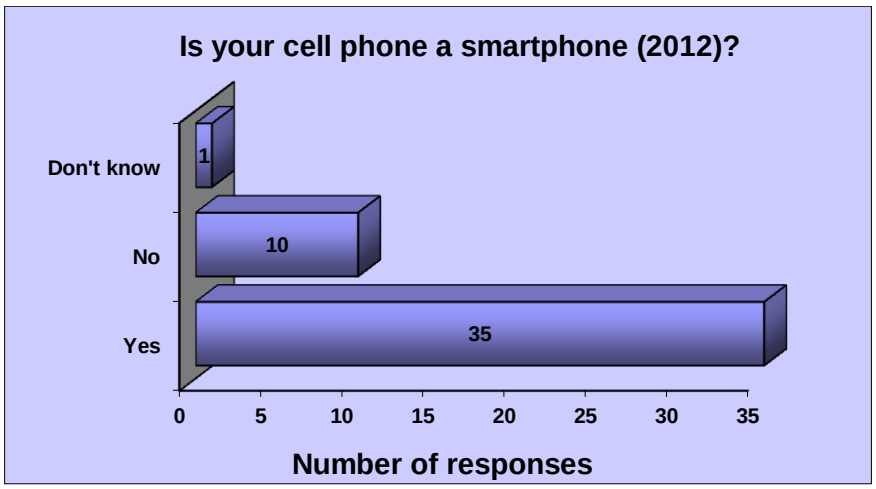


Figure 5.26: Respondents' indication of whether they possess a smartphone (2012)

Figure 5.26 reflects that most of the 2012 respondents indicated that they are in possession of a smartphone (76.1%).

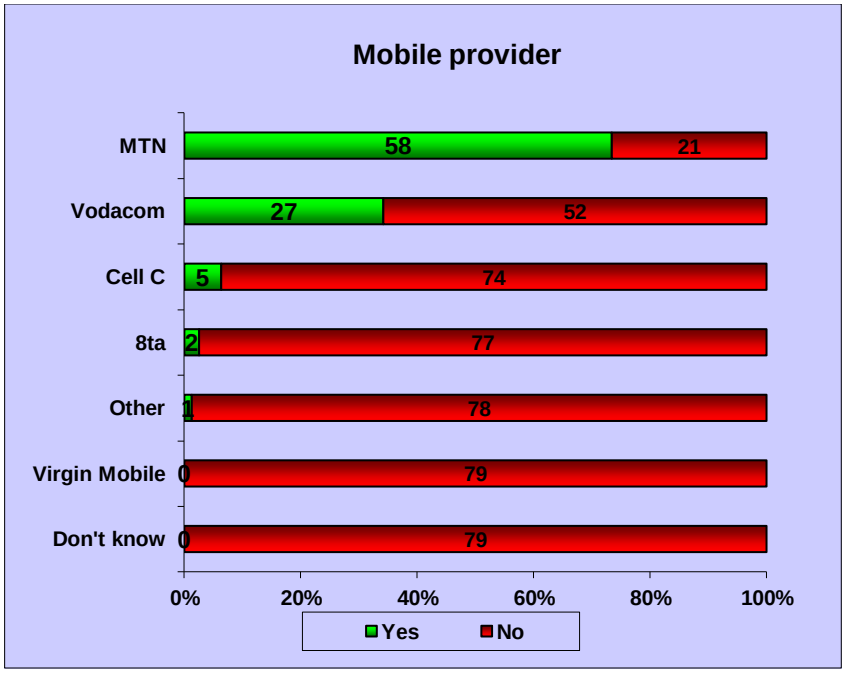


Figure 5.27: Preferred mobile provider

The following mobile providers are preferred and mostly used by respondents (Figure 5.27):

- MTN (73.4%), Vodacom (34.2%), and Cell C (6.3%).

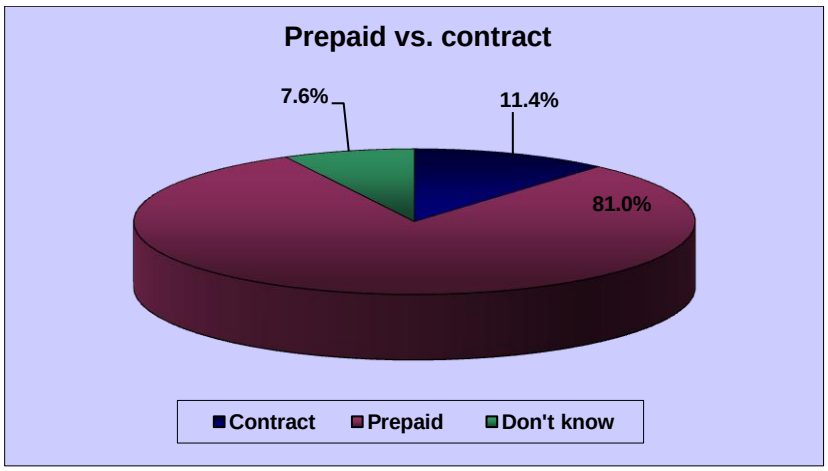


Figure 5.28: Prepaid vs. contract cell phone

Most (81.0%) of the respondents indicated that their phone use prepaid, and 11.4% of the respondents indicated that they have a cell phone contract (Figure 5.28).

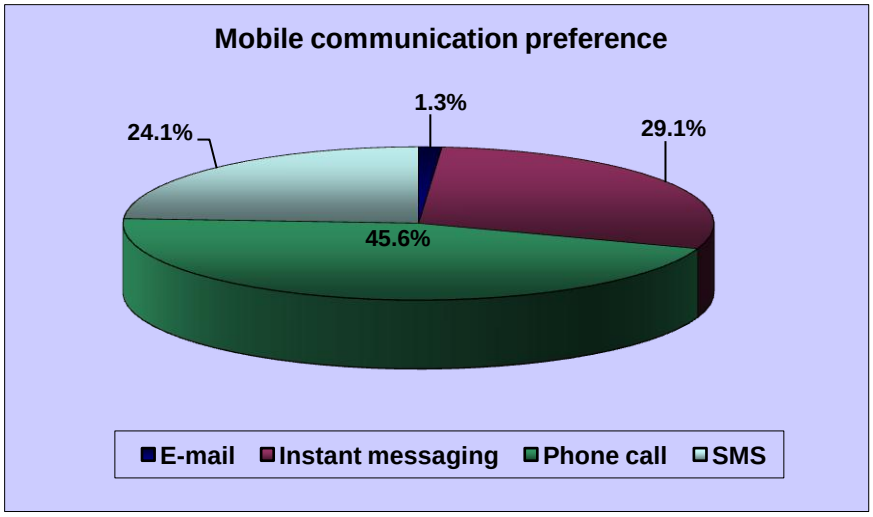


Figure 5.29: Mobile communication preference of respondents

Figure 5.29 shows that 29.1% of the respondents indicated that they use instant messaging to contact someone, whereas 45.6% make use of cell phone calls, and 24.1% make use of text messaging (SMS).

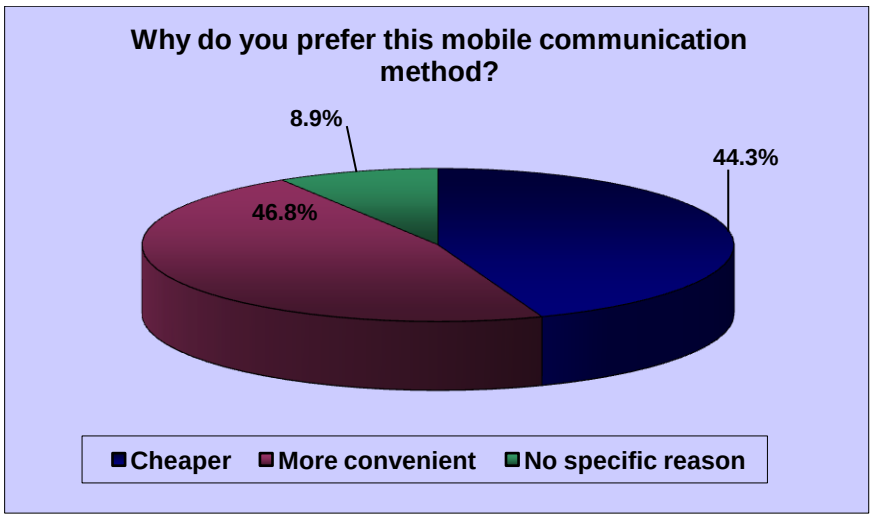


Figure 5.30: Preference for a specific mobile communication method

In terms of the data reflected in Figure 5.30, the majority of respondents prefer a specific mobile communication method, because they find it to be cheaper (44.3%), whereas 46.8% of the respondents found it more convenient to use a specific mobile communication method.

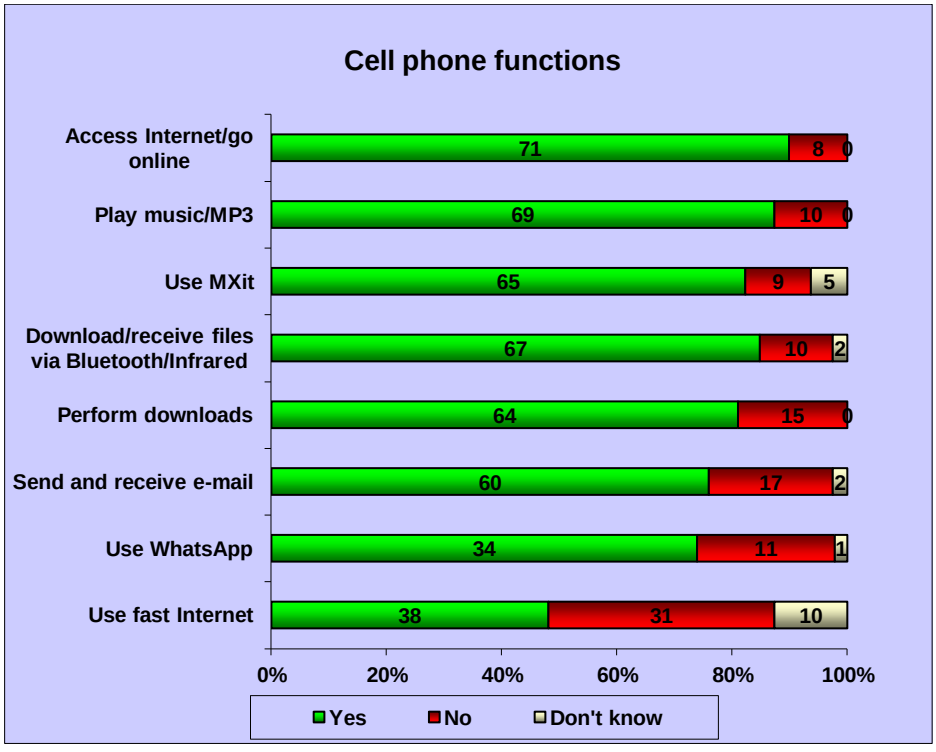


Figure 5.31: Main cell phone functions

Figure 5.31 reflects the main cell phone functions used by respondents and includes the following:

- It is possible to access the Internet/go online (89.9%)
- Play music or MP3 files (87.3%)
- Use MXit (82.3%)
- Download/receive files from other cell phones via Bluetooth or Infrared (84.8%)
- Download music, ringtones, games, applications or videos (81.0%)
- Send and receive e-mail (76.0%)
- Use WhatsApp (73.9%) - 2012 respondents only
- Use fast Internet (48.1%)

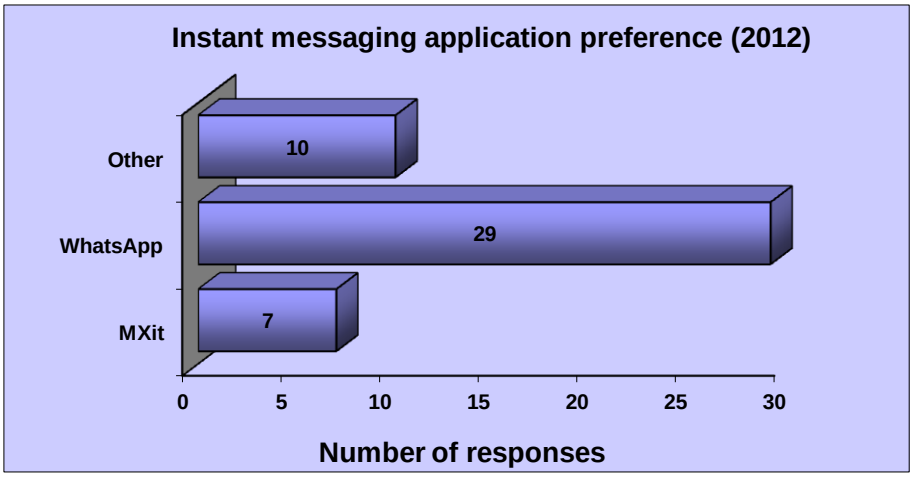


Figure 5.32: Instant messaging application preference (2012)

Figure 5.32 reflects that most of the 2012 respondents prefer the WhatsApp instant messaging application (63.0%). Only 15.2% preferred MXit, the largest South African instant messaging platform.

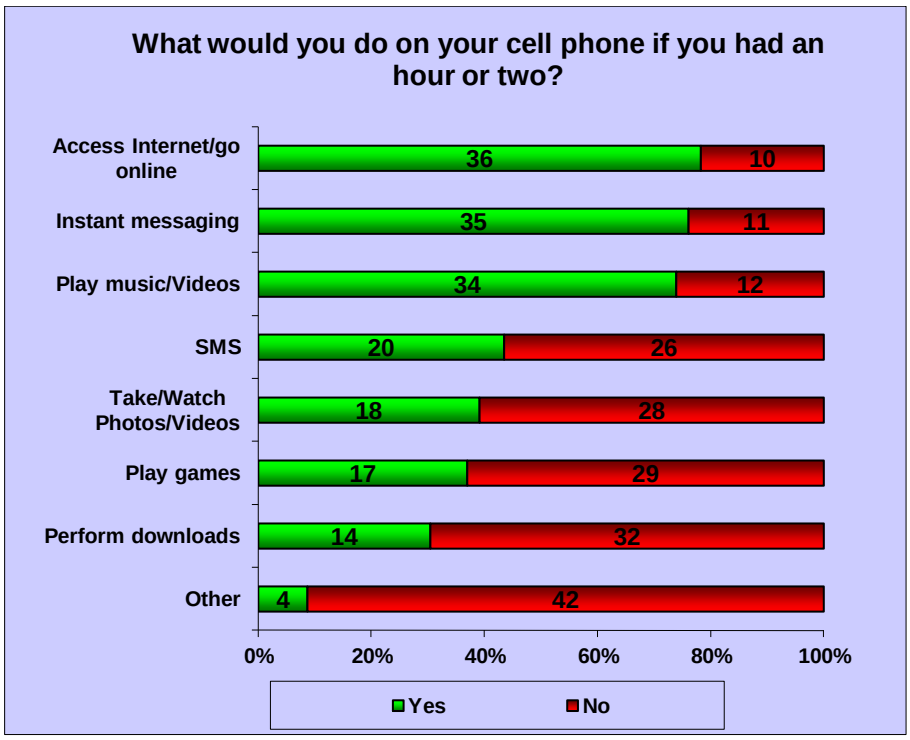


Figure 5.33: Respondents' preference for cell phone use when they have an hour or two

Figure 5.33 indicates respondents' preferences for certain activities they would perform on their cell phone if they have an hour or two:

- Access Internet/go online (78.3%), Instant messaging (76.1%), Play music/Videos (73.9%), and SMS (43.5%).

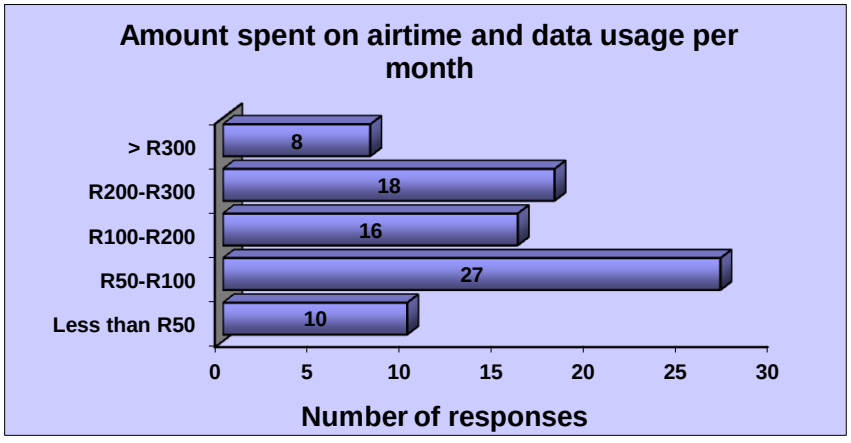


Figure 5.34: Amount spent on airtime and data usage per month

Figure 5.34 reflects that 12.7% of the learners spent less than R50 on airtime and data usage per month, 34.2% spent R50 to R100, 20.2% spent R100 to R200, 22.8% spend R200 to R300, and 10.1% spent more than R300.

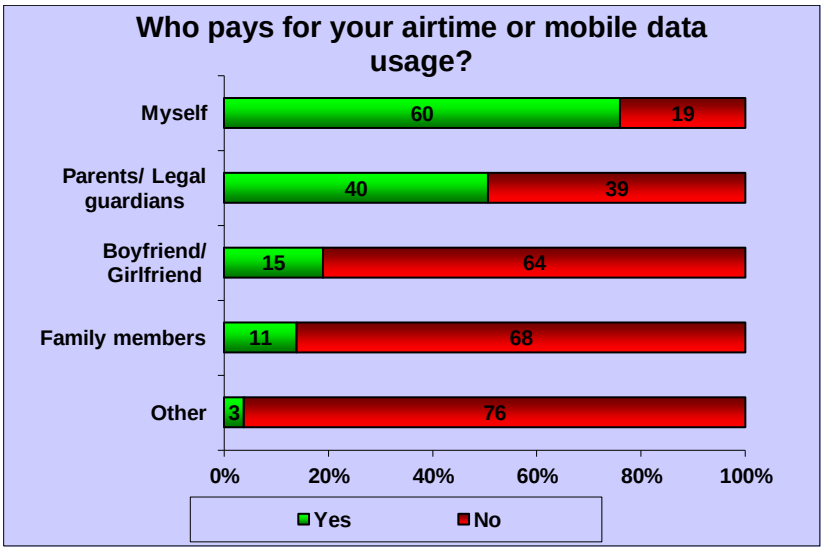


Figure 5.35: Person responsible for payment of airtime/mobile data usage

Figure 5.35 indicates the person who is primarily responsible for paying airtime and/or mobile data usage costs for and on behalf of the user:

- Myself (76.0%), Parents/Legal guardians (50.6%), Boyfriend/Girlfriend (19.0%), and Family members other than parents (13.9%).

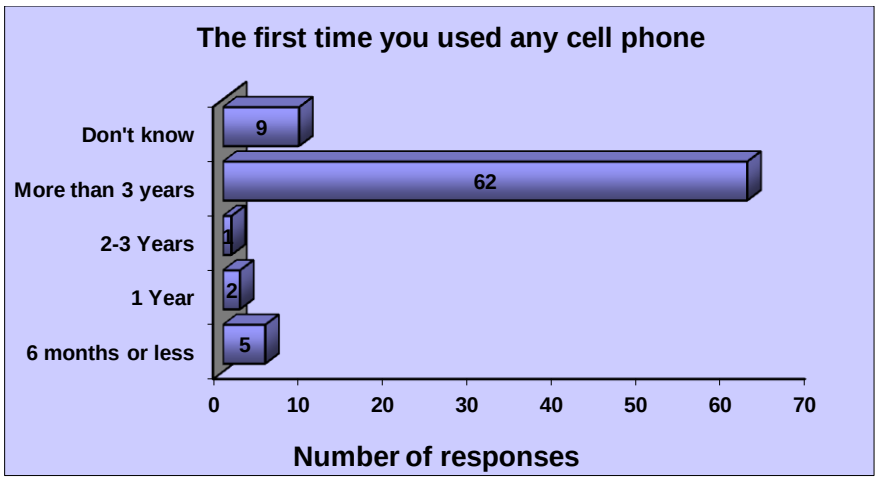


Figure 5.36: First time use of a cell phone by a respondent

Of the respondents, 78.5% indicated that they started using a cell phone more than three years ago (Figure 5.36).

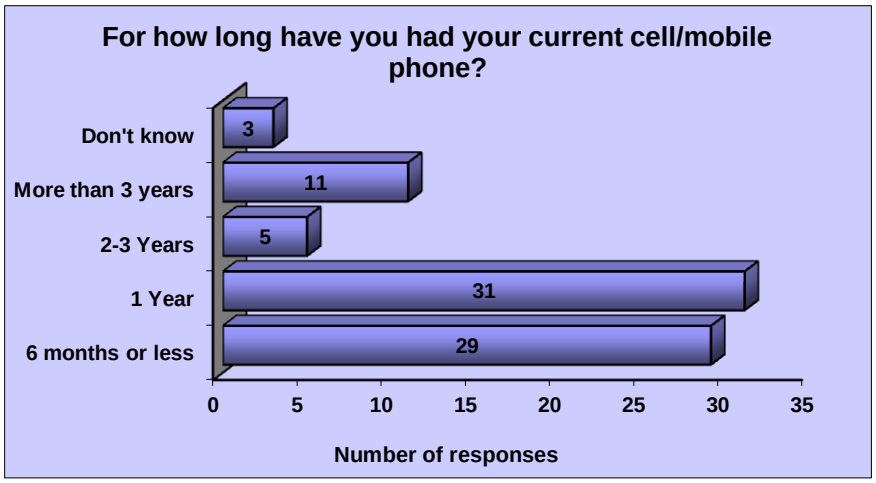


Figure 5.37: Time indication of how long respondents have had their current cell phone

The majority of the respondents (76.0%), have been in possession of their current cell phone for less than a year (Figure 5.37).

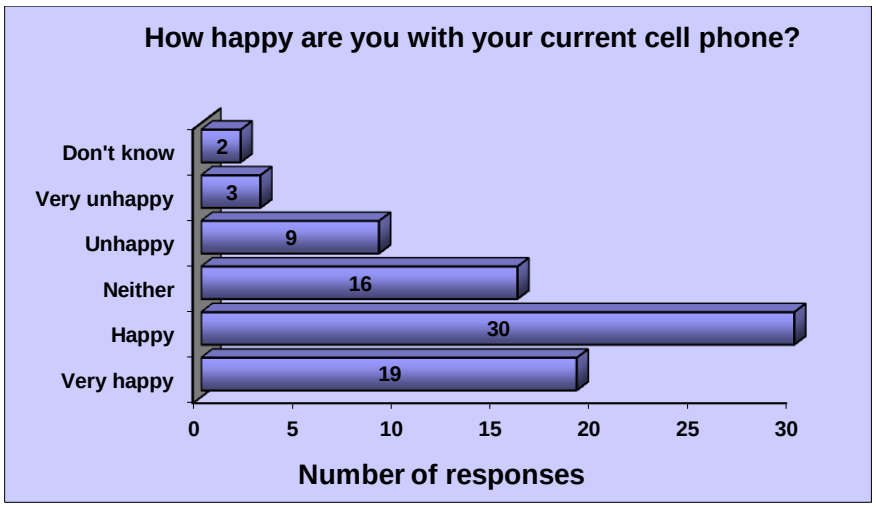


Figure 5.38: Respondents' happiness with regards to their current cell phone

Of the respondents, 62.0% indicated that they are happy to very happy with their current cell phone, whilst 15.2% of the respondents are unhappy to very unhappy with their current cell phone (Figure 5.38).

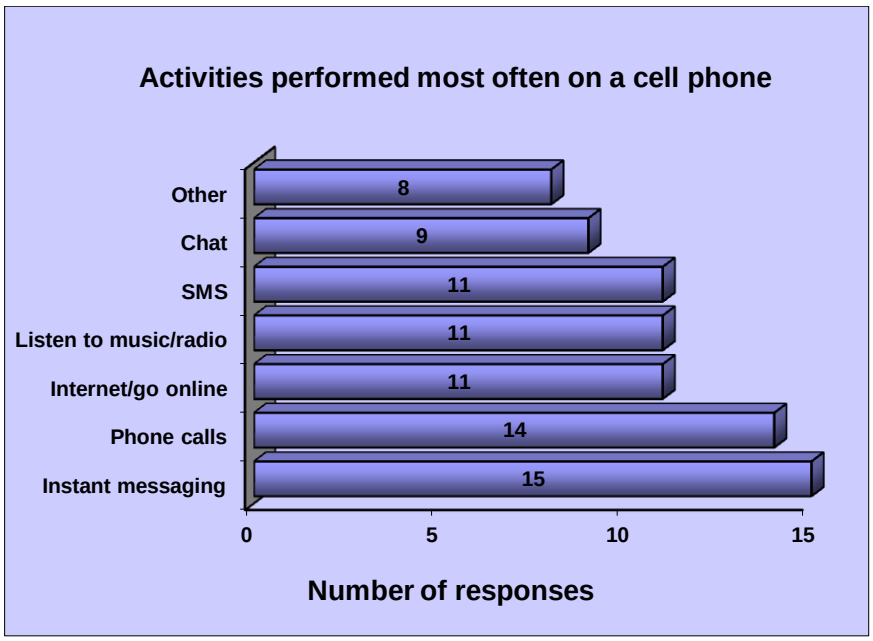


Figure 5.39: Activities performed most often with cell phone

Figure 5.39 reflects that 19% of the respondents do instant messaging most often on their cell phones, followed by 17.7% that use their cell phone to make phone calls, 13.9% to access the Internet/go online, 13.9% to listen to music or radio, and 13.9% to send text messages (SMS).

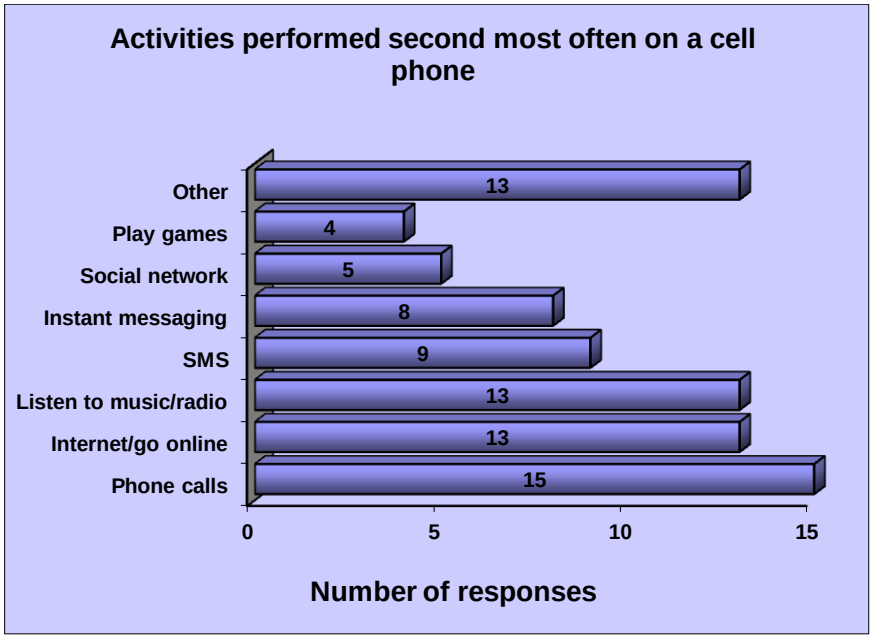


Figure 5.40: Activities performed second most often with cell phone

Of the respondents, 19% use their cell phone to make phone calls, 16.5% to access the Internet/go online, 16.5% to listen to music or radio, 11.4% to send text messages (SMS), and 10.1% do instant messaging the second most often on their cell phone (Figure 5.40).

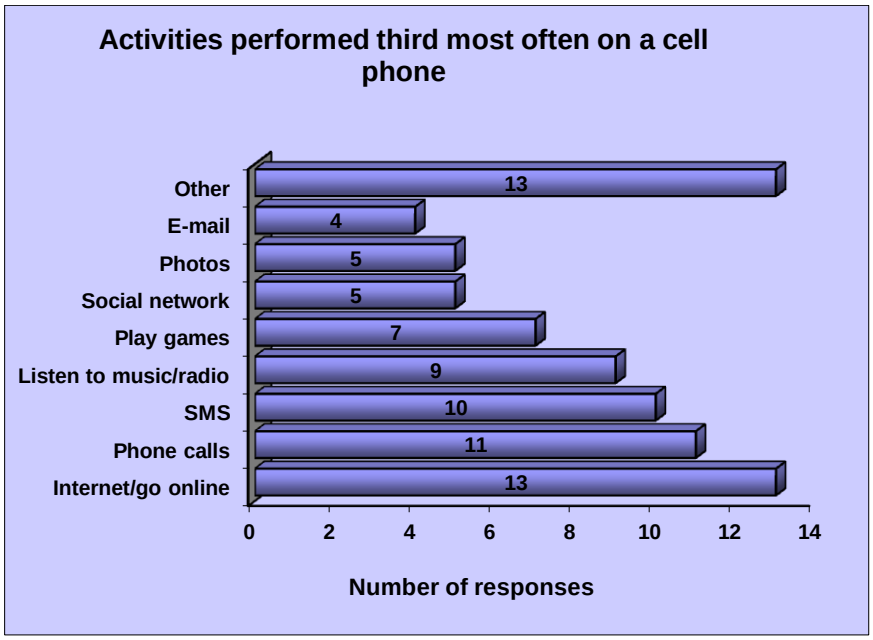


Figure 5.41: Activities performed third most often with cell phone

Of the respondents, 16.5% use their cell phones to access the Internet/go online, 13.9% to make phone calls, 12.7% to send text messages (SMS), 11.4% to listen to music or radio, and 8.9% to play games the third most often on their cell phones (Figure 5.41).

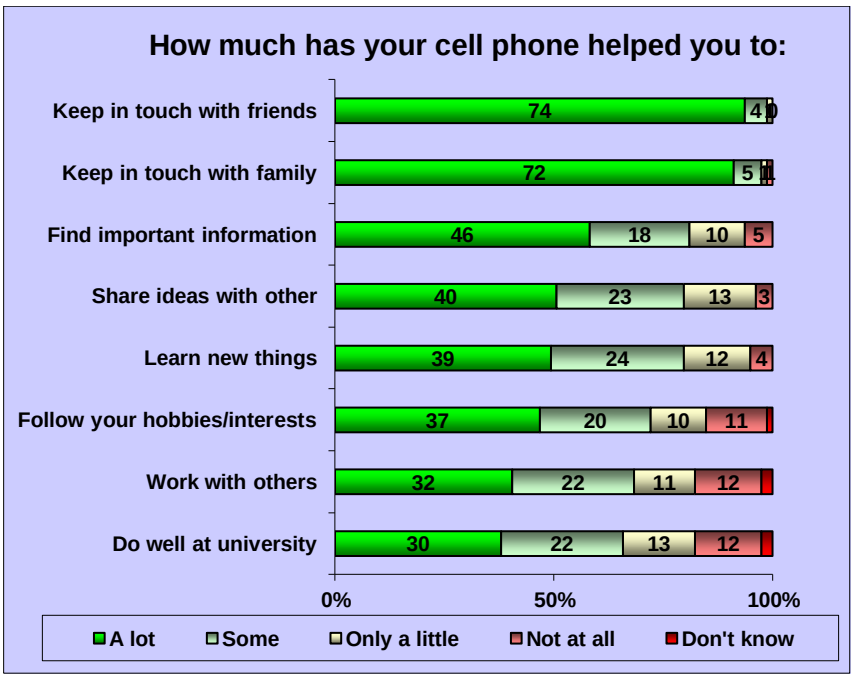


Figure 5.42: Indication of how much respondents' cell phone has assisted them in certain activities

Figure 5.42 reflects that respondents believe that their cell phone has helped them significantly ('a lot') to:

- Keep in touch with friends (93.7%)
- Keep in touch with family (91.1%)
- Find important information (58.2%)
- Share their ideas and creations with others (50.6%)

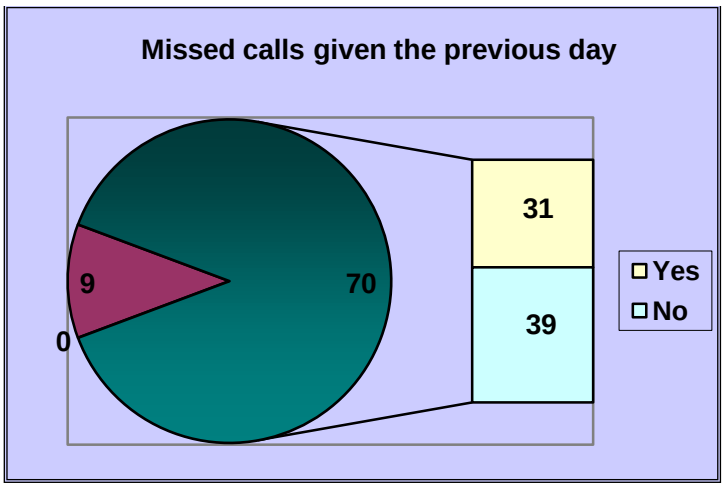


Figure 5.43: Number of missed calls given today and the previous day

Figure 5.43 reflects that 88.6% (70/79) of the respondents gave missed calls, and of that 44.3% (31/70) occurred the previous day.

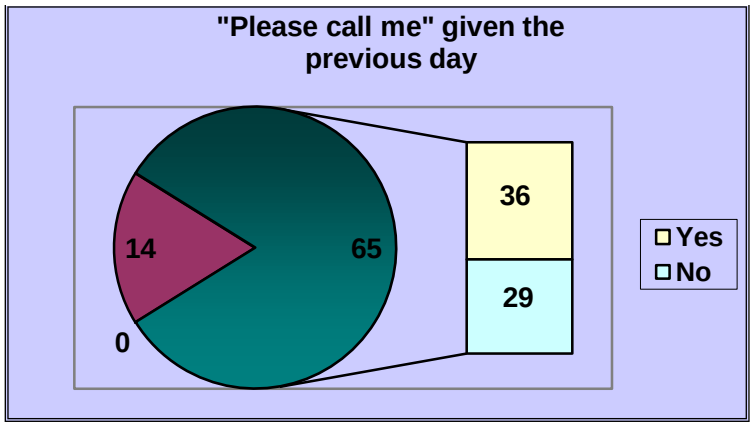
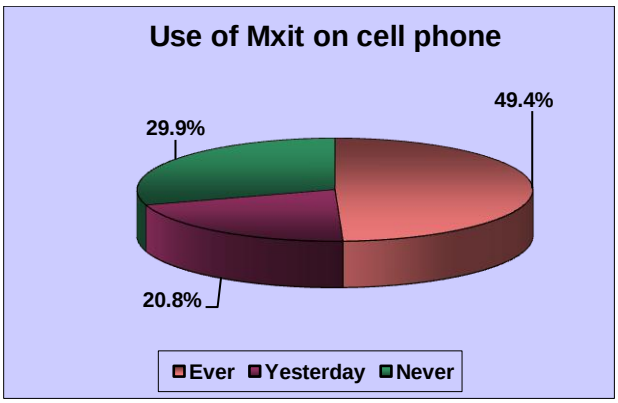
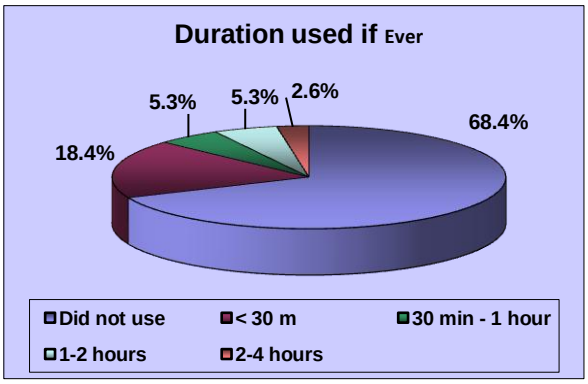


Figure 5.44: Number of respondents who used the feature "Please call me" today and the previous day

Figure 5.44 reflects that 82.3% (65/79) of the respondents used the feature “Please call me”, and of that 55.4% (36/65) occurred the previous day.





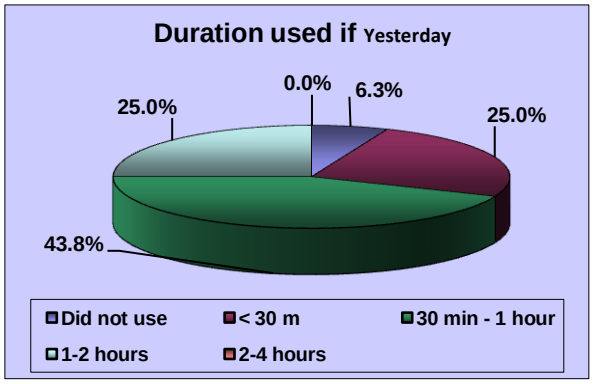
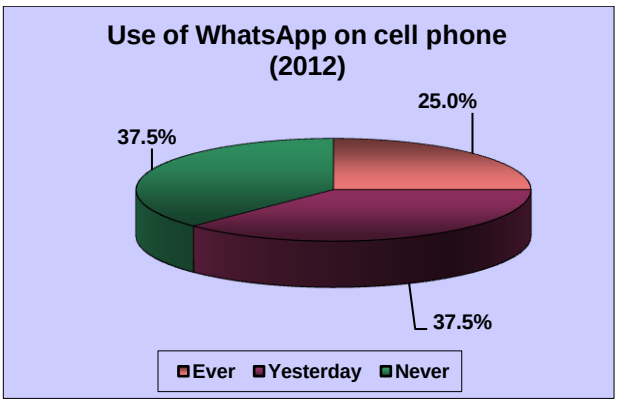
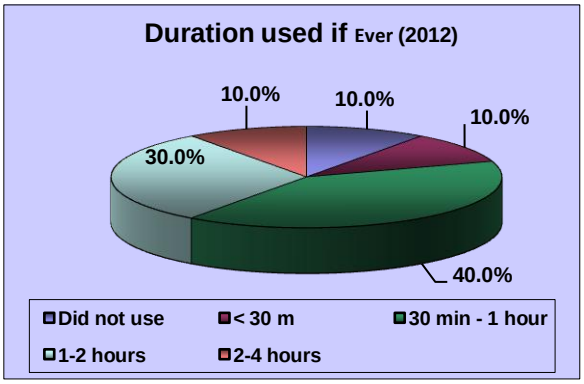


Figure 5.45: Use of MXit on cell phone

Figure 5.45 reflects that of the 49.4% of the respondents who indicated that they have *ever* used MXit, 68.4% (26/38) indicated that they did not spend any time using it the previous day, whereas 18.4% indicated that they have spend less than 30 minutes, and 13.2% indicated that they have spend more than 30 minutes. Of the respondents, 20.8% who indicated that they have used MXit the previous day (*yesterday),* 6.3% (1/16) indicated that they did not spend any time using it the previous day, whereas 25.0% (4/16) indicated that they have spend less than 30 minutes, 43.8% (7/16) indicated that they have spend 30 minutes to one hour, and 25.0% (4/16) indicated that they have spend one to two hours on MXit the previous day.





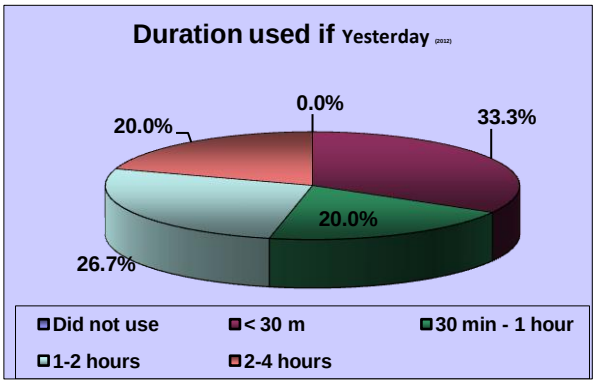


Figure 5.46: Use of WhatsApp on cell phone (2012)

Figure 5.46 reflects that of the 25% of the 2012 respondents who indicated that they have *ever* used WhatsApp, 10% (1/10) indicated that they did not spend any time on using it the previous day, whereas 10% indicated that they have spend less than 30 minutes, 40% indicated that they have spend 30 minutes to an hour, 30% indicated that they have spend one to two hours, and 10% indicated that they have spend two to four hours using it the previous day. Of the respondents, 37.5% who indicated that they have used WhatsApp the previous day (*yesterday)*, 33.3% (5/15) indicated that they have spend less than 30 minutes using it the previous day, 20% (3/15) indicated that they have spend 30 minutes to 1 hour, 26.7% (4/15) indicated that they have spend one to two hours, and 20% indicated that they have spend two to four hours on WhatsApp the previous day.

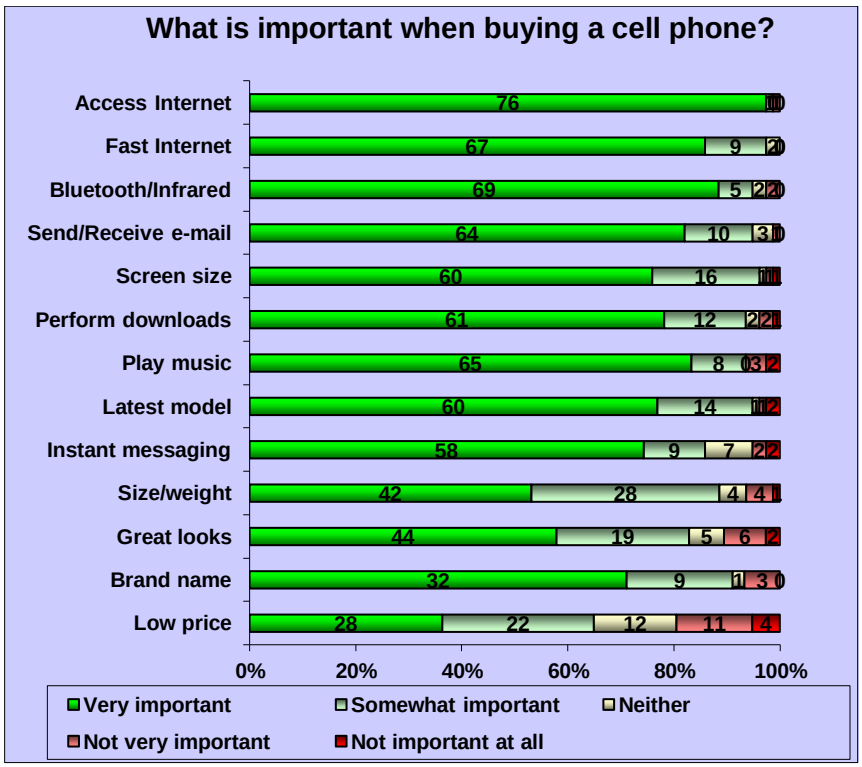


Figure 5.47: Aspects respondents consider when buying a cell phone

Respondents indicated that the following aspects were of importance when buying a cell phone (Figure 5.47):

- Access to Internet/going online (96.2%)
- Fast Internet capability (84.8%)
- Ability to download/receive files from other cell phones via Bluetooth or Infrared (87.3%)
- Ability to send/receive e-mail (81.0%)
- Screen size (76.0%)
- Ability to download music, ringtones, games, applications or videos (77.2%)
- Ability to play music/mp3 files (82.3%)
- That it is the latest model or newest technology (76.0%)
- Ability to send/receive instant messaging (73.4%)
- Size or weight (53.2%)
- Great looks (55.7%)
- Brand name (69.6%) - 2012 m-learning group only
- Low price (35.44%)

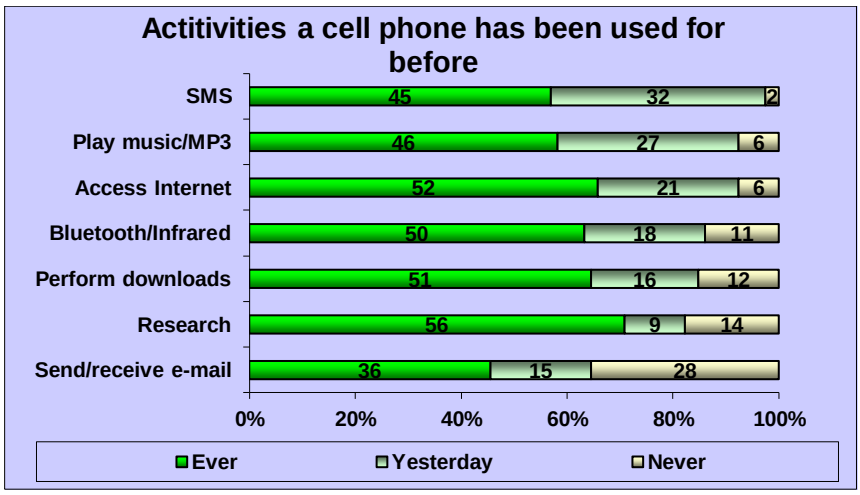


Figure 5.48: Activities for which a cell phone has been used for before

The respondents indicated the following activities for which a cell phone has been used for before (Figure 5.48):

- SMS (57%)
- Play music/MP3 files (58.2%)
- Access Internet/go online for no particular reason, just to browse for fun (65.8%)
- Download/receive files from other cell phones via Bluetooth/Infrared (63.3%)
- Download music, ringtones, games, applications or videos (64.6%)
- Research information for university work on the Internet (70.9%)
- Send and receive e-mail (45.6%)

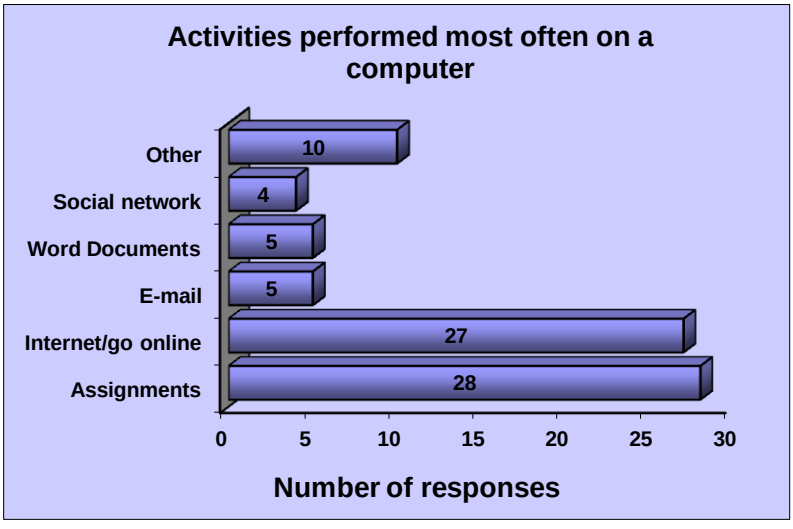


Figure 5.49: Activities performed most often on a computer

Of the respondents, 35.4% make use of a computer most often to complete assignments, 34.2% to access the Internet/go online, 6.3% to send and receive e-mails as well as typing Word documents, 5.1% to access social networking sites, and the remainder of the respondents make use of computers to chat, perform downloads, listen to music or the radio, watch movies, play games, and to study (Figure 5.49).

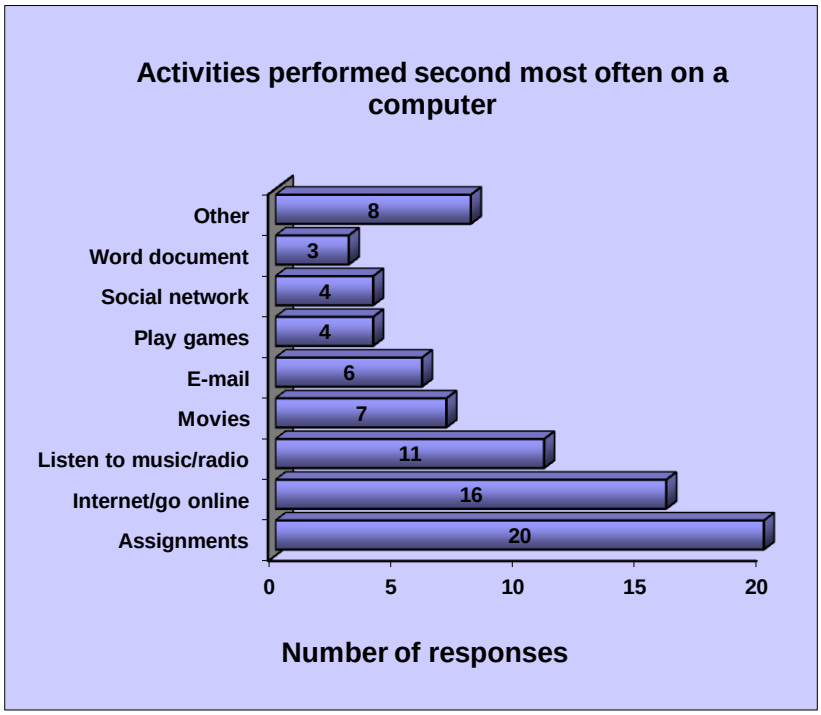


Figure 5.50: Activities performed second most often on a computer

Of the respondents, 25.3% indicated they make use of a computer second most often to complete their assignments, 20.2% to access the Internet/go online, 13.9% to listen to music/radio, 8.9% to watch movies, 7.6% to send and receive e-mails, 5.1% to play games or do social networking, 3.8% to type Word documents, and the remainder of the respondents to chat, perform downloads, view photos, reply, share files, and to use various applications (Figure 5.50).

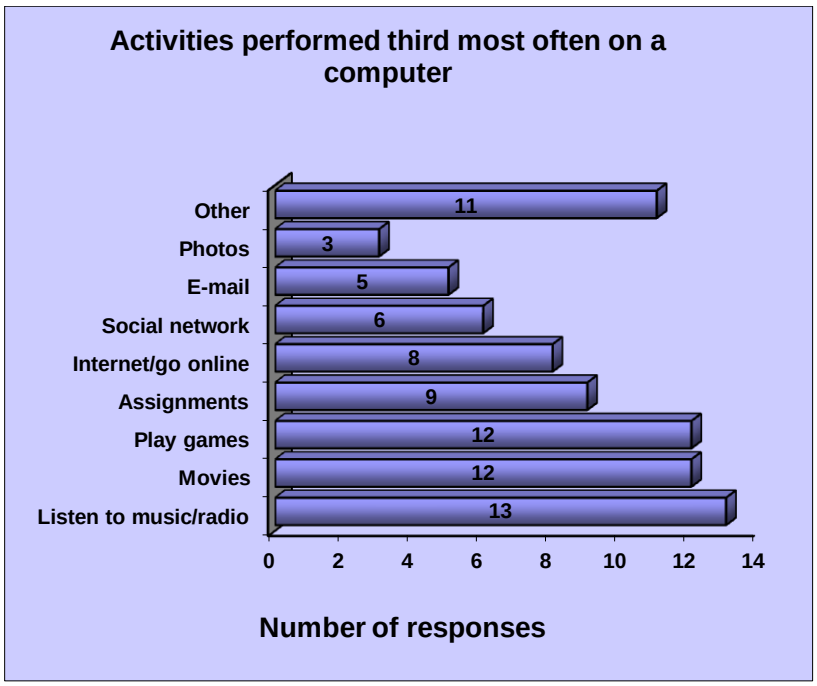


Figure 5.51 Activities performed third most often on a computer

Of the respondents, 19.1% make use of a computer third most often to listen to music or the radio, 15.2% to watch movies or play games, 11.4% to complete assignments, 10.1% to access the Internet/go online, 7.6% for social networking, 6.3% to send and receive e-mails, 3.8% to view photos, and the remainder of the respondents to chat, look at their horoscope, do instant messaging, complete online assessments, study, and type Word documents (Figure 5.51).

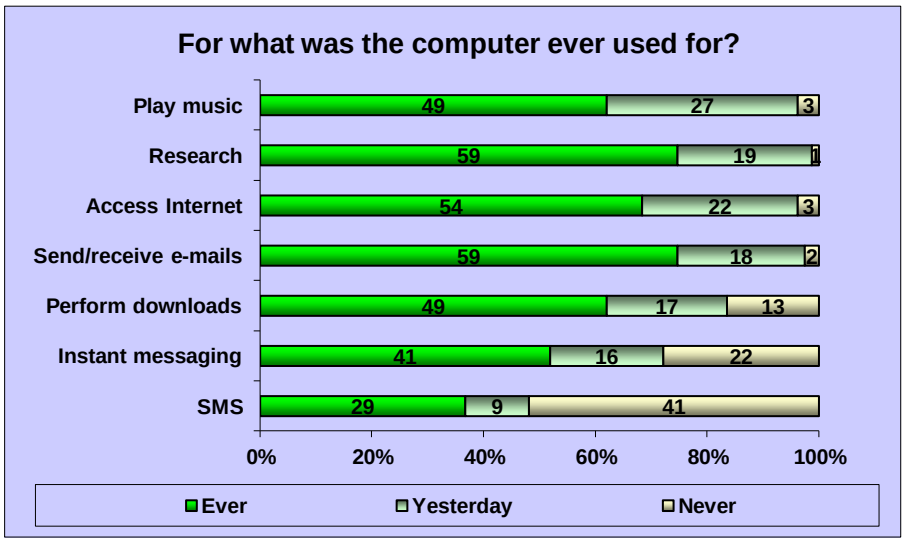


Figure 5.52: Activities a computer has ever been used for

The respondents indicated the following activities they have ever used a computer for (Figure 5.52):

- Play music (62.0%)
- Research information for university work by means of the Internet (74.7%)
- Access Internet/go online for no particular reason, just to browse for fun (68.4%)
- Send/receive e-mails (74.7%)
- Send instant messages to someone who was online at the same time (51.9%)
- SMS (36.7%)

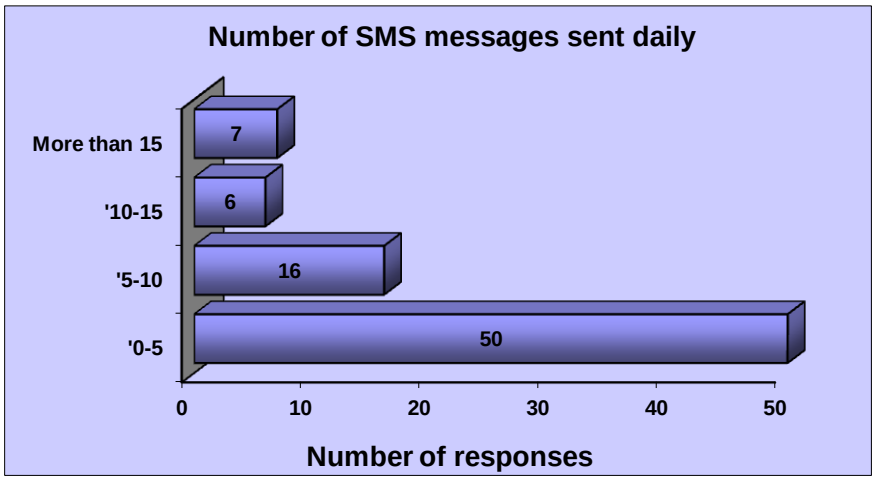


Figure 5.53 Number of SMS (text) messages sent daily

Of the respondents, 63.3% indicated that they typically send up to five SMS (text) messages on a daily basis, 20.2% send five to ten messages, 7.6% send 10-15 messages, and 8.9% indicated that they send more than 15 messages daily (Figure 5.53).

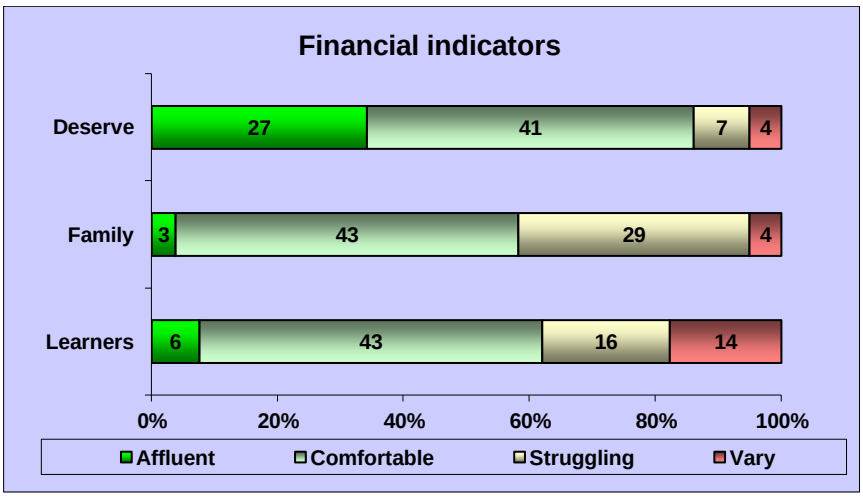


Figure 5.54: Financial indicators

The respondents indicated the following with respect to questions asked regarding the financial means of learners (Figure 5.54):

- Fellow-learners in the respondent's class are being viewed as being financially strong (54.4%)
- The respondent's family are financially strong (54.4%), but there is a large percentage who face financial difficulties (36.7%)
- The respondents mostly indicated that they believe that they deserve to be financially affluent (34.2%) or comfortable (51.9%)

5.3.3.1.2 First post-mobile learning (post 1) questionnaire (2011 - 2012)

After the m-learning intervention learners were requested to complete an online post 1 m-learning questionnaire. In this questionnaire, nine elements of the Technology Acceptance model (TAM) were used to analyse the factors that influence how learners will accept and utilise new mobile technology in both formal and informal settings, namely: Perceived Usefulness (PU), Perceived Mobility Value (PMV), Perceived Social Interaction Value (PSIV), Perceived Enjoyment (PE), Perceived Ease Of Use (PEOU), Attitude (ATT), Perceived Access Barriers (PAB), Behavioural Intention to use and adopt m-learning (BI), and Perceived Output Quality (POQ). Overall results returned from the post 1 m-learning questionnaire indicate that the learners showed a positive attitude and general sense of satisfaction, as m-learning in a technology-based subject was perceived to be useful, enjoyable, easy to use, and more effective than traditional learning. The ability to effectively complete and submit programming assignments by means of mobile devices was rated

highly by the learners (67.1%) and attributed to an increase in their enthusiasm. The majority of learners (93.6%) indicated that they would prefer to use mobile devices in the future. Results map to the research findings of Attewell (2005:12) who found that the majority (62%) of learners were enthusiastic about m-learning and were keen to participate in future m-learning initiatives, as well as to that of Rainbow and Sadler-Smith (2003:615), by showing a positive disposition towards m-learning irrespective of learners' gender, age or educational background. The fact that 87.2% of the learners agree to strongly agree that m-learning provides a better alternative for teaching and learning, and that it will improve their academic performance (96.2% agree to strongly agree), is a sound indication that m-learning has value and potential as a learning tool in a technology-based subject.

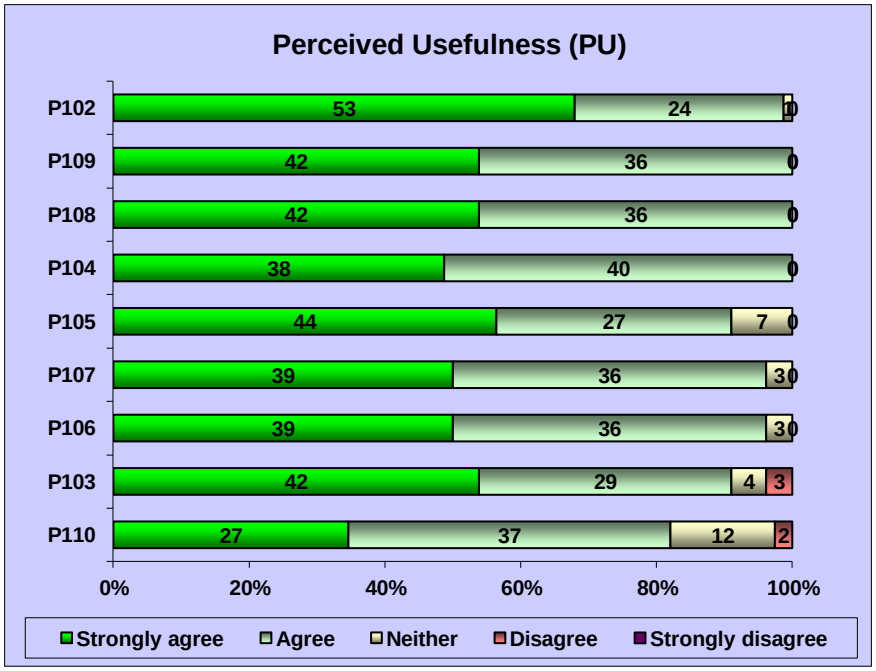


Figure 5.55: Perceived usefulness of mobile technology

In terms of the results reflected in Figure 5.55, the respondents 'agree to strongly agree' with the following statements:

- To use mobile devices for learning purposes would save them a lot of time (98.7%) (P102)
- To use mobile devices for learning computer programming would be feasible (100%) (P109)
- To use mobile devices would increase the quality of computer programming teaching and learning (100%) (P108)

- To use mobile devices for learning purposes would enhance the effectiveness of learning (100%) (P104)
- To use mobile devices for learning would be ubiquitous and useful (91.0%) (P105)
- To use mobile devices would increase productivity in the course work (96.2%) (P107)
- To use mobile devices would improve academic performance (96.2%) (P106)
- To use mobile devices to access material anywhere, anytime would allow the learner to spend more time on class work (91.0%) (P103)
- To buy a mobile device would be useful for course work (82.0%) (P110)

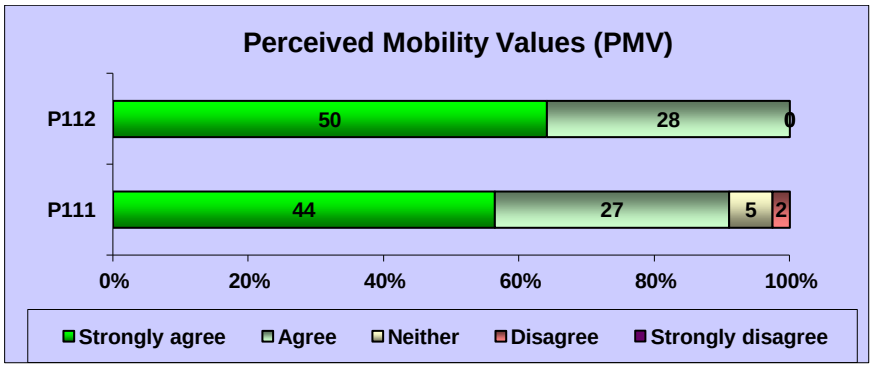


Figure 5.56: Perceived mobility values of mobile technology

According to Figure 5.56, the respondents 'agree to strongly agree' with the following statements:

- Mobility enables access to real-time information anywhere, anytime (100%) (P112)
- Mobility enables the accomplishment of tasks more quickly (91.0%) (P111)

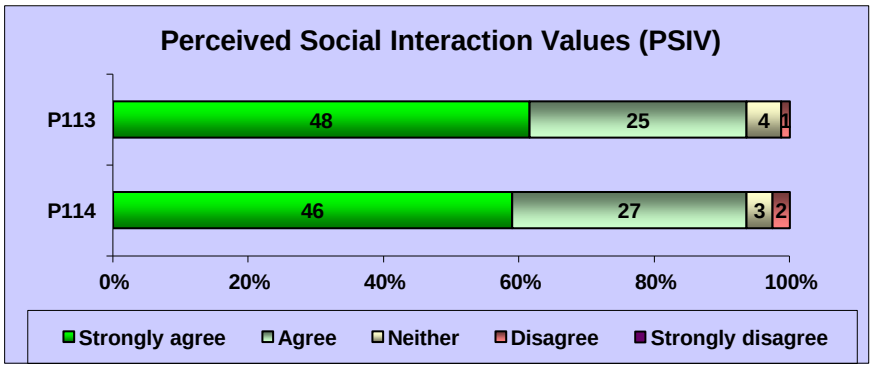


Figure 5.57: Perceived social interaction value of mobile technology

According to Figure 5.57, the respondents 'agree to strongly agree' with the following statements:

- I would be more likely to interact with lecturers and fellow learners both inside and outside the classroom if a mobile device could be used (93.6%) (P113)
- I would be more likely to participate in class discussions if thoughts should be posted/shared in real-time through mobile devices (93.6%) (P114)

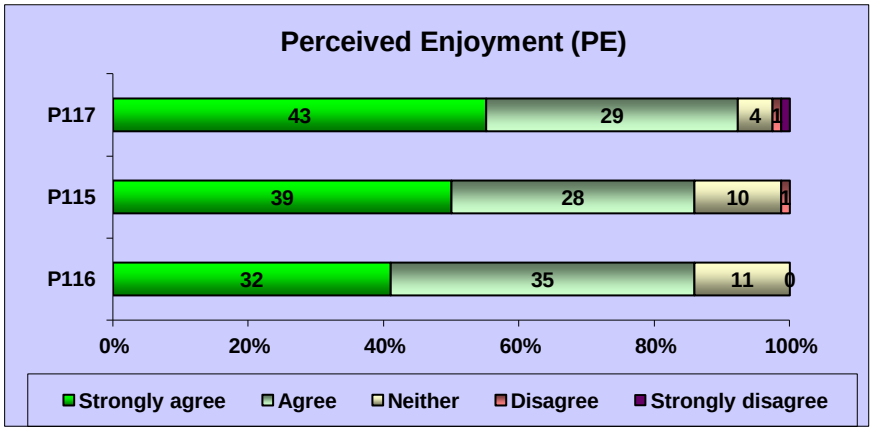


Figure 5.58: Perceived enjoyment of mobile technology use

According to Figure 5.58, the respondents 'agree to strongly agree' with the following statements:

- To use mobile devices would stimulate curiosity (92.3%) (P117)
- I would feel more interested in learning by using mobile devices (85.9%) (P115)
- I would enjoy learning if I could use mobile devices (85.9%) (P116)

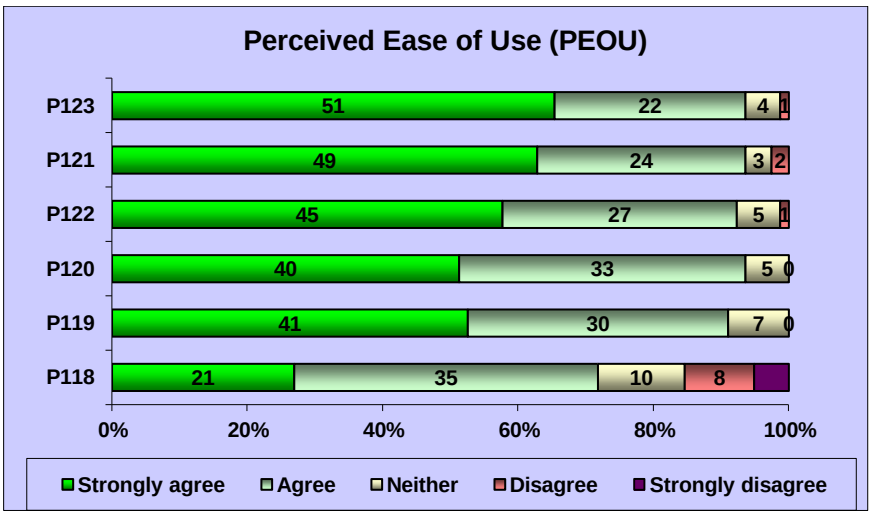


Figure 5.59: Perceived ease of use of mobile technology

According to Figure 5.59, the respondents 'agree to strongly agree' with the following statements:

- It would be easier to ask for help if I could communicate through mobile devices (93.6%) (P123)
- It would be easier to complete class work and assignments if I could use mobile devices (93.6%) (P121)
- It would be easy to engage in discussions using instant messaging on mobile devices (92.3%) (P122)
- It would be easy to use mobile devices for learning (93.6%) (P120)
- It would ease my learning, since it allows me to learn anywhere, anytime (91.0%) (P119)
- It would not require much effort to learn, because I can skilfully use mobile devices (71.8%) (P118)

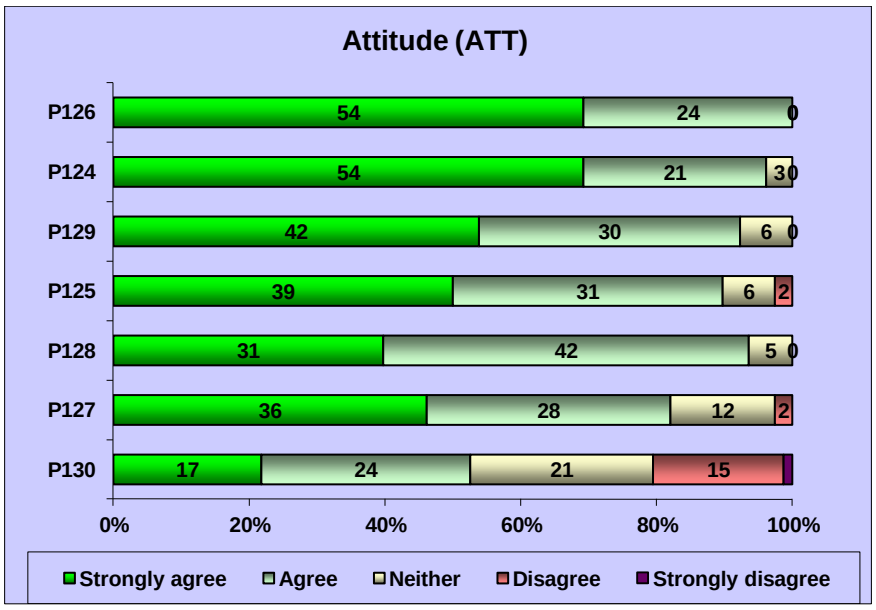


Figure 5.60: Attitude towards mobile technology

According to Figure 5.60, the respondents 'agree to strongly agree' with the following statements:

- I would like to be able to view course material on mobile devices (100%) (P126)
- I would be more encouraged to learn if I could access learning materials anywhere, anytime (96.2%) (P124)
- I would feel ready for m-learning if the university implements it now (92.3%) (P129)
- I would like to be able to use mobile devices as a method for learning, since it will allow me to learn in places I could normally not learn/study in (89.7%) (P125)
- I would feel positive towards using mobile devices in teaching and learning (93.6%) (P128)
- I would feel in control when using mobile devices in teaching and learning (82.1%) (P127)
- I would find it acceptable to study computer programming with mobile access only (52.6%) (P130)

It is of importance to note that of the respondents, 26.9% 'neither agreed nor disagreed' with any of the aforementioned statements.

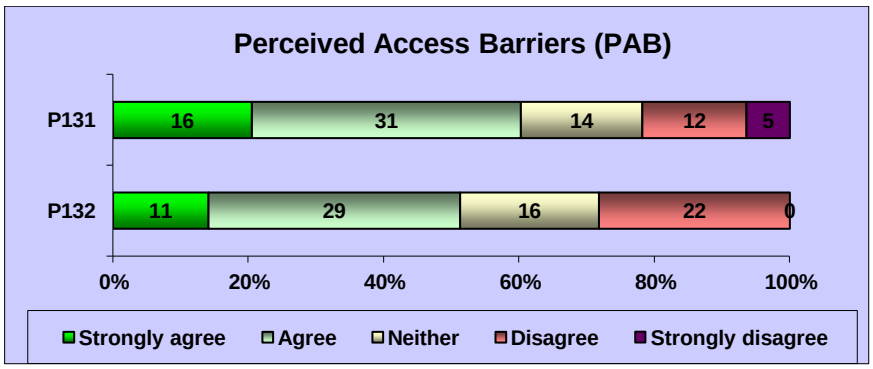


Figure 5.61: Perceived access barriers for mobile technology

According to Figure 5.61, the respondents 'agree to strongly agree' with the following statements:

- I would not be able to afford mobile devices for educational use (60.3%) (P131)
- I am afraid that I would have to spend more money on data usage, because of m-learning (51.3%) (P132)

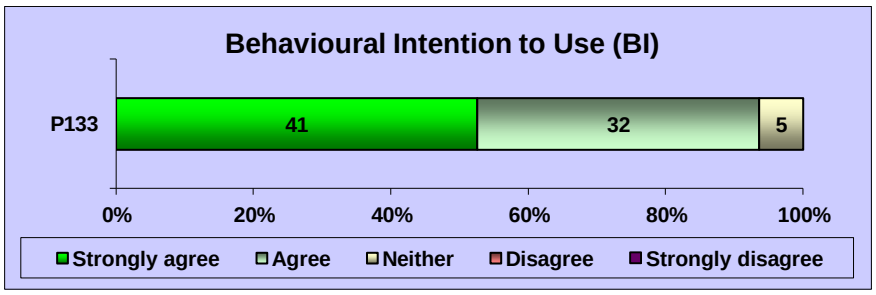


Figure 5.62: Behavioural intention to use mobile technology

According to Figure 5.62, of the respondents, 93.6% indicated that they 'agree to strongly agree' that they would like to use mobile devices in future, because it will assist them in their learning.

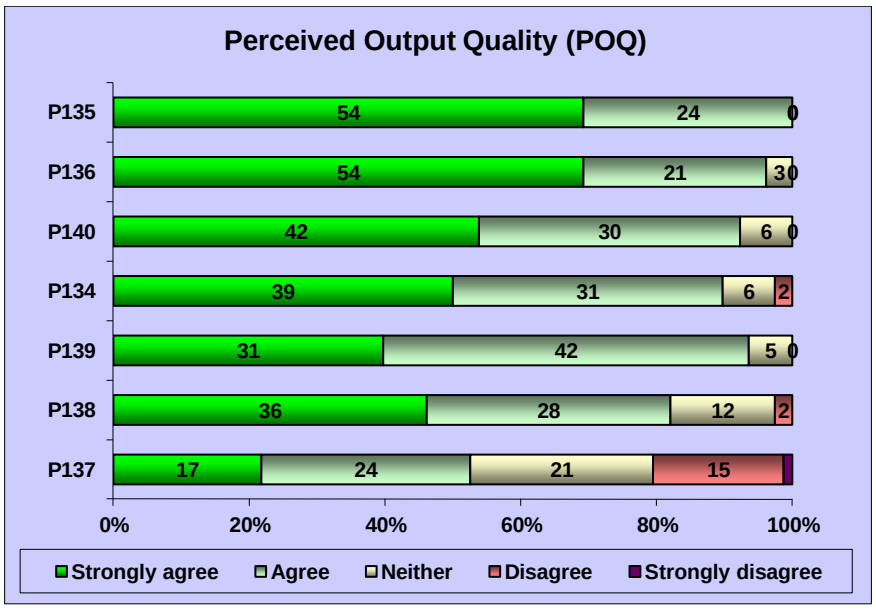


Figure 5.63: Perceived output quality for mobile learning

According to Figure 5.63, the respondents 'agree to strongly agree' with the following statements:

- Compared with traditional learning, I believe that m-learning is more portable/mobile and flexible enabling anywhere, anytime learning (100%) (P135)
- Compared with traditional learning, I believe that m-learning enhances daily teaching and learning (93.6%) (P136)
- Compared with traditional learning, I believe that m-learning improves communication between learners and their educator (87.2%) (P140)
- Compared with traditional learning, I believe that m-learning is more initiative and dynamic (84.6%) (P134)
- Compared with traditional learning, I believe that m-learning provides a better alternative for teaching and learning (87.2%) (P139)
- Compared with traditional learning, I believe that m-learning ensure learning effectiveness (89.7%) (P138)
- Compared with traditional learning, I believe that m-learning enables high engagement (Making me a more involved and active learner) (82.0%) (P137)

5.3.3.1.3 Second post-mobile learning (post 2) questionnaire (2011 - 2012)

After the m-learning intervention and the completion of the post 1 questionnaire, learners were requested to complete a second online questionnaire (post 2) of which some of the questionnaire items were partially adapted from Pollara (2011:131). Overall, results obtained from the questionnaire on learner use, perception and attitude towards the utilisation of mobile technology in a technology-based were encouraging. Learners pointed to the fact that they would: 1) Find it acceptable to learn computer programming with mobile device access only (63.3%), 2) feel more enthusiastic about the use of mobile devices after the m-learning experience when compared to their attitude in the beginning of the semester (74.7%), 3) like to be able to use mobile devices as a method for learning, since it will allow them to learn in places they could normally not learn/study in (89.7%), as well as that, 4) the use of mobile devices would increase the quality of computer programming teaching and learning (100%).

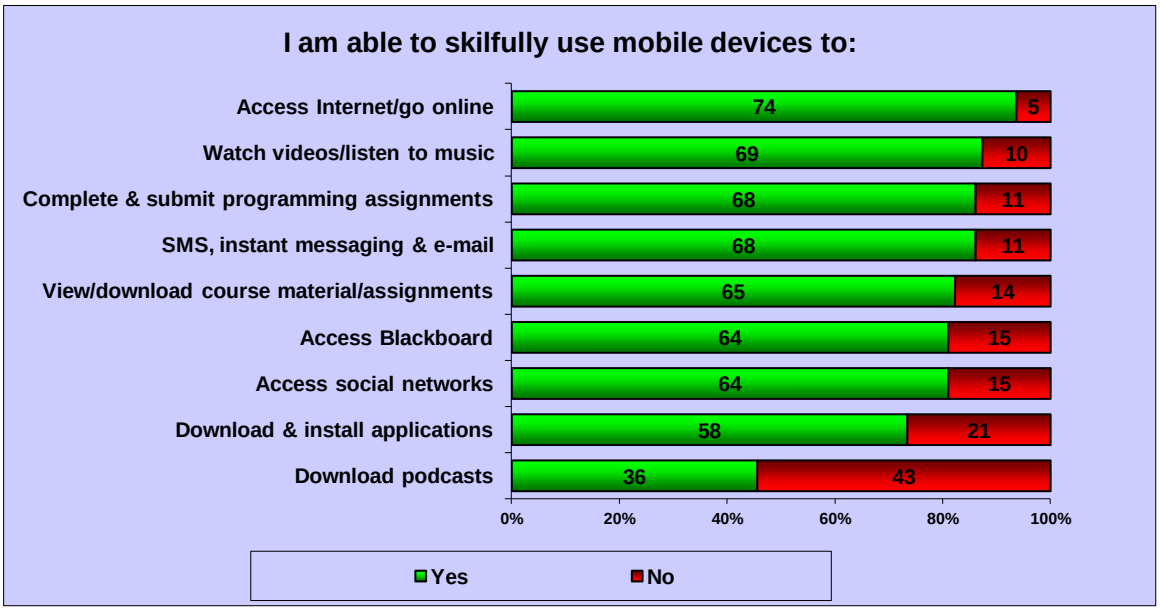


Figure 5.64: Respondent ability of skilfully using mobile devices

The respondents' ability to skilfully use mobile devices is reflected in Figure 5.64:

- Access Internet/go online (93.7%)
- Watch videos and listen to music (87.3%)
- Complete and submit programming assignments (86.1%)
- Send SMS (text) messages, instant messages and e-mails (86.1%)
- View and download course material and assignments (82.3%)

- Access Blackboard (81.0%)
- Access social networking sites (81.0%)
- Download and install applications (73.4%)
- Download podcasts (45.6%)

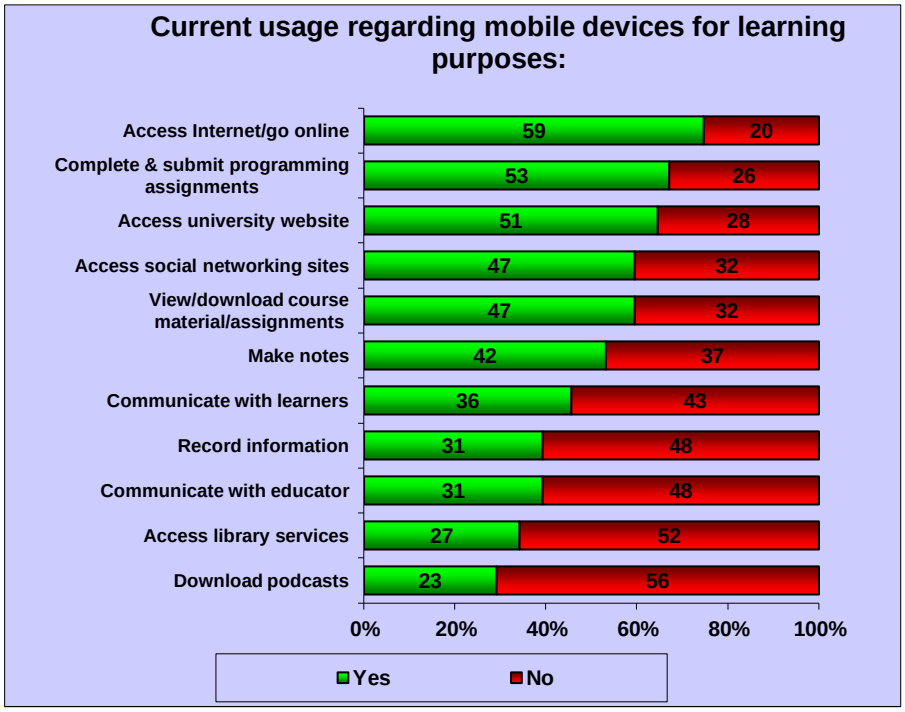


Figure 5.65: Current usage of mobile devices for learning purposes

Figure 5.65 indicates respondents' current usage of mobile devices for learning purposes:

Learners find mobile devices to be useful for learning purposes (P203), as it enables them to carry out a variety of activities such as to access the Internet/go online (74.7%), effectively complete and submit programming assignments (67.1%), access the university website (64.6%), access social networking sites (59.5%), view and download course material and assignments (59.5%), as well as to make notes during class (53.2%). These activities were also found in observations of learners in a formal educational setting.

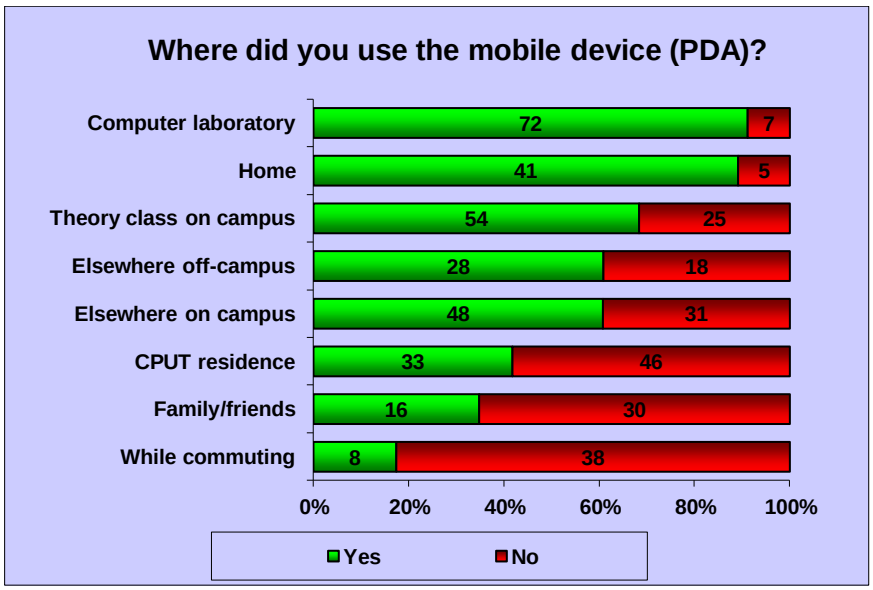


Figure 5.66: Location of mobile device (PDA) usage

Figure 5.66 indicates where respondents have mainly used a mobile device (PDA):

- Computer laboratory on campus (91.1%)
- Home (89.1%)
- Theory class on campus (68.4%)
- Elsewhere off-campus (60.9%)
- Elsewhere on campus (60.8%)

An analysis of the questionnaire reflects that learners use their mobile devices almost equally inside (91.1%) and outside (89.1%) the boundaries of the classroom (P204). Several learners primarily attributes this to the fact that they prefer to make use of PDAs instead of computers in a formal educational settings even when they had access to a computer in the same classroom. This comes as a surprise, since it was anticipated that learners would mostly find it easier to use a computer, because of its larger screen and easier means of data input, predominantly making tasks quicker and easier. A relatively small number of learners (11.8%) indicated that they have used the PDA during travel periods. These results are in contrast with research conducted by Pettit and Kukulska-Hulme (2007:28), as well as Thornton and Houser (2005:223) who found that a significant number of learners used their travel periods to access learning material on their mobile devices. When the computer science programming learners were probed about why they would not use mobile devices while making use of public transport, the main reason was the possibility of being robbed, which is unfortunately a harsh reality in South Africa.

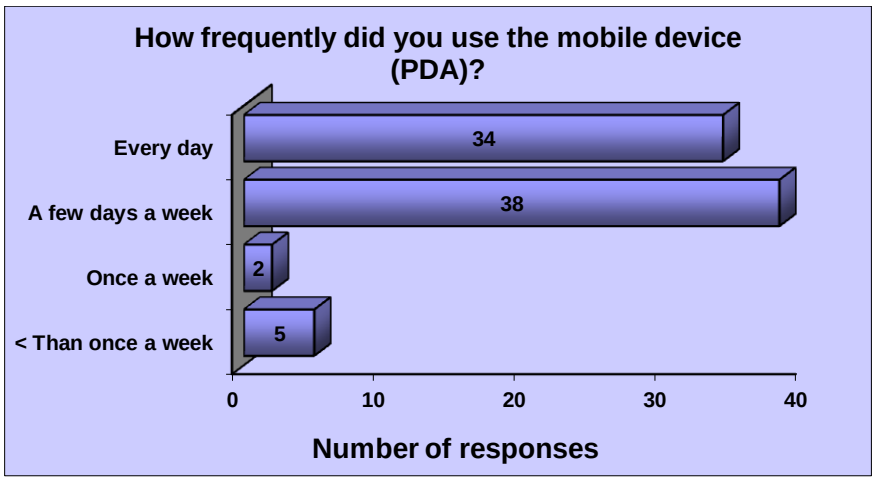


Figure 5.67: Frequency of mobile device (PDA) usage

Of the respondents, 43.0% indicated that they have used a mobile device (PDA) every day. The majority (48.1%) indicated that they have used a mobile device (PDA) a few days a week, whereas 2.5% indicated once a week and 6.3% indicated less than once a week (Figure 5.67).

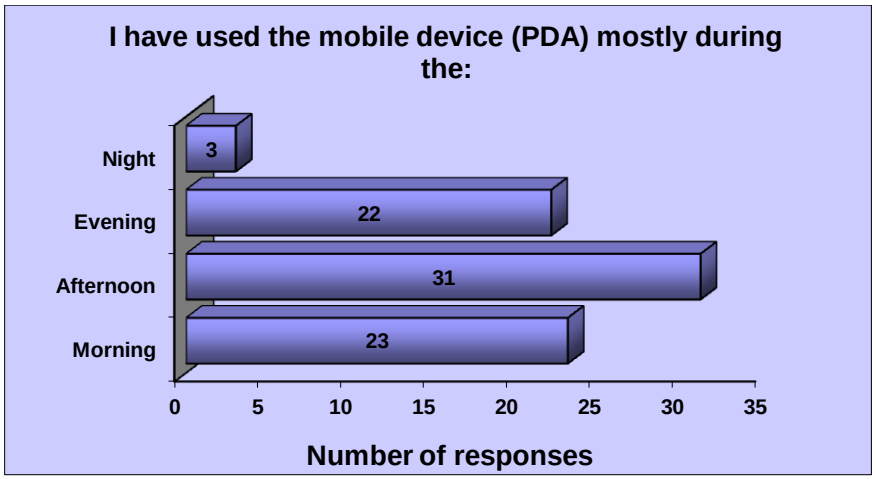


Figure 5.68: Time when mobile device (PDA) was mostly used

Figure 5.68 reflects that 39.2% of the respondents have used a mobile device (PDA) mostly in the afternoon (12 pm - 6 pm), followed by 29.1% in the morning (6 am - 12 pm), 27.8% in the evening (6 pm - 12 am), and 3.8% during the night (12 am - 6 am).

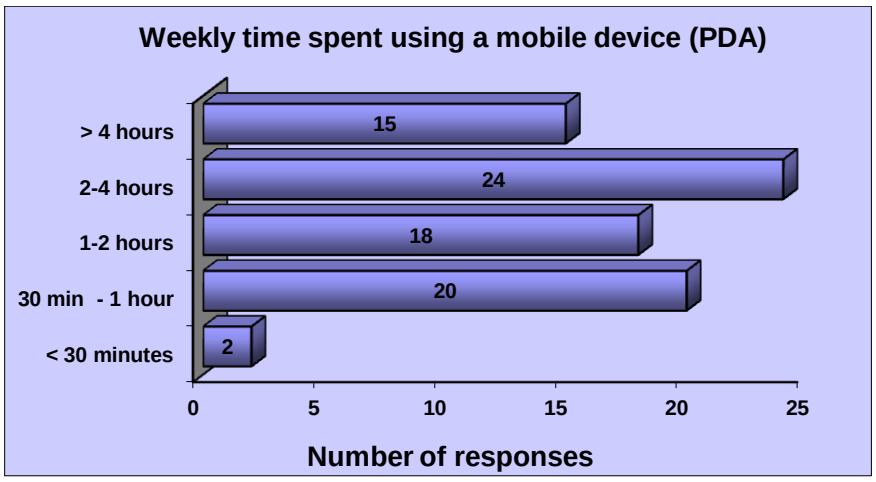


Figure 5.69: Weekly time spent using a mobile device (PDA)

Of the respondents, 30.4% indicated that they have spent two to four hours per week using a mobile device (PDA), 25.3% have spent 30 minutes to an hour, 22.8% have spent one to two hours, and 19% indicated that they have spent more than 4 hours a week using a mobile device (PDA) (Figure 5.69).

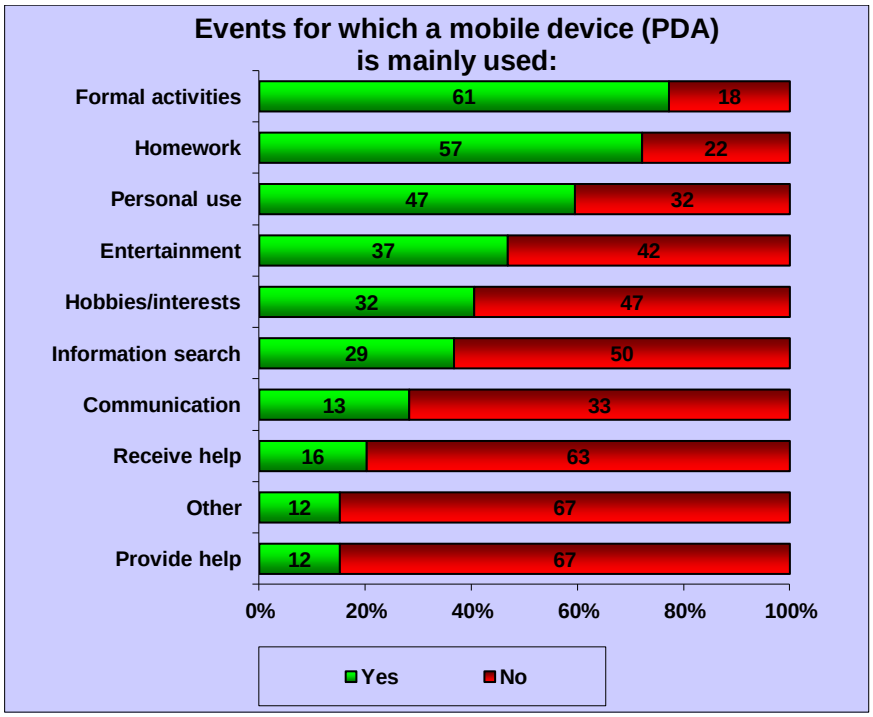


Figure 5.70: Events for which a mobile device (PDA) is mainly used

Learners recognise mobile devices (PDAs) as being useful for the following events (Figure 5.70):

- Formal subject-related activities (assignments etc.) (77.2%), Homework (any subject) (72.2%), Personal use (59.5%), Communication (28.3%), and Entertainment (46.8%).

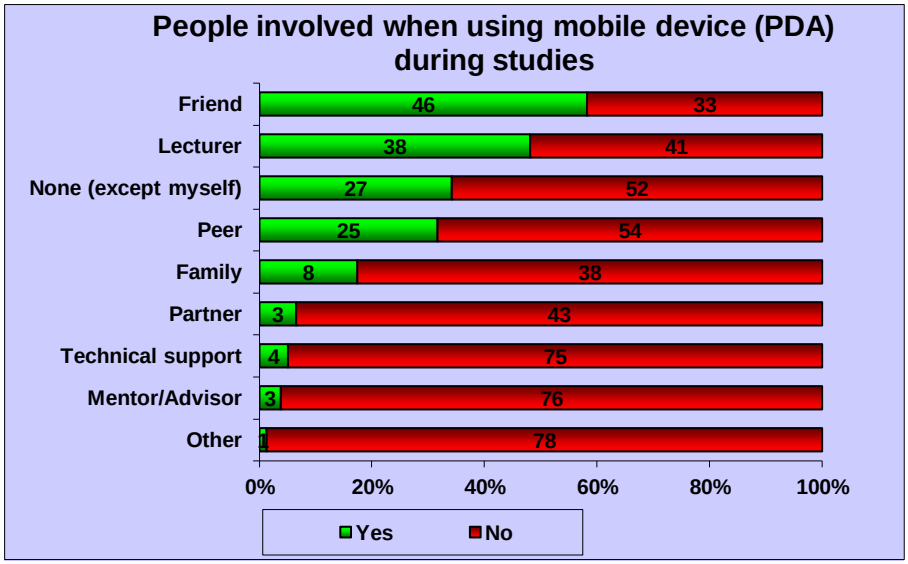


Figure 5.71: People involved when using mobile device (PDA) during studies

Figure 5.71 reflects that the following people were involved when respondents made use of a mobile device (PDA) during the course of their studies:

- Friend (58.2%), Educator (48.1%), Peer (31.7%), and None (except the learner self) (34.2%).

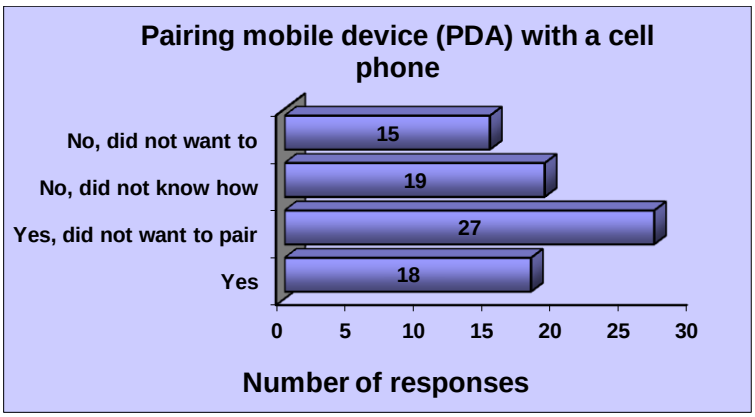


Figure 5.72: Pairing of mobile device (PDA) with a cell phone

Of the respondents, 22.8% indicated that they have paired a mobile device (PDA) with their cell phone, 34.2% have tried to pair a mobile device (PDA) with their cell phone, but the devices did not successfully pair, 24.0% did not attempt to pair a mobile device (PDA) with their cell phone, because apparently they did not know how to, and 19% indicated that they have not paired a mobile device (PDA) with their cell phone, because they did not wish to (Figure 5.72).

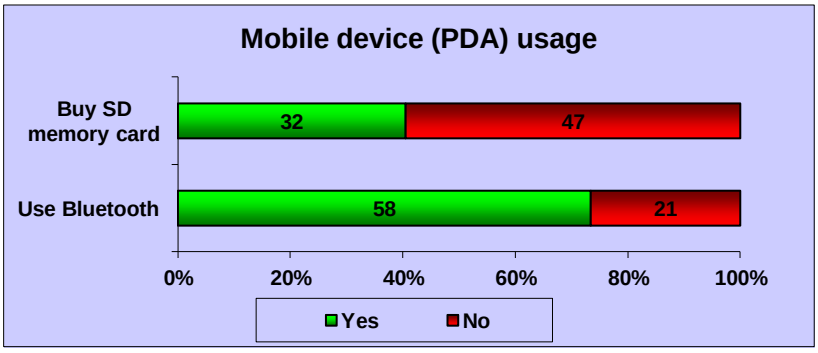


Figure 5.73: Use of mobile device (PDA)

Figure 5.73 reflects how learners have used their mobile devices (PDA):

- Shared files by means of Bluetooth (73.4%)
- Bought an SD memory card to extend the storage capacity of the mobile device (40.5%)

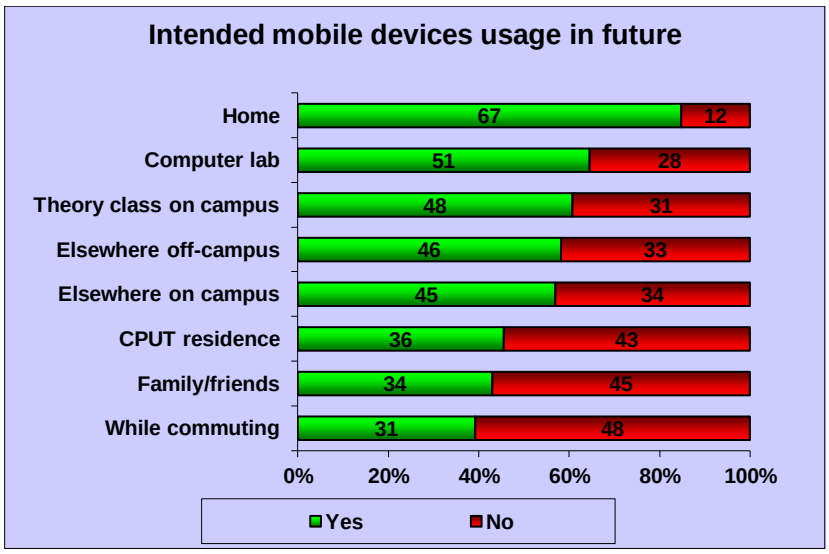


Figure 5.74: Location where mobile devices will be used in future

Figure 5.74 indicates the location of learners' intended use of mobile devices in future:

- Home (84.8%)
- Computer laboratory on campus (64.6%)
- Theory class on campus (60.8%)
- Elsewhere off-campus (58.2%)
- Elsewhere on campus (57.0%)
- Residence (45.6%)
- While commuting (39.2%)
- Family/Friends (43.0%)

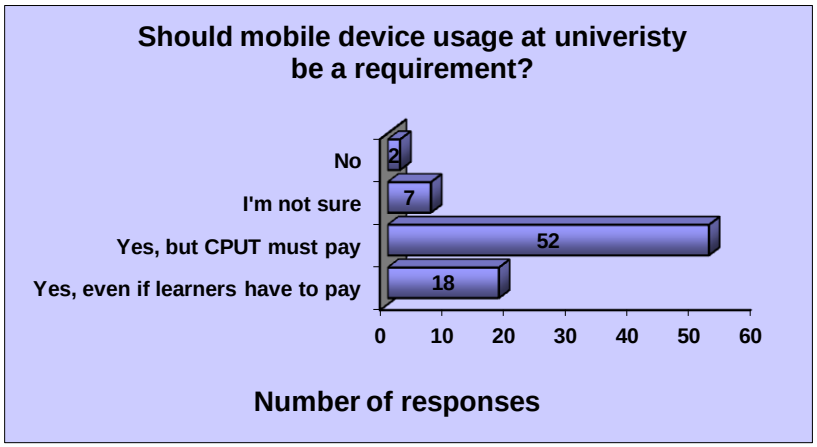


Figure 5.75: Indication of whether mobile device usage at university should be a requirement

Of the respondents, 22.8% indicated that mobile device usage at university should be requirement during the course of their studies, even if they have to pay for the devices themselves. The majority of learners (65.8%), indicated that they were of the opinion that mobile device usage at university should be a requirement, but that the university (CPUT) should pay for the devices. Of the respondents, 8.9% were not sure, and 2.5% felt that the use of mobile devices at university should not be a requirement (Figure 5.75).

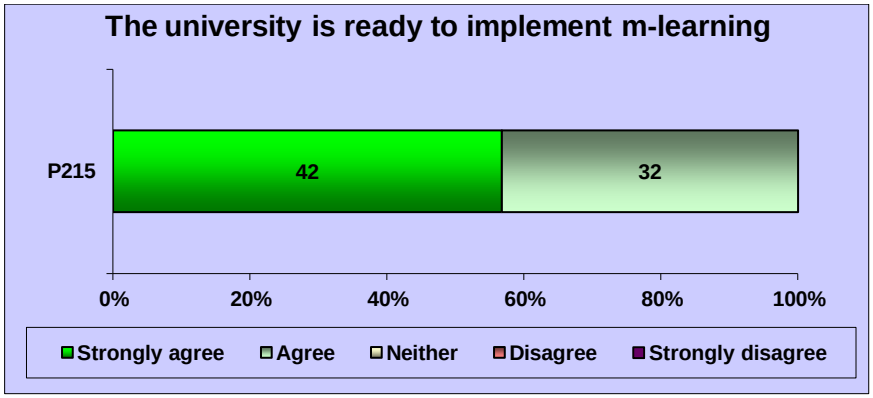


Figure 5.76: University readiness to implement mobile learning

In terms of Figure 5.76, respondents agree (43.2%) to strongly agree (56.8%), that the university is ready to implement m-learning.

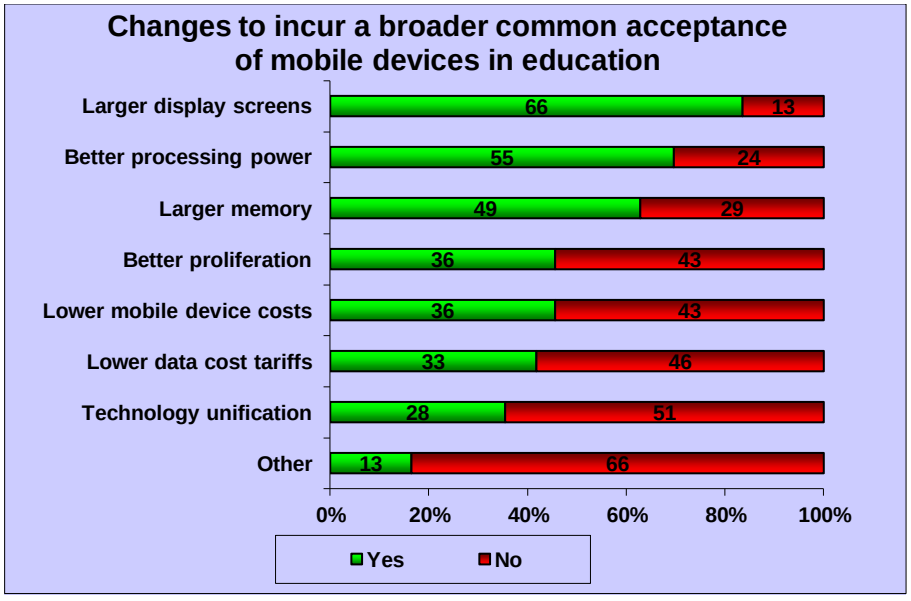


Figure 5.77: Changes to incur a broader common acceptance of mobile device usage in education

Figure 5.77 reflects that several factors limit the utilisation of mobile devices and as a result influence learners' common broader acceptance of educational offerings via mobile devices. These primarily include the size of the display screen (83.5%), weak processing power (69.6%), relatively small memory capacities (62.8%), high data cost tariffs (41.8%), and high mobile device costs (45.6%), however none of these limitations were viewed as a reason not to utilise mobile devices.

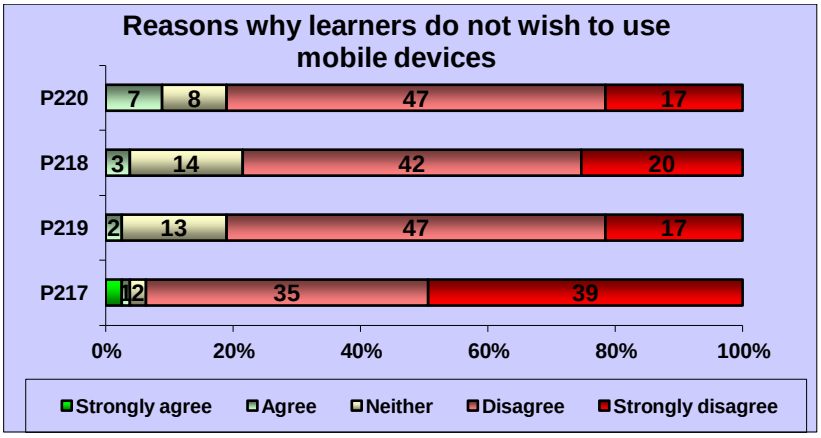


Figure 5.78: Reasons why learners do not wish to make use of mobile devices

Figure 5.78 reflects that the respondents 'disagree to strongly disagree' that they do not wish to use mobile devices because:

- It is difficult to enter data using the stylus/pen/touch on a mobile device (81.0%) (P220)
- The mobile devices are too fragile and are easily broken (78.5%) (P218)
- They find it difficult to read text on a mobile device screen (81.0%) (P219)
- The mobile devices are too heavy to carry around (93.7%) (P217)

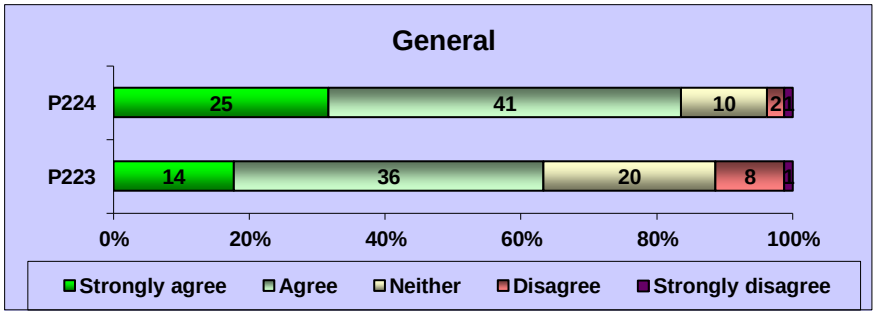


Figure 5.79: General questions regarding mobile device usage in a technology-based subject

Figure 5.79 reflects that the respondents 'agree to strongly agree' that:

- They would prefer to use a mobile device during tests to assist them with coding programs (83.5%) (P224)
- They would find it acceptable to learn computer programming with mobile device access only (63.3%) (P223)

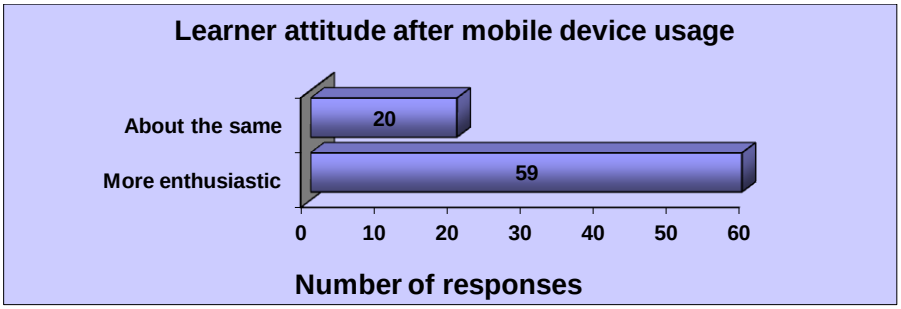


Figure 5.80: Learner attitude after mobile device usage

Of the respondents, 74.7% are more enthusiastic about the use of mobile devices after the m-learning experience when compared to their attitude in the beginning of the semester. Of the respondents, 25.3% feel the same about mobile device usage as in the beginning of the semester (Figure 5.80).

5.3.3.1.4 Learner journal (2012)

During 2012, the m-learning group was requested to make use of academic learner research journals to reflect their learning processes while utilising mobile technology both on- and off-campus (Appendix E). A mobile friendly learner journal document was provided to learners for easy completion after utilising the PDA. Learner journal entries were entirely optional to complete. Variable names for the learner journal can be found within the ambit of Appendix J. Data gathered from the academic learner research journals exhibits the following:

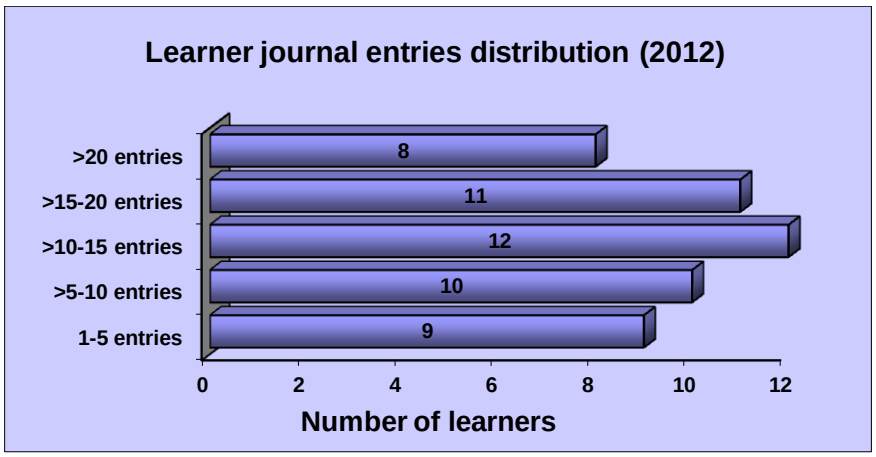


Figure 5.81: Distribution of learner journal entries

In terms of Figure 5.81, 18% of the 2012 respondents made one to five entries in the learner journal, 20% made between five and ten entries, 24% made between 10 and 15 entries, 22% made between 15 to 20 entries, and 16% made more than 20 learner journal entries.

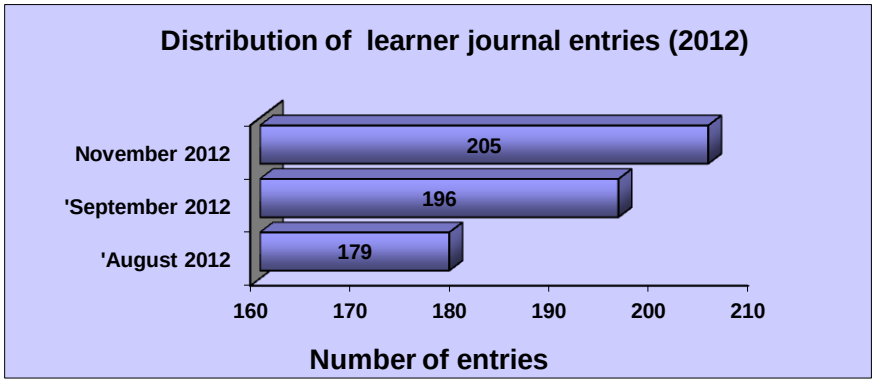


Figure 5.82: Distribution of when learner journal entries were captured (2012)

Of the learner journal entries, 40% were captured during the month of October 2012, 28.8% were captured during September 2012, and 26.3% were captured during August 2012 (Figure 5.82), indicating that learners use the PDA more frequently towards the end of the second semester when they prepare for summative assessments.

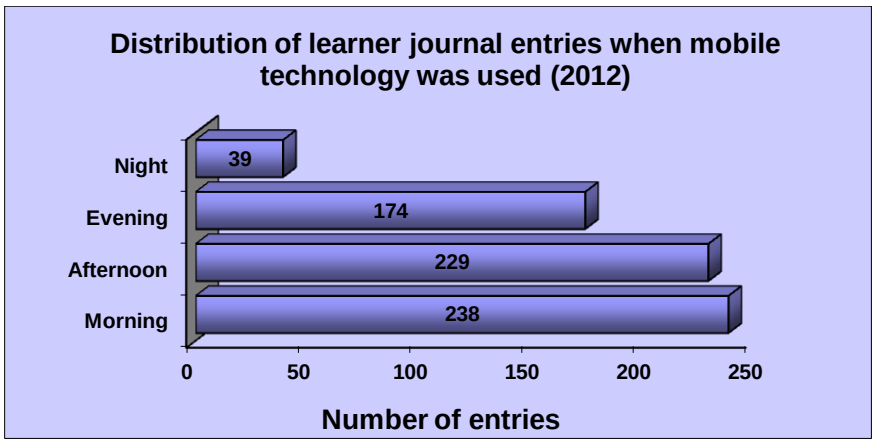


Figure 5.83: Distribution of learner journal entries when mobile technology was used (2012)

Figure 5.83 reflects that learner journal entries captured during 2012 indicate that mobile technology was mainly used in the mornings (35%) (6 am - 12 pm), followed by 33.7% in the afternoon (12 pm - 6 pm), 25.6% in the evening (6 pm - 12 am), and 5.7% at night (12 am - 6 am).

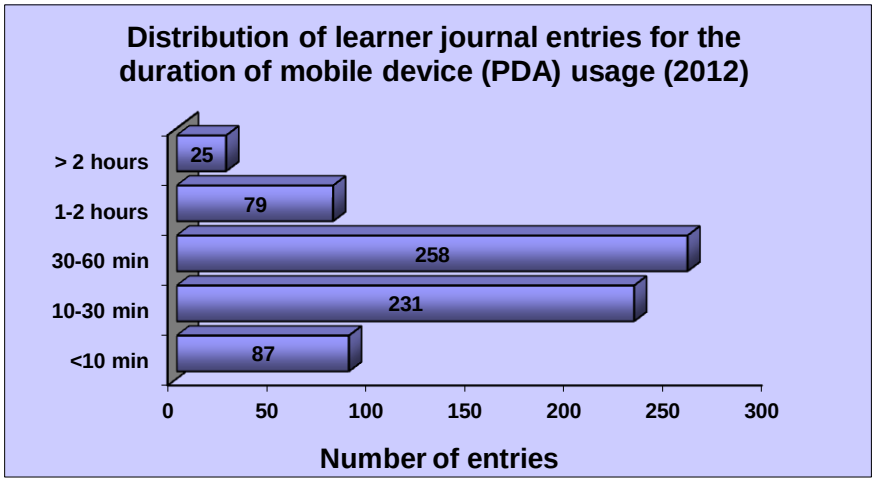


Figure 5.84: Learner journal entries distribution for the duration of mobile device (PDA) usage (2012)

Figure 5.84 reflects that 12.8% of the 2012 respondents used a mobile device (PDA) for less than 10 minutes, 34.0% for 10 to 30 minutes, 37.9% for 30 to 60 minutes, 11.6% for one to two hours and 3.7% for more than two hours.

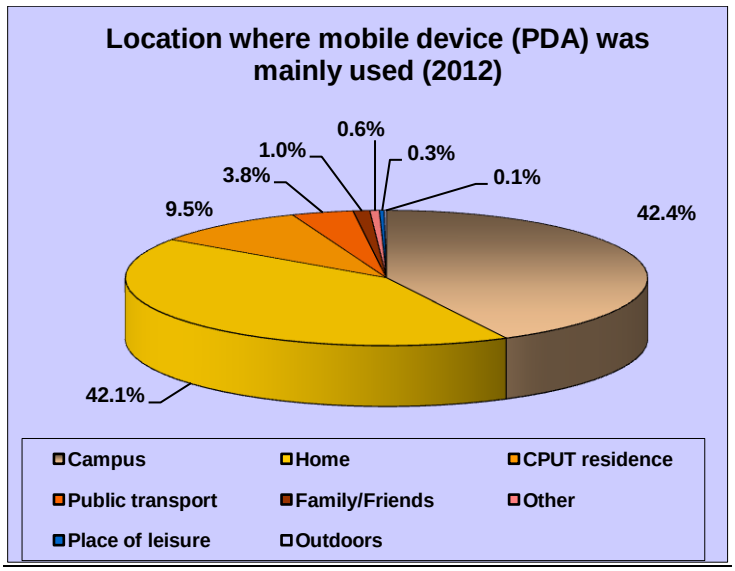


Figure 5.85: Location where mobile device (PDA) was mainly used (2012)

Figure 5.85 reflects the location where a mobile device was mainly used by respondents during 2012:

- Campus (42.5%), Home (42.2%), and CPUT residence (9.6%).

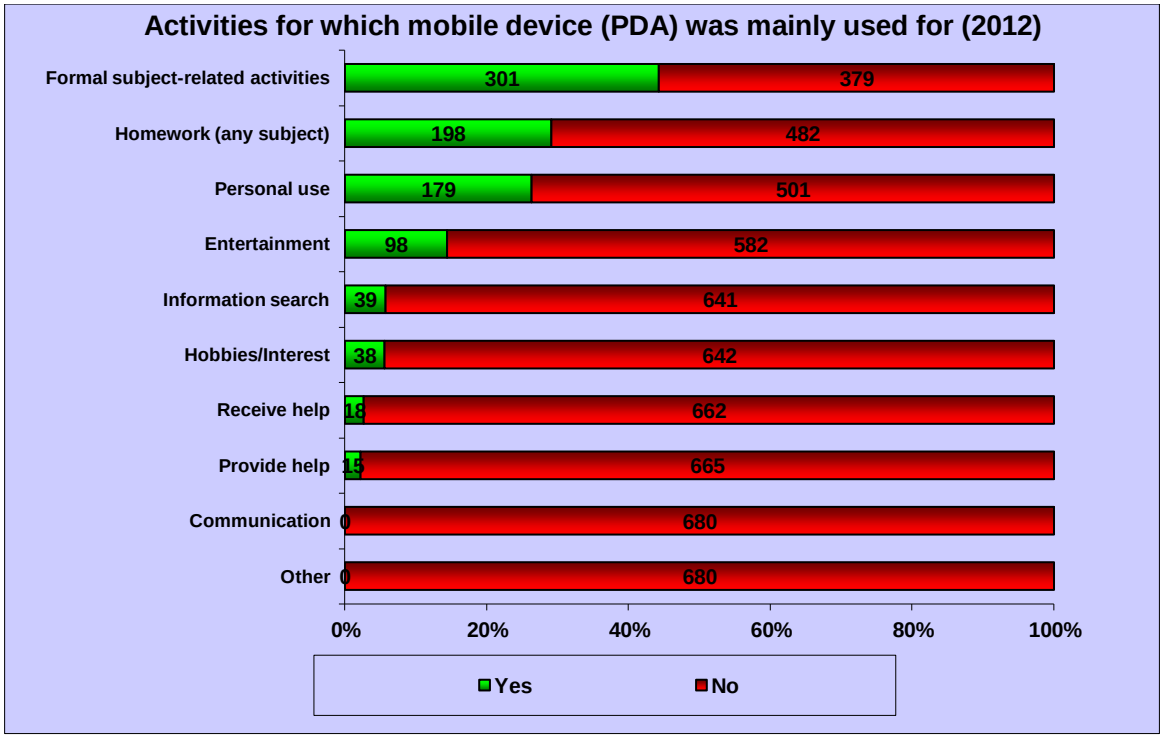


Figure 5.86: Activities for which a mobile device (PDA) was mainly used (2012)

Figure 5.86 reflects that respondents indicated that the activities for which they have mainly used a mobile device for are:

- Formal subject-related activities (44.3%)
- Homework (29.1%)
- Personal use (26.3%)
- Entertainment (14.4%)

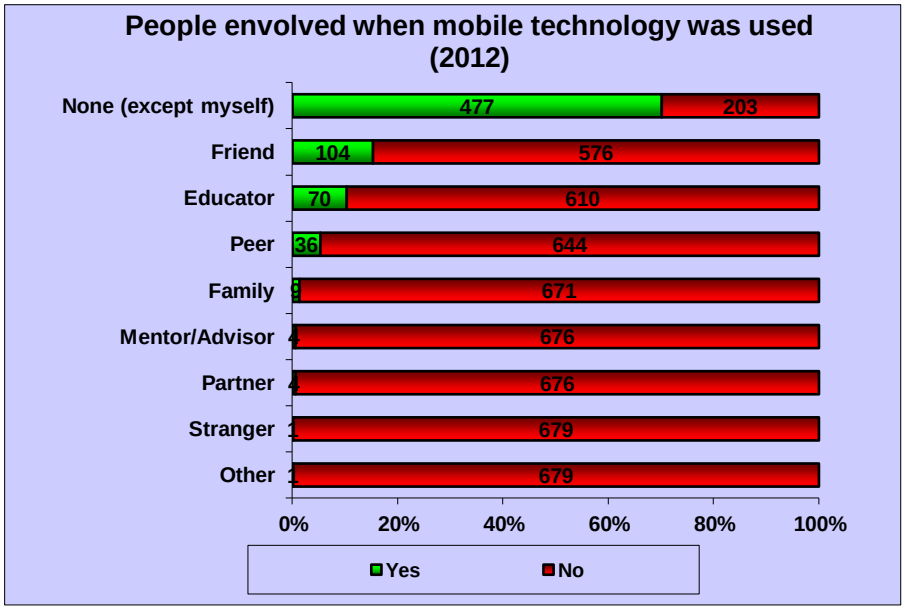


Figure 5.87: People involved when mobile device was used (2012)

In terms of Figure 5.87, the following people were involved when 2012 respondents made use of a mobile device:

- The learner - "None (except myself)" (70.2%)
- Friend (15.3%)
- Educator (10.3%)
- Entertainment (14.4%)

It is of importance to note that graphs were not prepared for questions P221 and P222 as they represent open-ended questions that the researcher analysed and used as motivational information.

Learners were requested to state at least one high point and one low point regarding their m-learning experience each time when they have utilised a PDA. Table 5.9 lists some of the learner comments (high points) on their mobile technology utilisation both on and off-campus (learner comments were not edited). Although the majority of learners did not provide any comments, they have mostly indicated an overall positive attitude towards the use of mobile technology, whether it was for entertainment and personal use, or formal subject-related activities. The mobility of the PDA was highlighted to be the most important high point. In addition, learners found the PDA to be extremely useful and easy to use.

Table 5.9: Learner high point(s) (unedited) regarding their m-learning experience each time a PDA was utilised

Can do your work anywhere.
the games
battery last long, convenient
because I have work so hard to make sure that this is correct
because the program is running exactly as it have required and I've follow all the instruction as they have required.
Can do your work anywhere.
Convenient in terms of portability and fun to use.
Easy and portable internet use around wifi hotspots
EASY WHEN YOU ARE DIONG IT ON PDA
every this worked well
I am able to use it on my own. The PDA is so helpful to me because I can also be able to do my other university activities when I am at home
I can set my alarms
I did revision on some of the previous exercises and assignments.
I Find the programming do-able if you put effort into your work.
I really enjoy this device, it helps me a lot to improve my skills and a lot of things....
I use other locations since because that's were I get assistance from strangers. Its help to prepare coding before doing the final assignment. The program is running as it have required by the question.
It kept me busy.
It was fun being able to type out a document on MS Word on the PDA and play games(the games are fun).
it was very easy to use
it's running perfectly
Its help to prepare coding before doing the final assignment. The program is running as it have required by the question.
long lasting battery
play games, music, doing some exercises with excell,word,power point and create some program for myself during my holiday.
Portable entertainer
practice the coding in PDA after I have already done in Desktop, its perfectly running
Program is running
Quick and easy to connect to the PC.
The PDA is so helpful to me because I can also be able to do my other university activities when I am at home

The program is running as it have required by the instruction document.
The program runs as it runs on a desktop PC.
the program runs proper
Time saving
Used on practicing coding,the program is absolutely running perfect as it have been required
Used whatsapp to communicate with lecturer
very helpful especially when time is limited.
very insightful
Very useful

Conversely, Table 5.10 reflects that a relatively small number of learners indicated some concerns (low points) on the utilisation of mobile technology (learner comments were not edited). Most learners indicated usability problems of which the small screen size (and as a result text being too small and difficult to read), the fragility and sensitivity of PDA screens, the difficulty in using the stylus efficiently, as well as the fact that it cannot be utilised as a cell phone, were the most prevalent low points mentioned.

Table 5.10: Learner concerns/low points (unedited) regarding their m-learning experience each time a PDA was utilised

Battery dying while I attempt to upload my assignments.
code shows no colour
I struggled first
Internet browsing is limited to areas that have Wi-fi
It takes a much longer to write the coding.
Its no one were assisting me to do an assignment
limited number of games
Limited Wifi hot spots
NO DIFFICULTIES
NO DIFFICULTIES I HAVE COME ACROSS WITH
no internet connection
Not easy spotting small mistakes
old software
old windows software, bad touch screen
Panic when using it.
Screen is to small.
Small screen
Small memory
Not a lot of memory
Struggling on my own
The only form of internet connection it uses is wi-fi,so I cannot browse the internet from anywhere
The screen is rather small for working on
There are no low points

5.3.4 Inferential statistics

This section includes all the inferential statistics that were executed in order to answer the research questions. The following information serves as background against which testing was accepted or rejected.

SAS computes a P-value (Probability value) that measure statistical significance, which is derived from the test values like the Chi-square, F-value (ANOVA) and t-value (T-tests). Results will be regarded as significant if the p-values are smaller than 0.05, because this value presents an acceptable level on a 95% confidence interval ($p \leq 0.05$). The p-value is the probability of observing a sample value as extreme as, or more extreme than the value actually observed, given that the null hypothesis is true. This area represents the probability of a Type 1 error that must be assumed if the null hypothesis is rejected (Cooper & Schindler, 2001:509).

The p-value is compared to the significance level (α) and on this basis the null hypothesis is either rejected or not rejected. If the p value is less than the significance level, the null hypothesis is rejected (if p value $< \alpha$, reject null). If the p value is greater than or equal to the significance level, the null hypothesis is not rejected (if p value $\geq \alpha$, don't reject null). Thus, with α=0.05, if the p value is less than 0.05, the null hypothesis will be rejected. The p value is determined by using the standard normal distribution. The small p value represents the risk of rejecting the null hypothesis.

A difference has statistical significance if there is good reason to believe the difference does not represent random sampling fluctuations only. Results will be regarded as significant if the p-values are smaller than 0.05, because this value is used as a cut-off point in most behavioural science research.

5.3.5 Factor analysis

In the first instance, the internal consistence (reliability) of the first post-m-learning questionnaire (post 1) that contains elements of a TAM (Technology Acceptance Model), was assessed by executing a Cronbach Alpha analysis on all the items, as well as per the assumed latent variable. This analysis yielded the scale to be internally consistent, thus reliable.

Secondly, exploratory factor analysis is used to investigate the factor structure underlying the set of original observed variables, as well as assess the construct validity that represents the measurements regarding the TAM. Per definition, factor analysis identifies the nature and number of latent factors responsible for covariation in data analysis. The final results, including the rotated factor pattern (Varimax rotation), and communality estimates of the exploratory factor analysis, are shown in Table 5.11. The communality refers to the percent of variance in an observed variable that is accounted for by the retained factors (Hatcher, 1994:13).

The Kaiser-Meyer measure of sampling adequacy was performed on the TAM questionnaire in order to determine whether a factor analysis is appropriate for the data. The MSA (measure of sampling adequacy) is 0.5853, which is just beyond the reach of being adequate to perform a factor analysis (Kaiser, 1974:31-36). To comply with the requirements to execute a factor analysis on the data, the items (statements) with a MSA of lower than 0.5 were omitted from the analysis. This yielded an overall MSA of 0.7644, which indicated a factor analysis can be performed on the data as it is in the middling range of Kaiser's Index. All the communality estimates for all the remaining 24 items (P102, P104, P106, P107, P108, P115, P116, P117, P119, P120, P121, P122, P123, P124, P126, P127, P128, P133, P134, P135, P136, P137, P138, P139), as depicted in Appendix N (see CD-ROM: Supporting Data), are also above 0.5. It is of importance to note that the variables that were not included for the final factor analysis will be analysed individually on completion of the analysis.

Table 5.11: Original items and corresponding factor loadings from the rotated factor pattern

Factor Pattern					Final Communality Estimates	Questionnaire Statements
1	2	3	4	5		
76	31	21	28	4	0.8060	P138
72	12	25	12	29	0.6934	P136
67	43	14	39	7	0.8107	P137
66	29	-1	0	18	0.5507	P117
64	30	-4	49	6	0.7416	P134
61	19	24	-14	54*	0.7798	P119
33	74	12	-3	-14	0.6954	P115
23	66	29	25	32	0.7408	P120
26	64	-3	15	15	0.5218	P127
19	61	-10	22	31	0.5621	P128
55*	61	30	11	-3	0.7781	P116
6	53	23	42	40	0.6735	P121
17	-11	75	27	-1	0.6776	P106
29	9	69	13	16	0.6082	P104
-7	9	68	16	12	0.5186	P107
11	43	54	-10	22	0.5512	P108
19	30	22	72	12	0.7114	P133
58*	34	13	66	-1	0.9001	P139
3	5	28	65	27	0.5836	P122
42	-19	18	56	46	0.7742	P135
10	21	6	22	80	0.7513	P126
29	1	45	25	67	0.8029	P123
11	25	48	38	50	0.7081	P124

❖ *Note that all the loadings are multiplied by 100 and rounded*

Measurements regarding the TAM were subjected to an exploratory factor analysis using Squared Multiple Correlations (SMC) as prior communality estimates. The principal factor method was used to extract the factors, and this was followed by a Varimax (orthogonal) rotation. A Scree Test suggested five meaningful factors, so only these factors were retained for rotation. These five factors explain collectively 85.9% of the variance of the set of items that were entered in the analysis.

Item P102 did not load enough on any factor to be included in further analysis. Items P116, P119 and P139 have large enough loadings to load on two factors and were subsequently excluded from the factor analysis. The results of the final factor analysis with these 4 items (P102, P116, P119 and P139) removed are reflected in Table 5.12.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.12: Final items and corresponding factor loadings from the Varimax rotated factor pattern

Factor Pattern					Final Communality Estimates	Questionnaire Statements
ITEM NR	1	2	3	4		
1.	76	14	32	22	0.7496	P138
2.	73	24	32	-2	0.6856	P134
3.	72	20	41	16	0.7468	P137
4.	70	29	17	22	0.6397	P136
5.	47	74	-9	14	0.7885	P135
6.	-1	71	43	10	0.6971	P126
7.	24	67	10	41	0.6794	P123
8.	15	61	31	47	0.7086	P124
9.	23	59	4	23	0.4589	P122
10.	21	24	73	-6	0.6369	P128
11.	25	11	71	2	0.5745	P127
12.	30	28	62	30	0.6488	P120
13.	38	-22	59	13	0.5614	P115
14.	21	19	-9	73	0.6147	P106
15.	-5	20	6	70	0.5299	P107
16.	29	23	11	67	0.6004	P104

❖ *Note that all the loadings are multiplied by 100 and rounded to the nearest integer*

In interpreting the rotated factor pattern, an item was said to load on a given factor if the factor loading was 0.50 or greater for that factor, and was less than 0.50 for the other. In total 16 items load on a given factor according to the abovementioned criteria. Using these criteria, four items were found to load on the first factor, which was subsequently labelled the “Output Quality” factor, five items loaded on the second factor, which was labelled the “Attitude” factor, four items loaded on the third factor, which was labelled the ”Perception” factor, and three items loaded on the fourth factor which was labelled the ”Usefulness” factor. These four factors explain collectively 91.8% of the variance of the set of 16 items that were entered in the analysis. The four factors of the TAM questionnaire will be used in further analysis and those items that did not load on a factor, will be analysed separately.

Pearson correlations were calculated to determine whether there exist relationships between the factors, and there were no statistically significant correlation between the factors (Appendix N – CD-ROM: Supporting Data).

For the second post-m-learning questionnaire (post 2), a factor analysis was performed on the items that were present for both the 2011 as well as the 2012 surveys, for the three latent variables presented in the questionnaire (Use, Perception and Attitude). The MSA which was very small in all three cases (Overall MSA for: Use=0.0779, Perception=0.5271 and Attitude=5526) indicated that the data is not adequate for factor analysis) even after deleting the items with a MSA of less than 0.5.

5.3.6 Comparison between the 2011 and 2012 m-learning groups

The information for the 2011 and 2012 surveys are compared with respect to all the questions in the three questionnaires (Appendix A, Appendix B and Appendix C) that were presented to both groups by using Chi-Square testing, as the data are either nominal or ordinal of nature.

The following tables and graphs indicate where there were statistically significant correlations between the dependent variable and response variables. Although only the statistically significant correlations are mentioned in this paragraph, it is of importance to note that all the Chi-square tests, including those that did not have a statistically significant correlation, are shown in Appendix O (see CD-ROM: Supporting Data).

It is further of importance to note that some of the categories were collapsed to fewer categories in order to meet the requirements of sufficient expected frequencies (these expected frequencies should all be greater than one and in no more than 20% of the cells should they be less than 5).

5.3.6.1 Pre-mobile learning questionnaire

Table 5.13: Contingency table for Year of survey vs. First language (A03)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	**Afrikaans**	**English**	**French**	**isiXhosa**	**Other**	**TOTAL**
2011 m-learning group	3 3.7% 9.1% 75.0%	10 12.4% 30.3% 45.4%	1 1.2% 3.0% 5.3%	19 23.5% 57.6% 59.4%	0 0.0% 0.0% 0.0%	33 40.7%
2012 m-learning group	1 1.2% 2.1% 25.0%	12 14.8% 25.0% 54.6%	18 22.2% 37.5% 94.7%	13 16.0% 27.1% 40.6%	4 4.9% 8.3% 100.0%	48 59.3%
TOTAL	4 4.9%	22 27.2%	19 23.5%	32 39.5%	4 4.9%	81 100%

Table 5.14: Chi-square test of comparisons (Year of survey vs. First language - A03)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and First language (A03)				
3. First language	81	19.4050	4	0.0007***

The Chi-square test in Table 5.14 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group has isiXhosa as their first language when compared to the 2012 group. Furthermore, the 2012 group had more French speaking respondents. Table 5.13 and Figure 5.88 reflect the comparison between the year of the survey and respondents' first language.

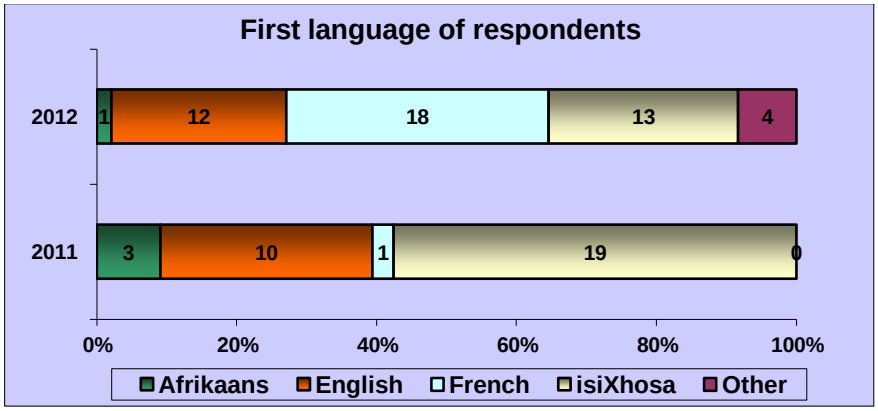


Figure 5.88: Year of survey vs. First language (A03)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.15: Contingency table for Year of survey vs. Place of residence (A06)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Family/ Friends	Home	Residence	Other	TOTAL
2011 m-learning group	1 1.3% 3.0% 5.9%	16 20.2% 48.5% 47.1%	15 19.0% 45.4% 60.0%	1 1.3% 3.0% 33.3%	33 41.8%
2012 m-learning group	16 20.2% 34.8% 94.1%	18 22.8% 39.1% 52.9%	10 12.7% 21.7% 40.0%	2 2.5% 4.4% 66.7%	46 58.2%
TOTAL	17 21.5%	34 43.0%	25 34.6%	3 3.8%	79 100%

Table 5.16: Chi-square test of comparisons (Year of survey vs. Place of residence - A06)

Question/Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A06				
6. Where do you live during your studies?	79	12.8963	3	0.0049**

The Chi-square test in Table 5.16 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group live in a CPUT residence during their studies when compared to the 2012 group. Furthermore, more respondents of the 2012 group live with their family or friends. Table 5.15 and Figure 5.89 reflect the comparison between the year of the survey and respondents' place of residence during the course of their studies.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

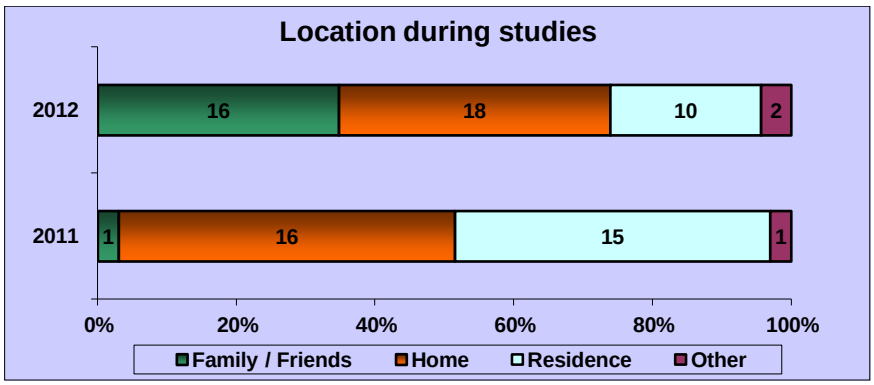


Figure 5.89: Year of survey vs. Place of residence during studies (A06)

Table 5.17: Contingency table for Year of survey vs. means of transportation to university (A07)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Car	Public Transport / Taxi	University bus	Walk	TOTAL
2011 Survey	5 6.3% 15.2% 83.3%	12 15.2% 36.4% 27.3%	11 13.9% 33.3% 57.9%	5 6.3% 15.2% 50.0%	33 41.8%
2012 Survey	1 1.3% 2.2% 16.7%	32 40.5% 69.6% 72.7%	8 10.1% 17.4% 42.1%	5 6.3% 10.9% 50.0%	46 58.2%
TOTAL	6 7.6%	44 55.7%	19 24.0%	10 12.7%	79 100%

Table 5.18: Chi-square test of comparisons (Year of survey and means of transportation to university - A07)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A07				
7. How do you usually get to the university?	79	10.3729	3	0.0156*

The Chi-square test in Table 5.18 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group use the university bus to travel to the university when compared to the 2012 group.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Furthermore, more respondents of the 2012 group make use of public transport/a taxi. Table 5.17 and Figure 5.90 reflect the comparison between the year of the survey and respondents' means of travelling to the university/campus.

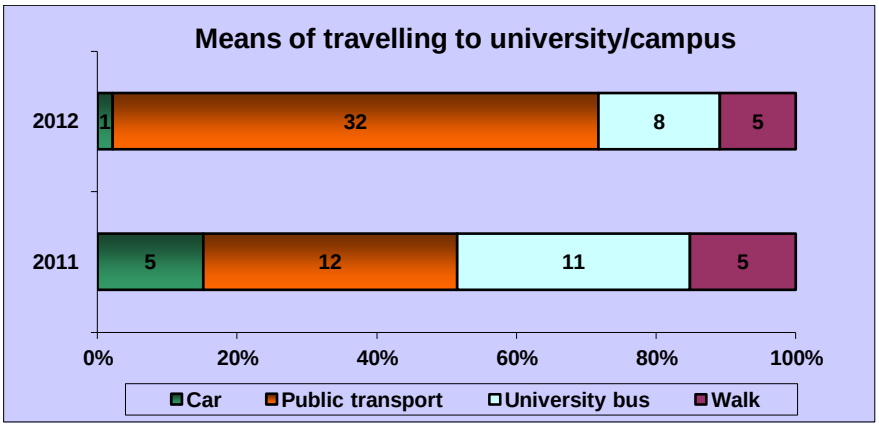


Figure 5.90: Year of survey vs. means of travelling to university/campus (A07)

Table 5.19: Contingency table for Year of survey vs. whether learners believe that the use of mobile technology as a tool in the classroom will make any difference to the quality of their university output (A11)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	Don't Know	TOTAL
2011 Survey	21 26.6% 63.6% 33.9%	3 3.8% 9.1% 42.9%	9 11.3% 27.3% 90.0%	33 41.8%
2012 Survey	41 51.9% 89.1% 66.1%	4 5.1% 8.7% 57.1%	1 1.3% 2.2% 10.0%	46 58.2%
TOTAL	62 78.5%	7 8.9%	10 12.7%	79 100%

Table 5.20: Chi-square test of comparisons (Year of survey vs. A11)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A11				
11. Do you believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of your university work?	79	11.1574	2	0.0038**

The Chi-square test in Table 5.20 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. As a result the analogy can be drawn that statistically significant more respondents from the 2011 group did not know whether the use of mobile technology as a tool in the classroom would make a difference to the quality of their university output when compared to the 2012 group. The analogy can be drawn that more respondents from the 2012 group believe that it would make a difference, which might be due to the fact that they were already using the mobile devices in the classroom. Table 5.19 and Figure 5.91 reflect the comparison between the year of the survey and whether respondents believe that the use of mobile technology in the classroom will make a difference to the quality of their university output.

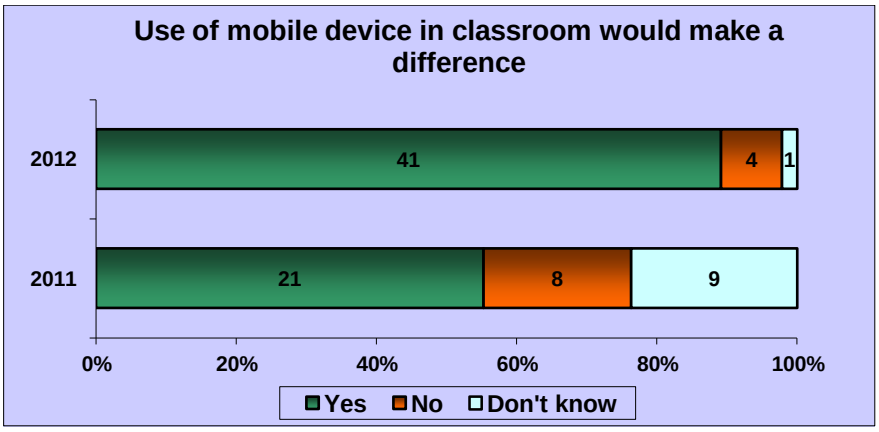


Figure 5.91: Year of survey vs. A11

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.21: Contingency table for Year of survey vs. whether a learner has ever used a laptop computer (A13b)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	32 40.5% 97.0% 48.5%	1 1.3% 3.0% 7.79%	33 41.8%
2012 Survey	34 43.0% 73.9% 51.5%	12 15.2% 26.1% 92.3%	46 58.2%
TOTAL	66 83.5%	13 16.5%	79 100%

Table 5.22: Chi-square test of comparisons (Year of survey vs. A13b)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A13b				
13b. Which mobile technology have you ever used? Laptop computer	79	7.4303	1	0.0064**

The Chi-square test in Table 5.22 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group never used a laptop computer when compared to the 2011 group. Table 5.21 and Figure 5.92 reflect the comparison between the year of the survey and whether respondents have ever used a laptop computer.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

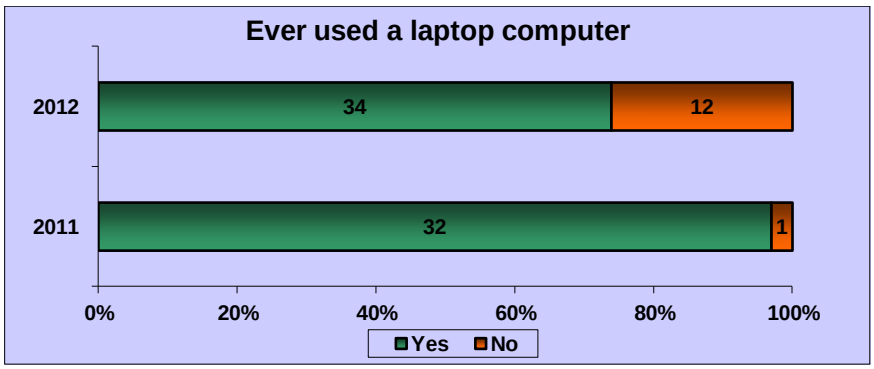


Figure 5.92: Year of survey vs. A13b

Table 5.23: Contingency table for Year of survey vs. whether a learner has ever used a(n) iPad/Tablet (A13d)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	33 41.8% 100.0% 57.9%	33 41.8%
2012 Survey	22 27.8% 47.8% 100.0%	24 30.4% 52.2% 42.1%	46 58.2%
TOTAL	22 27.8%	57 72.2%	79 100%

Table 5.24: Chi-square test of comparisons (Year of survey vs. A13d)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A13d				
13d. Which mobile technology have you ever used? iPad/Tablet	79	21.8741	1	<0.0001***

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.24 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have used a(n) iPad/Tablet before when compared to the 2011 group. Table 5.23 and Figure 5.93 reflect the comparison between the year of the survey and whether respondents have ever used a(n) iPad/Tablet.

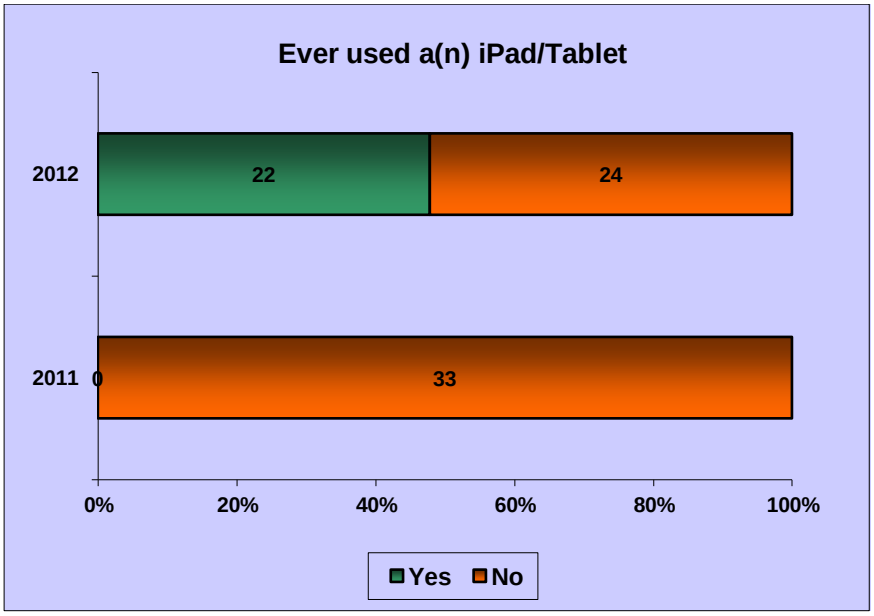


Figure 5.93: Year of survey vs. A13d

Table 5.25: Contingency table for Year of survey vs. whether a learner has ever used a cell phone (A13e)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	31 39.2% 93.9% 47.7%	2 2.5% 6.1% 14.3%	33 41.8%
2012 Survey	34 43.0% 73.9% 52.3%	12 15.2% 26.1% 85.7%	46 58.2%
TOTAL	65 82.3%	14 17.7%	79 100%

Table 5.26: Chi-square test of comparisons (Year of survey vs. A13e)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A13e				
13e. Which mobile technology have you ever used? Cell phone	79	5.2852	1	0.0215**

The Chi-square test in Table 5.26 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have never used a cell phone when compared to the 2011 group. Table 5.25 and Figure 5.94 reflect the comparison between the year of the survey and whether respondents have ever used a cell phone.

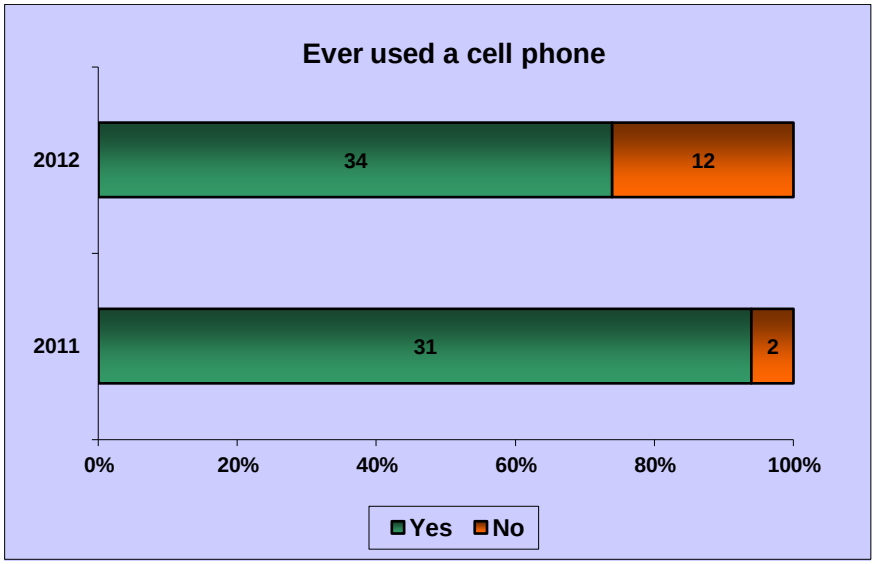


Figure 5.94: Year of survey vs. A13e

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.27: Contingency table for Year of survey vs. whether a learner has used a(n) iPad/Tablet the previous day (A14d)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	33 41.8% 100.0% 45.2%	33 41.8%
2012 Survey	6 7.6% 13.0% 100.0%	40 50.6% 87.0% 54.8%	46 58.2%
TOTAL	6 7.6%	73 92.4%	79 100%

Table 5.28: Chi-square test of comparisons (Year of survey vs. A14d)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A14d				
14d. Which mobile technology have you used yesterday? iPad/Tablet	79	4.6581	1	0.0309*

The Chi-square test in Table 5.28 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have used a(n) iPad/Tablet the previous day when compared to the 2011 group. Table 5.27 and Figure 5.95 reflect the comparison between the year of the survey and whether respondents have used a(n) iPad/Tablet the previous day.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

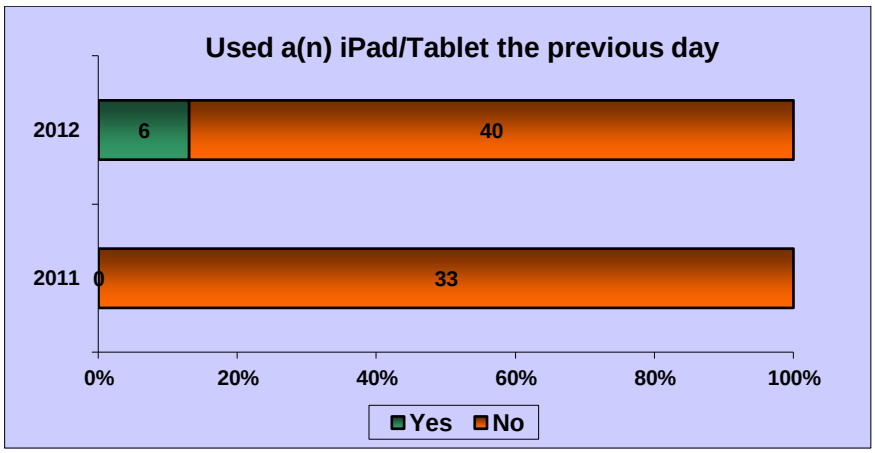


Figure 5.95: Year of survey vs. A14d

Table 5.29: Contingency table for Year of survey vs. whether a learner has used a(n) iPod/Other MP3 player the previous day (A14f)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	2 2.5% 6.1% 15.4%	31 39.2% 93.9% 47.0%	33 41.8%
2012 Survey	11 13.9% 23.9% 84.6%	35 44.3% 76.1% 53.0%	46 58.2%
TOTAL	13 16.5%	66 83.5%	79 100%

Table 5.30: Chi-square test of comparisons (Year of survey vs. A14f)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A14f				
14f. Which mobile technology have you used yesterday? iPod/other MP3 player	79	4.4546	1	0.0348*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.30 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have used a(n) iPod/MP3 player the previous day when compared to the 2011 group. Table 5.29 and Figure 5.96 reflect the comparison between the year of the survey and whether respondents have used a(n) iPod/MP3 player the previous day.

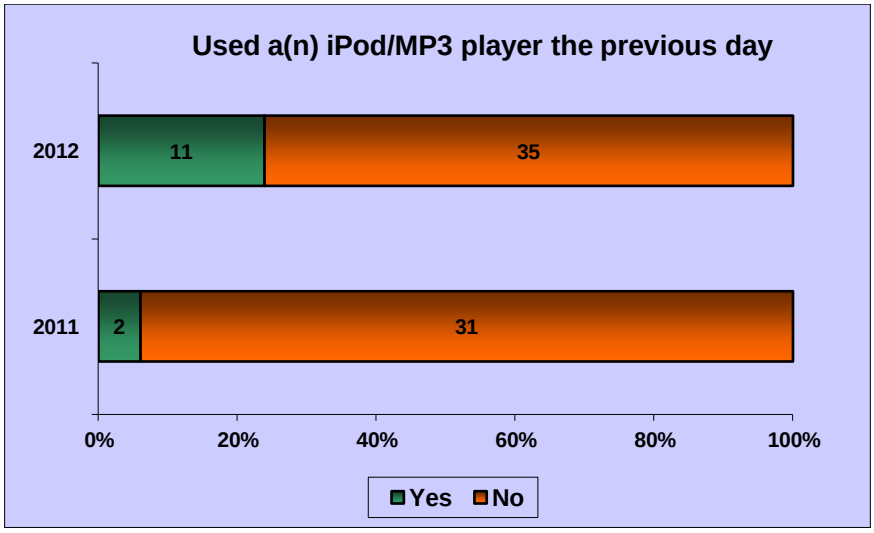


Figure 5.96: Year of survey vs. A14f

Table 5.31: Contingency table for Year of survey vs. whether a learner owns a desktop computer (A15a)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	15 19.0% 45.4% 57.7%	18 22.8% 54.6% 34.0%	33 41.8%
2012 Survey	11 13.9% 23.9% 42.3%	35 44.3% 76.1% 66.0%	46 58.2%
TOTAL	26 32.9%	53 67.1%	79 100%

Table 5.32: Chi-square test of comparisons (Year of survey vs. A15a)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A15a				
15a. Which technology do you own? Desktop computer	79	4.0383	1	0.0445*

The Chi-square test in Table 5.32 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group did not own a desktop computer when compared to the 2011 group. Table 5.31 and Figure 5.97 reflect the comparison between the year of the survey and whether respondents own a desktop computer.

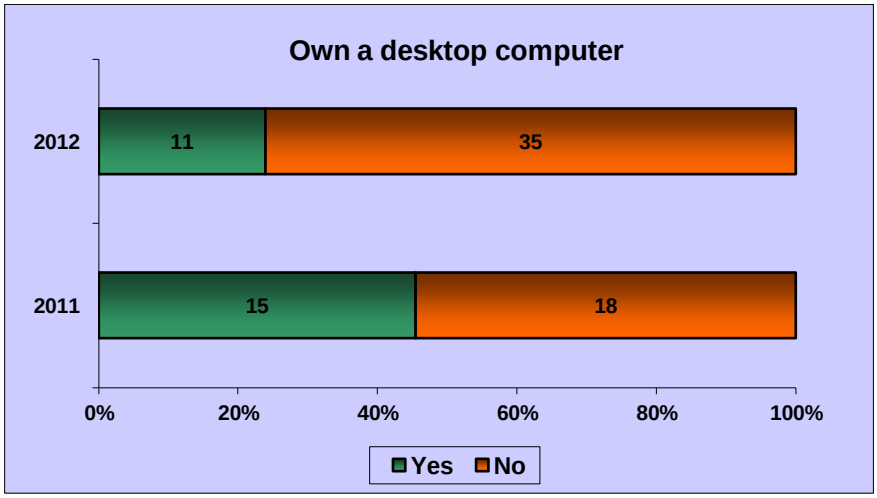


Figure 5.97: Year of survey vs. A15a

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.33: Contingency table for Year of survey vs. whether a learner owns a(n) iPad/Tablet (A15d)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	33 41.8% 100.0% 47.8%	33 41.8%
2012 Survey	10 12.7% 21.7% 100.0%	36 45.6% 78.3% 52.2%	46 58.2%
TOTAL	10 12.7%	69 87.3%	79 100%

Table 5.34: Chi-square test of comparisons (Year of survey vs. A15d)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A15d				
15d. Which technology do you own? iPad/Tablet	79	8.2136	1	0.0042**

The Chi-square test in Table 5.34 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group own a(n) iPad/Tablet when compared to the 2011 group. Table 5.33 and Figure 5.98 reflect the comparison between the year of the survey and whether respondents own a(n) iPad/Tablet.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

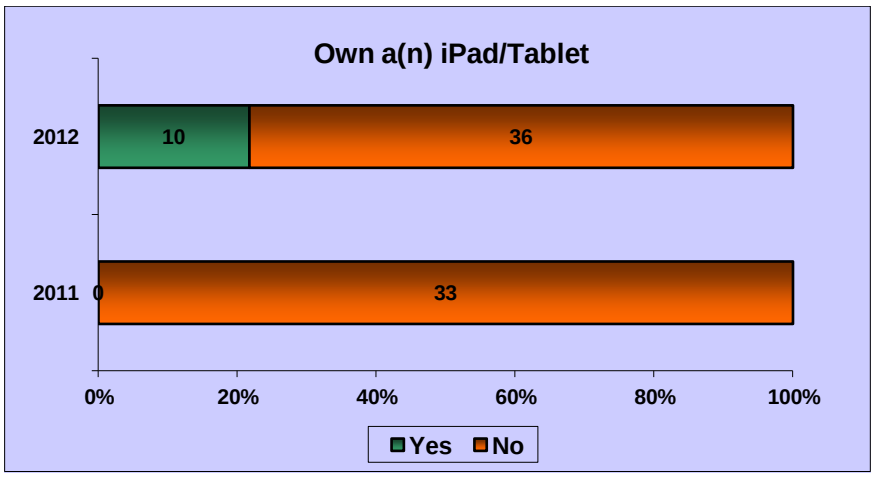


Figure 5.98: Year of survey vs. A15d

Table 5.35: Contingency table for Year of survey vs. whether a learner uses a(n) iPad/Tablet to go online (A22d)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	33 41.8% 100.0% 45.8%	33 41.8%
2012 Survey	7 8.9% 15.2% 100.0%	39 49.4% 84.8% 54.2%	46 58.2%
TOTAL	7 8.9%	72 91.1%	79 100%

Table 5.36: Chi-square test of comparisons (Year of survey vs. A22d)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A22d				
22d. Which mobile technology do you go online with? iPad/Tablet	79	5.5100	1	0.0189*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.36 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group access the Internet/go online by means of (a)n iPad/Tablet when compared to the 2011 group. Table 5.35 and Figure 5.99 reflect the comparison between the year of the survey and whether respondents have accessed the Internet/went online by using a(n) iPad/Tablet.

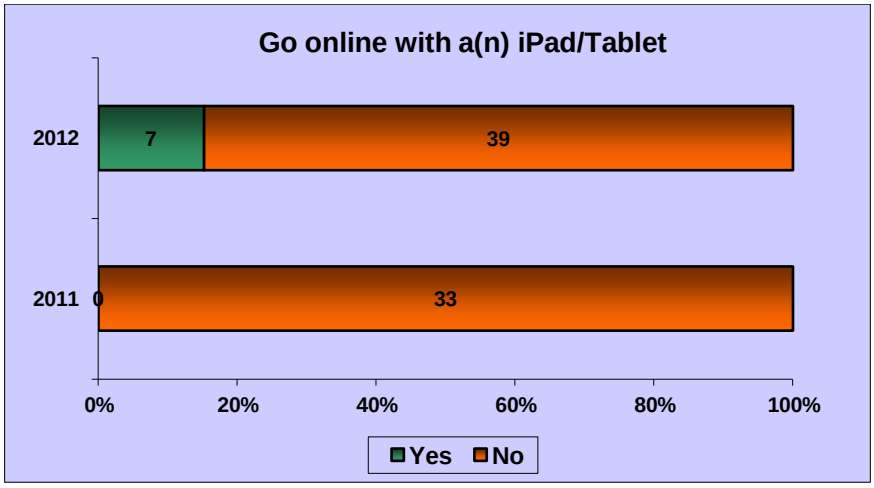


Figure 5.99: Year of survey vs. A22d

Table 5.37: Contingency table for Year of survey vs. Cell phone brand (A28)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	BlackBerry	HTC	LG	Nokia	Samsung	TOTAL
2011 Survey	2 2.5% 6.1% 12.5%	0 0.0% 0.0% 0.0%	2 2.5% 6.1% 50.0%	18 22.8% 54.6% 52.9%	4 5.1% 12.1% 33.3%	33 41.8%
2012 Survey	14 17.7% 30.4% 87.5%	3 3.8% 6.5% 100.0%	2 2.5% 4.4% 50.0%	16 20.2% 34.8% 47.1%	8 10.1% 17.4% 66.7%	46 58.2%
TOTAL	16 20.2%	3 3.8%	4 5.1%	34 43.0%	12 15.2%	79 100%

CONTINUE

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Sony Ericsson	Techno	Windows Mobile Mova	ZTE	Don't have	TOTAL
2011 Survey	5 6.3% 15.2% 83.3%	1 1.3% 3.0% 100.0%	1 1.3% 3.0% 100.0%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	33 41.8%
2012 Survey	1 1.3% 2.2% 16.7%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	1 1.3% 2.2% 100.0%	1 1.3% 2.2% 100.0%	46 58.2%
TOTAL	6 7.6%	1 1.3%	1 1.3%	1 1.3%	1 1.3%	79 100%

Table 5.38: Chi-square test of comparisons (Year of survey vs. A28)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A28				
28. What is the brand name of your cell phone?	79	18.4788	9	0.0300*

The Chi-square test in Table 5.38 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group own BlackBerry cell phones when compared to the 2011 group who mostly owned Nokia cell phones. Table 5.37 and Figure 5.100 reflect the comparison between the year of the survey and respondents' cell phone brand name preference.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

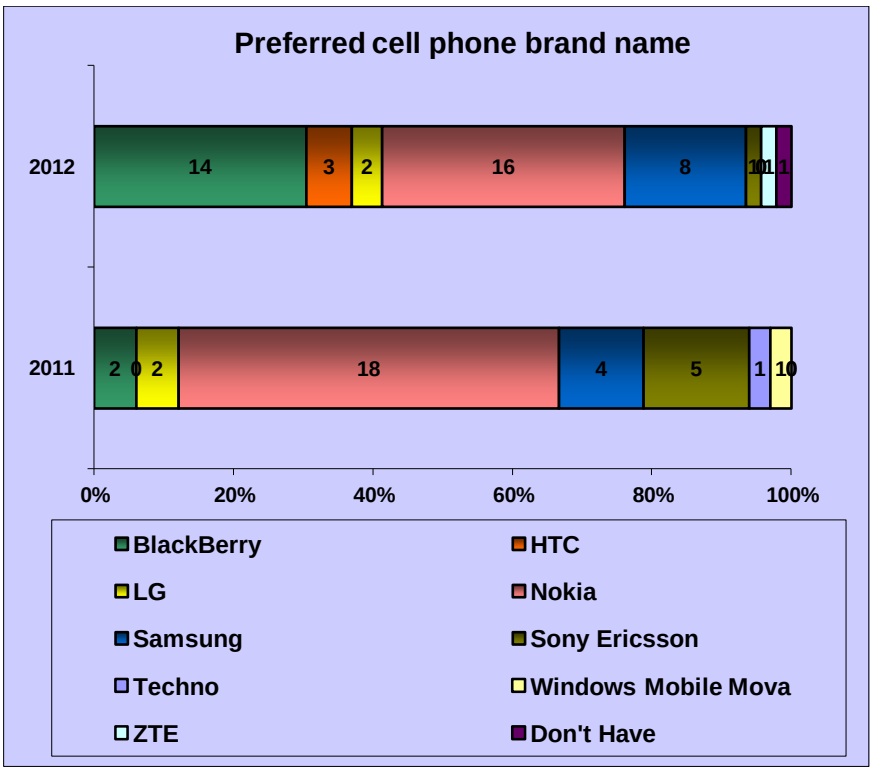


Figure 5.100: Year of survey vs. A28

Table 5.39: Contingency table for Year of survey vs. Contact method preference (A32)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	E-mail	Instant messaging	Phone call	SMS	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	18 22.8% 54.6% 50.0%	15 19.0% 45.4% 79.0%	33 41.8%
2012 Survey	1 1.3% 2.2% 100.0%	23 29.1% 50.0% 100.0%	18 22.8% 39.1% 50.0%	4 5.1% 8.7% 21.0%	46 58.2%
TOTAL	1 1.3%	23 29.1%	36 45.6%	19 24.0%	79 100%

Table 5.40: Chi-square test of comparisons (Year of survey vs. A32)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A32				
32. Do you prefer contacting someone via a(n) … ?	79	29.0149	3	<0.0001***

The Chi-square test in Table 5.40 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group prefers a phone call or SMS (text message) as a method of contact when compared to the 2012 group. It is of importance to note that the 2011 group did not have e-mail or instant messaging as an option to choose from during the 2011 survey. Table 5.39 and Figure 5.101 reflect the comparison between the year of the survey and respondents' preferred contact method.

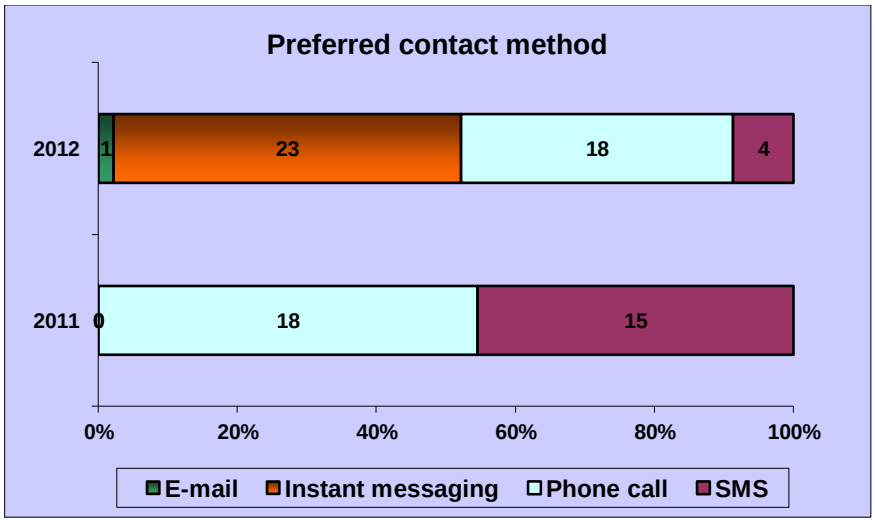


Figure 5.101: Year of survey vs. A32

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.41: Contingency table for Year of survey vs. whether learners believe that their cell phone has helped them to do well at university (A52)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Don't know	Not at all	Only a little	Some	A lot	TOTAL
2011 Survey	0 0.0% 0.0% 0.0%	9 11.39% 27.3% 75.0%	7 8.9% 21.2% 53.8%	9 11.4% 27.3% 40.9%	8 10.1% 24.2% 26.7%	33 41.8%
2012 Survey	2 2.5% 4.4% 100.0%	3 3.8% 6.5% 25.0%	6 7.6% 13.0% 46.2%	18 16.5% 28.3% 59.1%	22 27.8% 47.8% 73.3%	46 58.2%
TOTAL	2 2.5%	12 15.2%	13 16.5%	22 27.8%	30 38.0%	79 100%

Table 5.42: Chi-square test of comparisons (Year of survey vs. A52)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A52				
52. How much, if at all, has your cell phone helped you to do well at university?	79	10.4821	4	0.0330*

The Chi-square test in Table 5.42 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group believe that they have been helped a lot by means of a cell phone to do well at university when compared to the 2011 group. This could be attributed to the fact that the 2011 group has not started using mobile technology in their learning process when this question was posed. Table 5.41 and Figure 5.102 reflect the comparison between the year of the survey and whether respondents believe that their cell phones have helped them a lot to do well at university.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

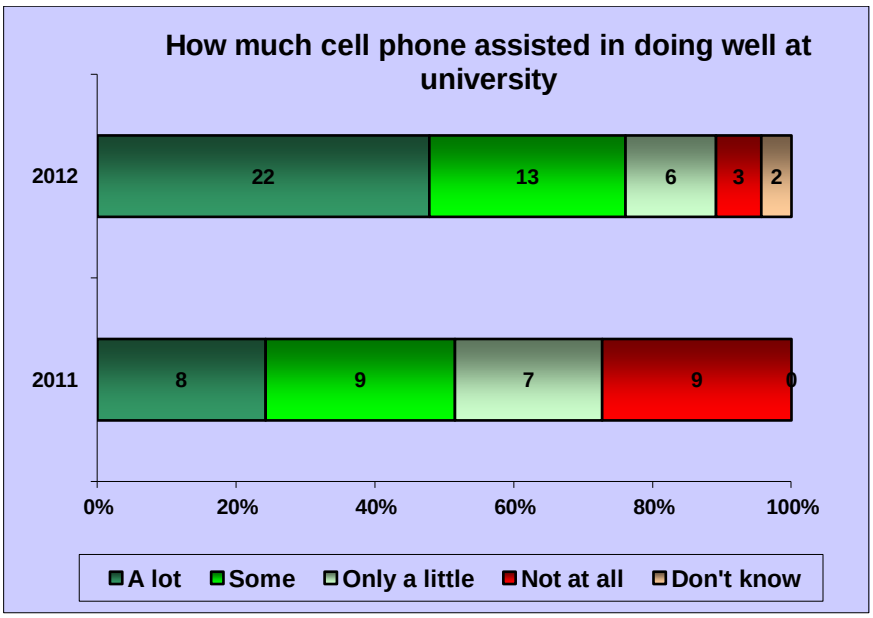


Figure 5.102: Year of survey vs. A52

Table 5.43: Contingency table for Year of survey vs. MXit use (A62)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	23 29.1% 69.7% 57.5%	8 10.1% 24.2% 50.0%	2 2.5% 6.1% 8.7%	33 41.8%
2012 Survey	17 21.5% 37.0% 42.5%	8 10.1% 17.4% 50.0%	21 26.6% 45.6% 91.3%	46 58.2%
TOTAL	40 50.6%	16 20.2%	23 29.1%	79 100%

Table 5.44: Chi-square test of comparisons (Year of survey vs. A62)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A62				
62. Have you ever used MXit on a cell phone?	79	14.8588	2	0.0006***

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.44 reflects that the modes of classification were not independent and therefore indicate a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group had never used MXit on a cell phone when compared to the 2011 group. Table 5.43 and Figure 5.103 reflect the comparison between the year of the survey and whether respondents have ever used MXit on a cell phone.

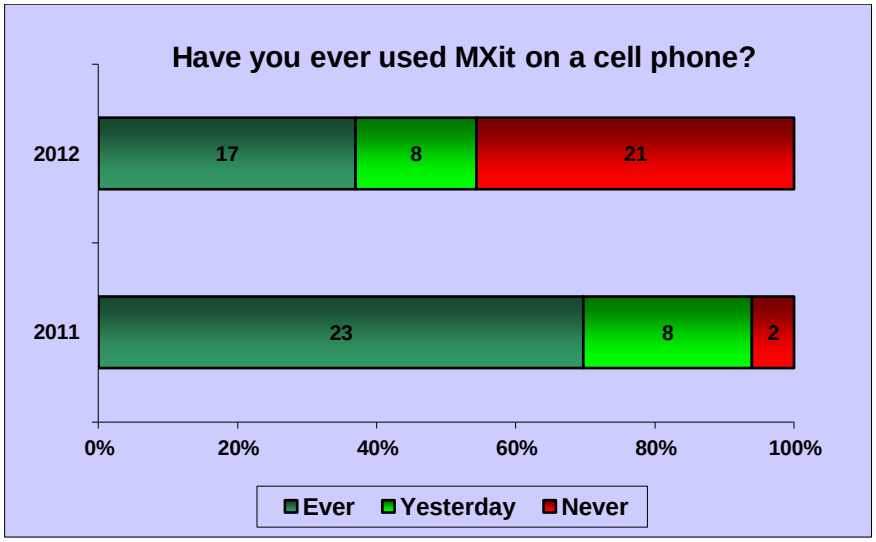


Figure 5.103: Year of survey vs. A62

Table 5.45: Contingency table for Year of survey vs. whether it is important to buy a cell phone that can send and receive instant messages (A78)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Very important	Somewhat important	Neither	Not very important	Not important at all	Don't know	TOTAL
2011 Survey	18 22.8% 54.6% 31.0%	6 7.6% 18.2% 66.7%	6 7.6% 18.2% 85.7%	1 1.3% 3.0% 50.0%	2 2.5% 6.1% 100.0%	0 0.0% 0.0% 0.0%	33 41.8%
2012 Survey	40 50.6% 87.0% 69.0%	3 3.8% 6.5% 33.3%	1 1.3% 2.2% 14.3%	1 1.3% 2.2% 50.0%	0 0.0% 0.0% 0.0%	1 1.3% 2.2% 100.0%	46 58.2%
TOTAL	58 73.4%	9 11.4%	7 8.9%	2 2.5%	2 2.5%	1 1.3%	79 100%

Table 5.46: Chi-square test of comparisons (Year of survey vs. A78)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A78				
78. If you had to buy a new cell phone today, how important is it to be able to send and receive instant messages?	79	14.1605	5	0.0146*

The Chi-square test in Table 5.46 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group found it very important to be able to send and receive instant messages when they buy a new cell phone when compared to the 2011 group. Table 5.45 and Figure 5.104 reflect the comparison between the year of the survey and whether respondents found it important to be able to send and receive instant messages when buying a new cell phone.

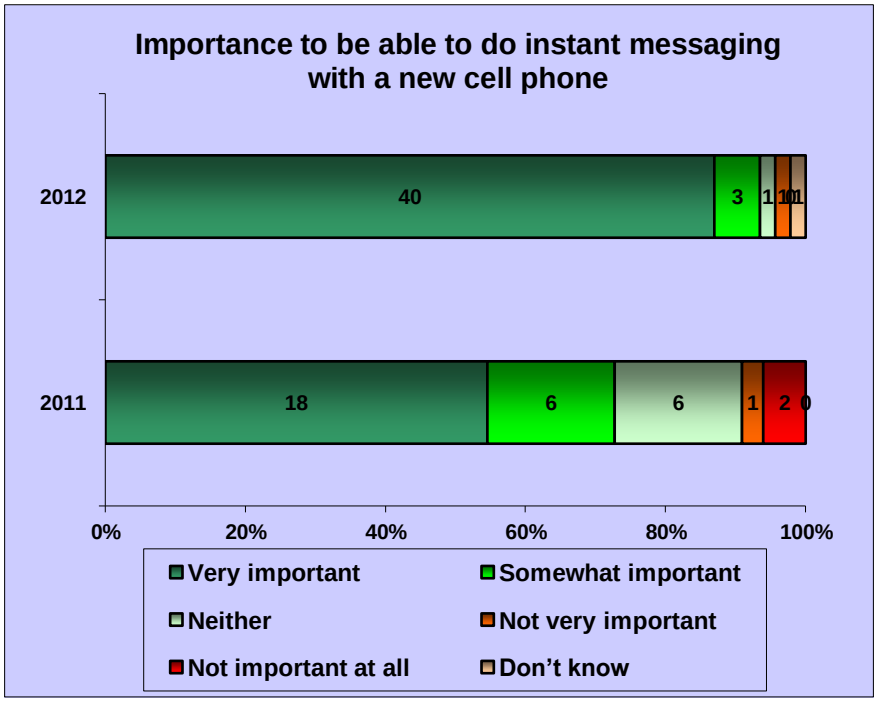


Figure 5.104: Year of survey vs. A78

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.47: Contingency table for Year of survey vs. whether a learner has ever used a cell phone to download music, ringtones, games, applications or videos (A85)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	25 31.6% 75.8% 49.0%	2 2.5% 6.0% 12.5%	6 7.6% 18.2% 50.0%	33 41.8%
2012 Survey	26 32.9% 56.5% 51.0%	14 17.7% 30.4% 87.5%	6 7.6% 13.0% 50.0%	46 58.2%
TOTAL	51 64.6%	16 20.2%	12 15.2%	79 100%

Table 5.48: Chi-square test of comparisons (Year of survey vs. A85)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A85				
85. Have you ever used a cell phone to download music, ringtones, games, applications or videos?	79	7.0719	2	0.0291*

The Chi-square test in Table 5.48 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have ever used a cell phone to download music etc. when compared to the 2011 group. Table 5.47 and Figure 5.105 reflect the comparison between the year of the survey and whether respondents have ever used a cell phone to download music, ringtones, games, applications or videos.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

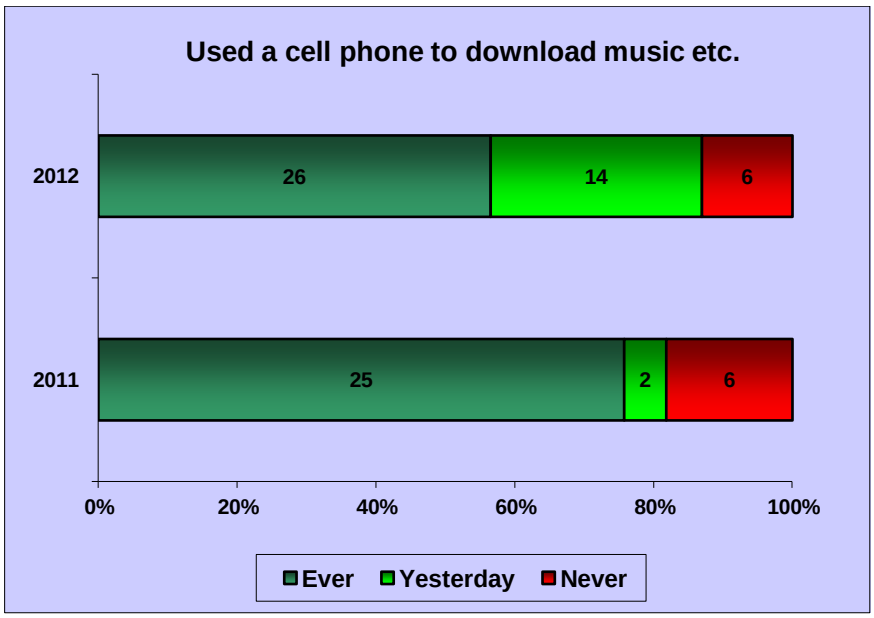


Figure 5.105: Year of survey vs. A85

Table 5.49: Contingency table for Year of survey vs. whether a learner has ever used a computer to play music or MP3 files (A88)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	26 32.9% 78.8% 53.1%	6 7.6% 18.2% 22.2%	1 1.3% 3.0% 33.3%	33 41.8%
2012 Survey	23 29.1% 50.0% 46.9%	21 26.6% 45.6% 77.8%	2 2.5% 4.4% 66.7%	46 58.2%
TOTAL	49 62.0%	27 34.2%	3 3.8%	79 100%

Table 5.50: Chi-square test of comparisons (Year of survey vs. A88)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A88				
88. Have you ever used a computer to play music or MP3 files?	79	6.8979	2	0.0318*

The Chi-square test in Table 5.50 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group have ever used a computer to play music/MP3 files when compared to the 2012 group. Table 5.49 and Figure 5.106 reflect the comparison between the year of the survey and whether respondents have previously used a computer to play music/MP3 files.

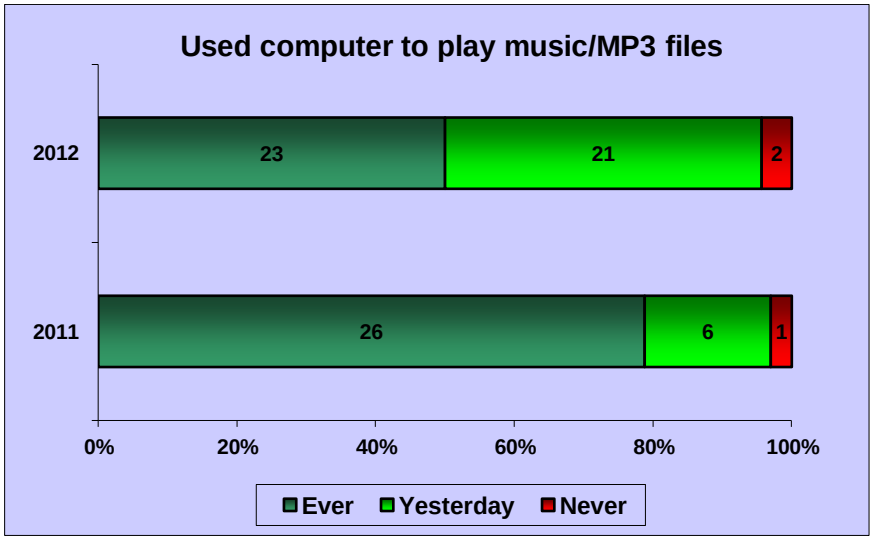


Figure 5.106: Year of survey vs. A88

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.51: Contingency table for Year of survey vs. whether a learner has ever used a computer to send and receive e-mail (A90)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	29 36.7% 87.9% 49.2%	3 3.8% 9.1% 16.7%	1 1.3% 3.0% 50.0%	33 41.8%
2012 Survey	30 38.0% 65.2% 50.8%	15 19.0% 32.6% 83.3%	1 1.3% 2.2% 50.0%	46 58.2%
TOTAL	59 74.7%	18 22.8%	2 2.5%	79 100%

Table 5.52: Chi-square test of comparisons (Year of survey vs. A90)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A90				
90. Have you ever used a computer to send and receive e-mail?	79	6.0413	2	0.0488*

The Chi-square test in Table 5.52 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2012 group have ever used a computer to send and receive e-mail when compared to the 2011 group. Table 5.51 and Figure 5.107 reflect the comparison between the year of the survey and whether respondents have ever used a computer to send and receive e-mail.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

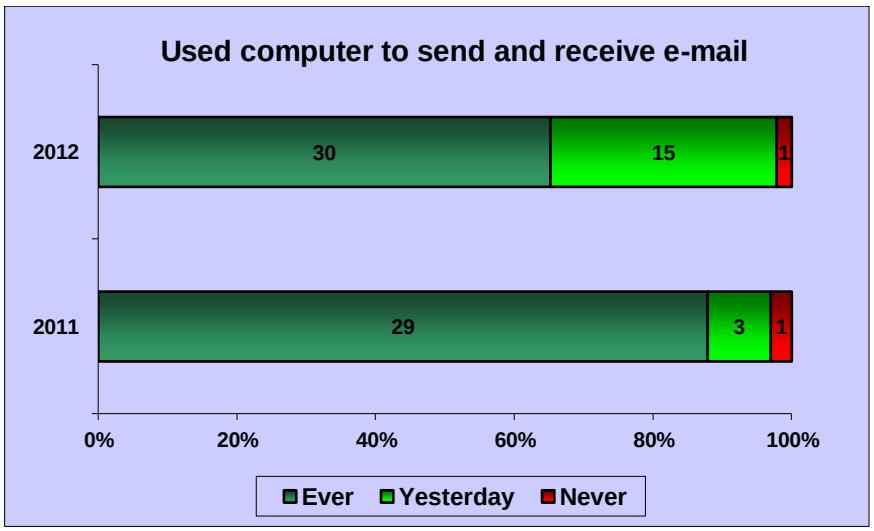


Figure 5.107: Year of survey vs. A90

Table 5.53: Contingency table for Year of survey vs. whether a learner has ever used a computer to send instant messages (A93)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	14 17.7% 42.4% 34.2%	4 5.1% 12.1% 25.0%	15 19.0% 45.4% 68.2%	33 41.8%
2012 Survey	27 34.2% 58.7% 65.8%	12 15.2% 26.1% 75.0%	7 8.9% 15.2% 31.8%	46 58.2%
TOTAL	41 51.9%	16 20.2%	22 27.8%	79 100%

Table 5.54: Chi-square test of comparisons (Year of survey vs. A93)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A93				
93. Have you ever used a computer to send instant messages to someone who was online at the same time?	79	9.1393	2	0.0104*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.54 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group have never used a computer to send instant messages when compared to the 2012 group. Table 5.53 and Figure 5.108 reflect the comparison between the year of the survey and whether respondents have ever used a computer to send instant messages.

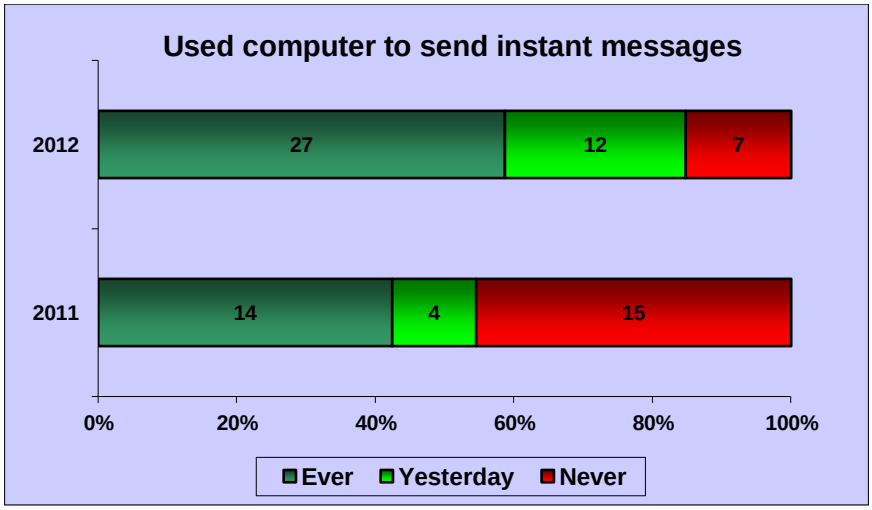


Figure 5.108: Year of survey vs. A93

Table 5.55: Contingency table for Year of survey vs. whether a learner has ever used a computer to research information for university work on the Internet (A94)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Ever	Yesterday	Never	TOTAL
2011 Survey	31 39.2% 93.9% 52.5%	2 2.5% 6.1% 10.5%	0 0.0% 0.0% 0.0%	33 41.8%
2012 Survey	28 35.4% 60.9% 47.5%	17 21.5% 37.0% 89.5%	1 1.3% 2.2% 100.0%	46 58.2%
TOTAL	59 74.7%	19 24.0%	1 1.3%	79 100%

Table 5.56: Chi-square test of comparisons (Year of survey vs. A94)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and A94				
94. Have you ever used a computer to research information for university work on the Internet?	79	11.1575	2	0.0038**

The Chi-square test in Table 5.56 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group have used a computer to research information for university work on the Internet when compared to the 2012 group. Table 5.55 and Figure 5.109 reflect the comparison between the year of the survey and whether respondents have ever used a computer to research information for university work on the Internet.

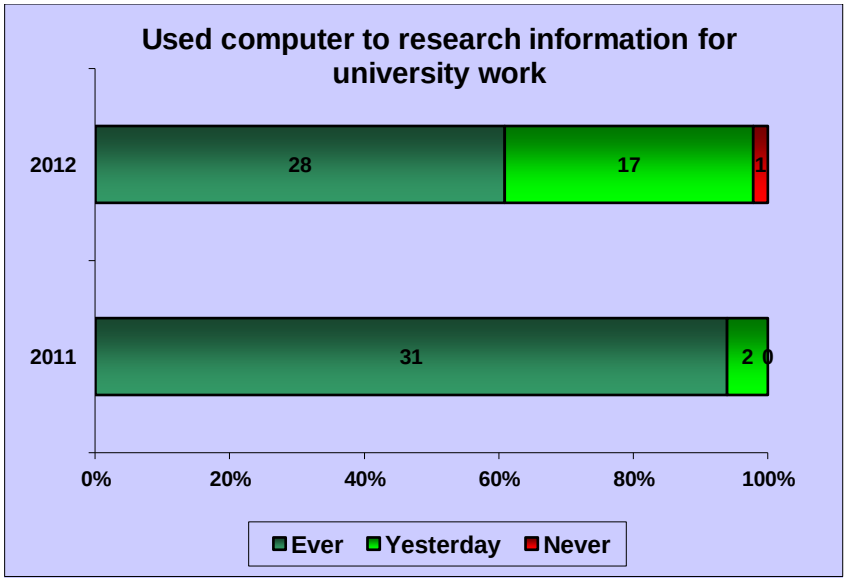


Figure 5.109: Year of survey vs. A94

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

5.3.6.2 Second post-mobile learning (post 2) questionnaire

Table 5.57: Contingency table for Year of survey vs. when learners have mostly used mobile devices (P206)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Morning	Afternoon	Evening	Night	TOTAL
2011 Survey	19 24.0% 57.6% 82.6%	14 17.7% 42.4% 45.6%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	33 41.8%
2012 Survey	4 5.1% 8.7% 17.4%	17 21.5% 37.0% 54.8%	22 27.8% 47.8% 100.0%	3 3.8% 6.5% 100.0%	46 58.2%
TOTAL	23 29.1%	31 39.2%	22 27.8%	3 3.8%	79 100%

Table 5.58: Chi-square test of comparisons (Year of survey vs. P206)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between Year and P206				
6. I have used the mobile device mostly during the:	79	33.8503	3	<0.0001***

The Chi-square test in Table 5.58 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more respondents from the 2011 group have used the mobile device (PDA) during the morning when compared to the 2012 group. It is of importance to note that the 2011 group did not have the options “evening” and “night” to choose from since these learners only had access to the mobile devices (PDAs) while on campus. Table 5.57 and Figure 5.110 reflect the comparison between the year of the survey and whether respondents have used their mobile device (PDA) mostly during the morning, afternoon, evening or night.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

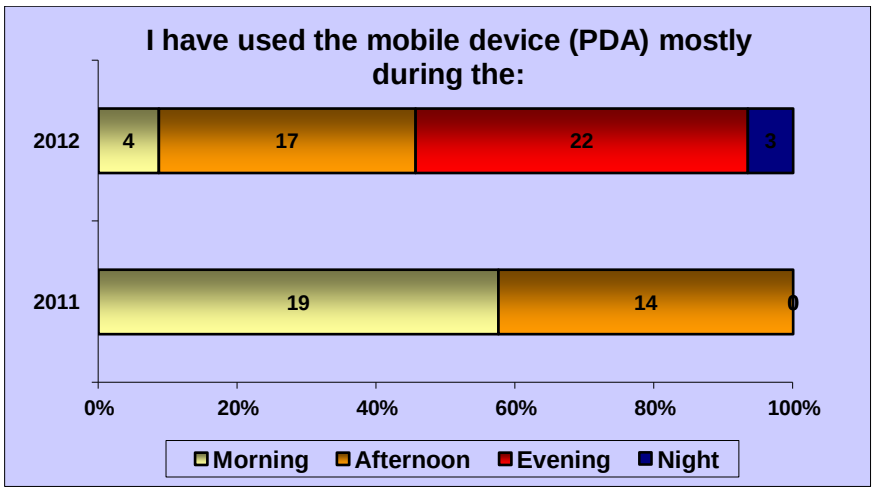


Figure 5.110: Year of survey vs. P206

5.3.7 Comparison of gender

A comparison was done to determine whether the genders differed in their perceptions of m-learning by using the Chi-Square statistic as the data are either nominal or ordinal in nature.

The following tables and graphs indicate where there were statistically significant correlations between the dependent variable and response variables. It is of importance to note that only the statistically significant correlations are mentioned in this paragraph. All the Chi-square tests, including those that did not have a statistically significant correlation, are shown in Appendix P (see CD-ROM: Supporting Data).

It is of further importance to note that some of the categories were collapsed to fewer categories in order to meet the requirements of sufficient expected frequencies (these expected frequencies should all be greater than one and in no more than 20% of the cells should they be less than 5).

5.3.7.1 First post-mobile learning (post 1) questionnaire

Table 5.59: Contingency table for Gender vs. whether learners would enjoy learning if they could use mobile devices (P116)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Strongly agree	Agree	Neither agree nor disagree	TOTAL
Female	12 15.8% 30.8% 37.5%	19 25.0% 48.7% 55.9%	8 10.5% 20.5% 80.0%	39 51.3%
Male	20 26.3% 54.0% 62.5%	15 19.7% 40.5% 44.1%	2 2.6% 5.4% 20.0%	37 48.7%
TOTAL	32 42.1%	34 44.7%	10 13.2%	76 100%

Table 5.60: Chi-square test of comparisons (Gender vs. P116)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P116				
16. I would enjoy learning if I could use mobile devices	76	6.0221	2	0.0492*

The Chi-square test in Table 5.60 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males strongly agree that they would enjoy learning if they could use mobile devices when compared to females. This difference lies in the degree with which learners agree with the statement. It is of importance to note that 20.5% of the females indicated 'Neither' and are thus not sure whether they would enjoy learning if they could use mobile devices. Table 5.59 and Figure 5.111 reflect the comparison between respondents' gender and whether they would enjoy learning if they could use a mobile device (PDA) during the course of their studies.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

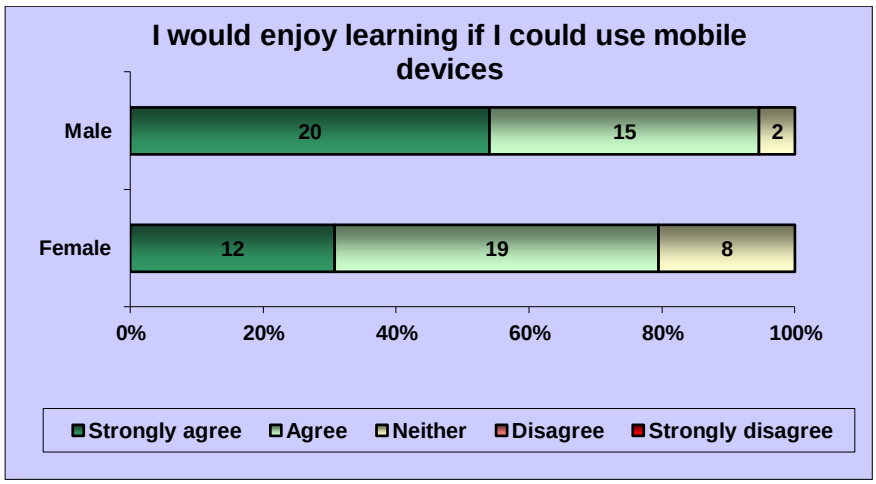


Figure 5.111: Gender vs. P116

5.3.7.2 Second post-mobile learning (post 2) questionnaire

Table 5.61: Contingency table for Gender vs. whether a learner is able to skilfully use mobile devices to download podcasts (P202c)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	13 16.9% 33.3% 37.1%	26 33.8% 66.7% 61.9%	39 50.6%
Male	22 28.6% 57.9% 62.9%	16 20.8% 42.1% 38.1%	38 49.4%
TOTAL	35 45.4%	42 54.6%	77 100%

Table 5.62: Chi-square test of comparisons (Gender vs. P202c)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P202c				
2c. I am able to skilfully use mobile devices to download podcasts	77	4.6830	1	0.0305*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.62 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males are able to skilfully use mobile devices to download podcasts when compared to females. Table 5.61 and Figure 5.112 reflect the comparison between respondents' gender and whether they are able to skilfully use mobile device to download podcasts.

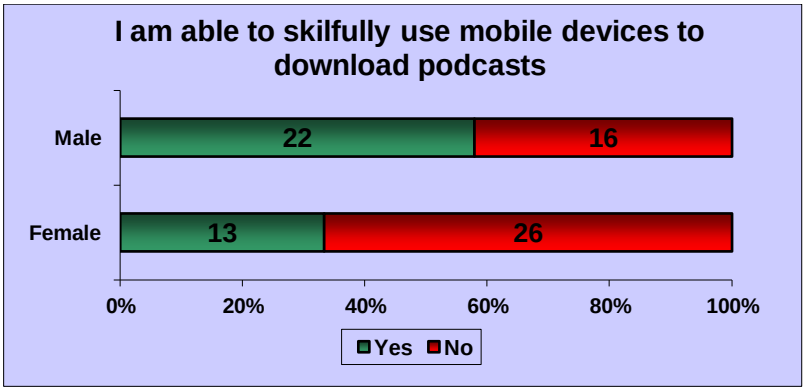


Figure 5.112: Gender vs. P202c

Table 5.63: Contingency table for Gender vs. whether a learner has used a mobile device to interact and communicate with fellow learners (P203g)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	13 16.9% 33.3% 37.1%	26 33.8% 66.7% 61.9%	39 50.6%
Male	22 28.6% 57.9% 62.9%	16 20.8% 42.1% 38.1%	38 49.4%
TOTAL	35 45.4%	42 54.6%	77 100%

Table 5.64: Chi-square test of comparisons (Gender vs. P203g)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P203g				
3g. Current uses regarding mobile devices for learning purposes: I have interacted and communicated with fellow students	77	4.6830	1	0.0305*

The Chi-square test in Table 5.64 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males have interacted and communicated with fellow learners by means of mobile devices when compared to females. Table 5.63 and Figure 5.113 reflect the comparison between respondents' gender and whether they have interacted and communicated with a fellow learner by means of a mobile device.

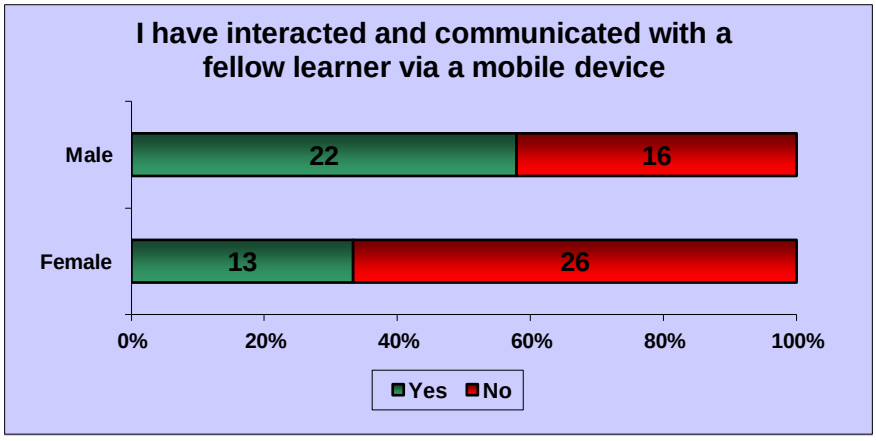


Figure 5.113: Gender vs. P203g

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.65: Contingency table for Gender vs. Mobile device use while commuting (P204f)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	0 0.0% 0.0% 0.0%	23 52.3% 100.0% 62.2%	23 52.3%
Male	7 15.9% 33.3% 100.0%	14 31.8% 66.7% 37.8%	21 47.7%
TOTAL	7 15.9%	37 84.1%	44 100%

Table 5.66: Chi-square test of comparisons (Gender vs. P204f)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P204f				
4f. Use mobile device while commuting	44	9.1171	1	0.0025**

The Chi-square test in Table 5.66 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males have used a mobile device (PDA) while commuting when compared to none of the female that used a mobile device while commuting. This probably could be attributed to the fact that females are more vulnerable and afraid to use mobile technology in public, because of the fear of robbery. Table 5.65 and Figure 5.114 reflect the comparison between respondents' gender and whether they have used a mobile device (PDA) while commuting.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

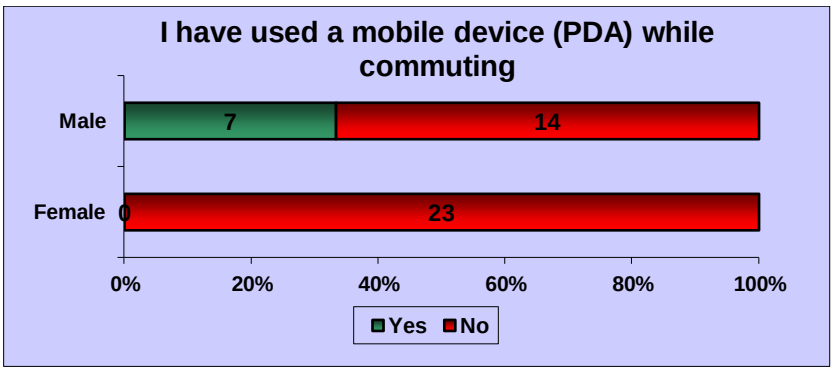


Figure 5.114: Gender vs. P204f

Table 5.67: Contingency table for Gender vs. Mobile device use at family/friends (P204g)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	5 11.4% 21.7% 31.2%	18 40.9% 78.9% 64.3%	23 52.3%
Male	11 25.0% 52.4% 68.8%	10 22.7% 47.6% 35.7%	21 47.7%
TOTAL	16 36.4%	28 63.6%	44 100%

Table 5.68: Chi-square test of comparisons (Gender vs. P204g)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P204g				
4g. Use mobile device at family/friends	44	4.4540	1	0.0348*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.68 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males than females have used the mobile device at family/friends. Table 5.67 and Figure 5.115 reflect the comparison between respondents' gender and whether they have used a mobile device (PDA) while being at family/friends.

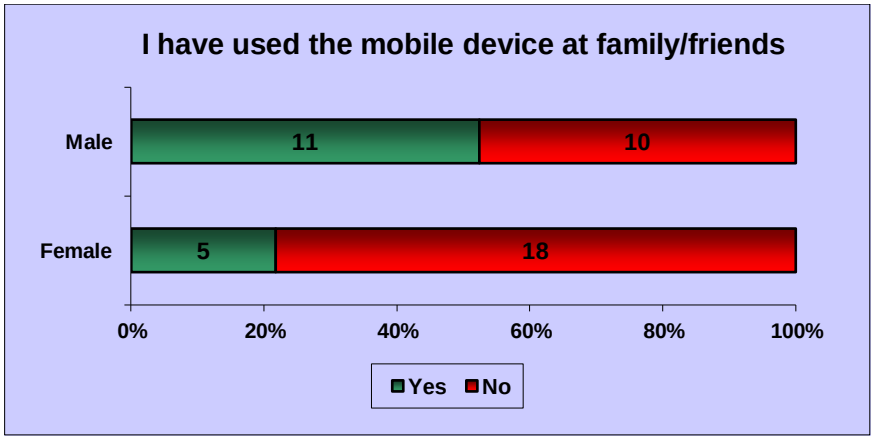


Figure 5.115: Gender vs. P204g

Table 5.69: Contingency table for Gender vs. P208b

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	9 11.7% 23.1% 32.1%	30 39.0% 76.9% 61.2%	39 50.6%
Male	19 24.7% 50.0% 67.9%	19 24.7% 50.0% 38.8%	38 49.4%
TOTAL	28 36.4%	49 63.6%	77 100%

Table 5.70: Chi-square test of comparisons (Gender vs. P208b)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P208b				
8b. Use mobile device to search for information	77	6.0288	1	0.0141*

The Chi-square test in Table 5.70 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males than females have used the mobile device to search for information. Table 5.69 and Figure 5.116 reflect the comparison between respondents' gender and whether they have used a mobile device (PDA) to search for information.

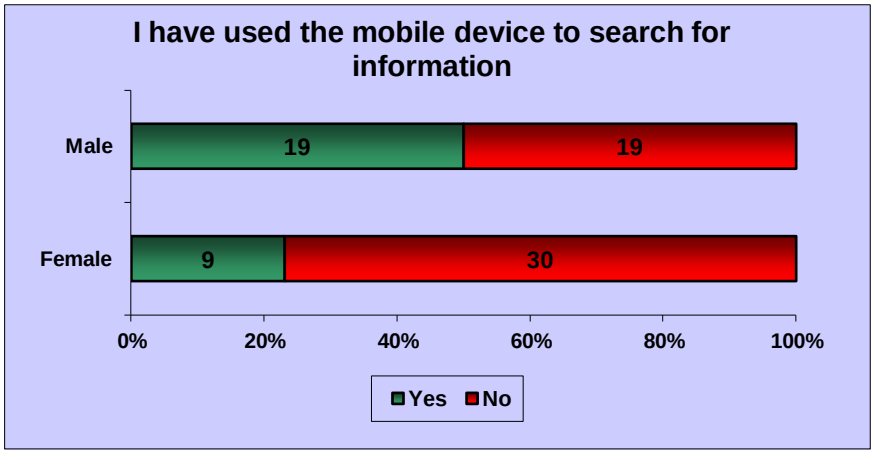


Figure 5.116: Gender vs. P208b

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.71: Contingency table for Gender vs. where learners think they will use mobile devices elsewhere off-campus in the future (P213h)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	18 23.4% 46.2% 40.9%	21 27.3% 53.8% 63.6%	39 50.6%
Male	26 33.8% 68.4% 59.1%	12 15.6% 31.6% 36.4%	38 49.4%
TOTAL	44 57.1%	33 42.9%	77 100%

Table 5.72: Chi-square test of comparisons (Gender vs. P213h)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P213h				
13h. I will use the mobile device elsewhere off-campus in the future	77	3.8968	1	0.0484*

The Chi-square test in Table 5.72 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males than females will use the mobile device elsewhere off-campus in the future. Table 5.71 and Figure 5.117 reflect the comparison between respondents' gender and whether they will use a mobile device (PDA) elsewhere off-campus in the future.

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

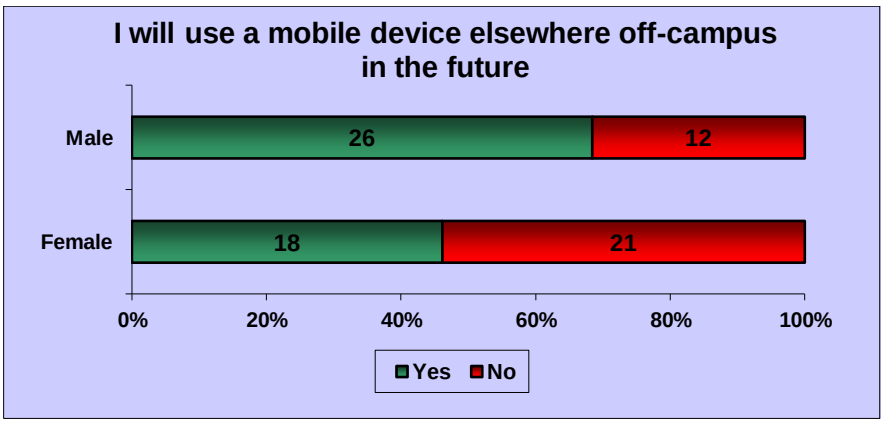


Figure 5.117: Gender vs. P213h

Table 5.73: Contingency table for Gender vs. whether 'other' changes should be made so that educational offerings on mobile devices can incur a broader common acceptance (P216h)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Yes	No	TOTAL
Female	2 2.6% 5.3% 18.2%	37 48.0% 94.9% 56.1%	39 50.6%
Male	9 11.7% 23.7% 81.8%	29 37.7% 76.3% 43.9%	38 49.4%
TOTAL	11 14.3%	66 85.7%	77 100%

Table 5.74: Chi-square test of comparisons (Gender vs. P216h)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between gender and P216h				
16h. Changes should be made so that educational offerings on mobile devices can incur a broader common acceptance. 'Other'	77	5.4122	1	0.0200*

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.74 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more males than females indicated the 'Other' category as changes to be made so that educational offerings on mobile devices can incur a broader common acceptance. Table 5.73 and Figure 5.118 reflect the comparison between respondents' gender and what changes should be made so that educational offerings on mobile devices can incur a broader common acceptance.

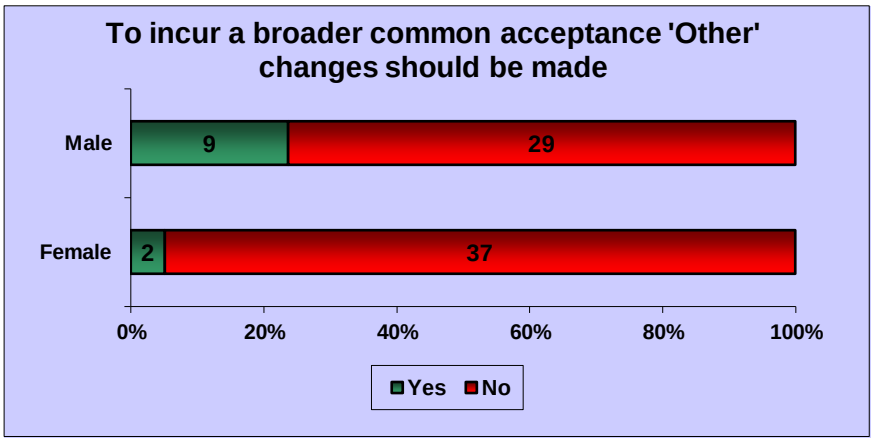


Figure 5.118: Gender vs. P216h

5.3.8 Comparison of age

Respondents' age was compared by comparing the categories of all the statements with respect to the average age by using non-parametric testing (due to small numbers) such as the Mann Whitney or Kruskal Wallis tests (test depending on the number of groups).

The following tables and graphs indicate where there were statistically significant correlations between age and the response variables. It is of importance to note that only the statistically significant correlations are mentioned in this paragraph. All the Chi-square tests, including those that did not have statistically significant differences in age, are shown in Appendix Q (see CD-ROM: Supporting Data).

5.3.8.1 First post-mobile learning (post 1) questionnaire

Table 5.75 indicates the test statistics in the instances where there were statistically significant differences in age.

Table 5.75: Statistically significant Kruskal Wallis test for comparisons (Age vs. whether the use of mobile devices to access material anywhere, anytime would allow learners to spend more time on class work (P103))

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparison between age and P103				
3. To use mobile devices to access material anywhere, anytime would allow me to spend more time on class work.	76	8.4761	3	0.0371*

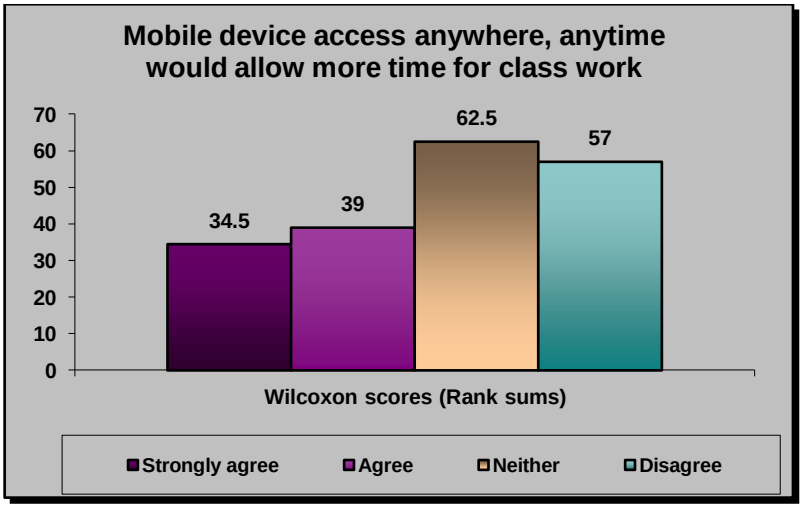


Figure 5.119: Age vs. P103

The bar chart in Figure 5.119 reflects that the ages are statistically significant higher for those learners who indicate that they neither agree nor disagree, as well as those learners who disagree with the statement that the use of mobile devices to access course material anywhere, anytime would allow them to spend more time on class work, when compared to the ages for those learners that strongly agree or agree. Table 5.75 and Figure 5.119 reflect

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

the comparison between respondents' age and whether the use of mobile devices to access material anywhere, anytime would allow learners to spend more time on class work.

5.3.8.2 Second post-mobile learning (post 2) questionnaire

Table 5.76 indicates the test statistics for where there were statistically significant differences in age.

Table 5.76: Statistically significant Kruskal Wallis tests for comparisons ((Age vs. whether a learner is able to skilfully use mobile devices to access the Internet/go online (P202a) and whether a learner will use mobile devices elsewhere off-campus in future (P213h))

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparison between age and P202a and P213h				
2a. I am able to skilfully use mobile devices to access the Internet/go online.	77	4.7203	1	0.0298*
13h. I will use mobile devices elsewhere off-campus in future.	77	5.2159	1	0.0224*

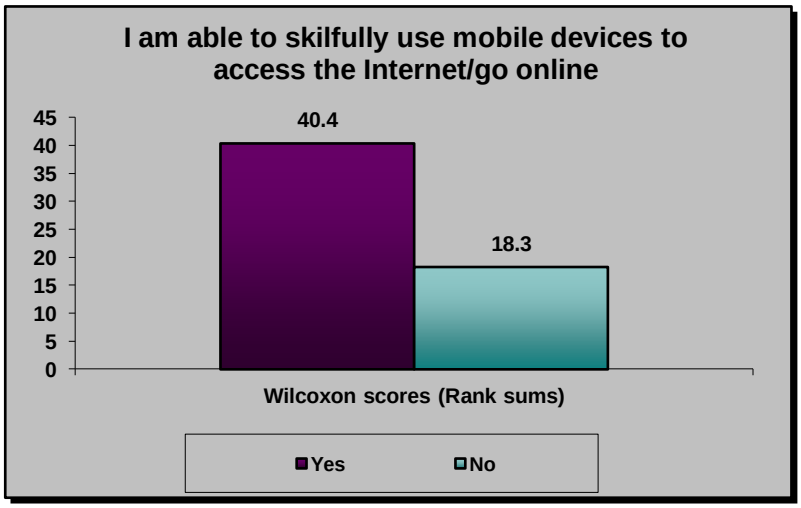


Figure 5.120: Age vs. P202a

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The bar chart in Figure 5.120 reflects that the ages are statistically significant higher for those learners who indicated 'Yes' for the statement that they are able to skilfully use mobile devices to access the Internet/go online, when compared to those learners who indicated 'No'. Table 5.76 and Figure 5.120 reflect the comparison between respondents' age and whether a learner is able to skilfully use mobile devices to access the Internet/go online.

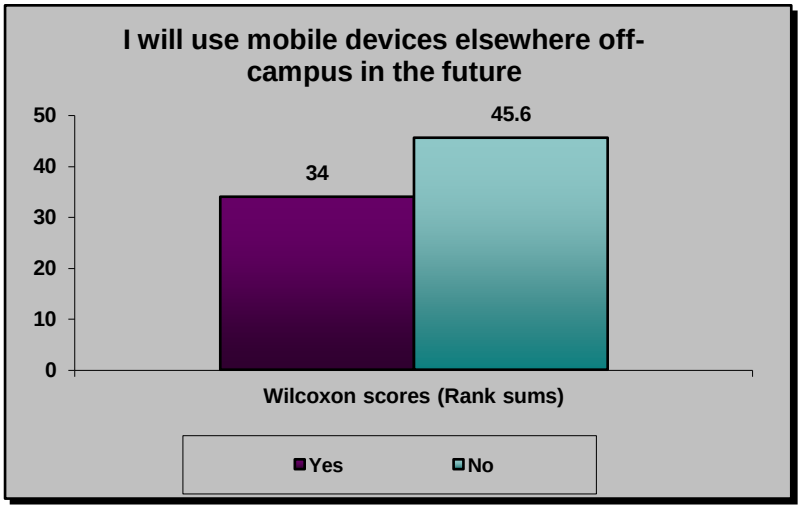


Figure 5.121: Age vs. P213h

The bar chart in Figure 5.121 reflects that the ages are statistically significant lower for those learners who indicated 'Yes' for the statement that they believe that they will use mobile devices elsewhere off-campus in the future, when compared to those learners who indicated 'No'. Table 5.76 and Figure 5.121 reflect the comparison between respondents' age and whether a learner will use mobile devices elsewhere off-campus in the future.

5.3.9 Comparison of the first language groups

The first language groups are compared with respect to all the questions in the three questionnaires (pre-, post 1-, and post 2 m-learning questionnaires) that were presented to the respondents by using Chi-Square testing as the data are either nominal or ordinal of nature.

The following tables and graphs indicate where there were statistically significant correlations between the dependent variable and response variables. It is of importance to note that only the statistically significant correlations are mentioned in this paragraph. All the Chi-square

tests, including those that did not have a statistically significant correlation, are shown in Appendix R (see CD-ROM: Supporting Data).

5.3.9.1 First post-mobile learning (post 1) questionnaire

Table 5.77: Contingency table for First language vs. whether learners think the use of mobile devices for learning purposes would safe them a lot of time (P102)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Strongly agree	Agree	Neither agree nor disagree	TOTAL
Afrikaans	3 3.8% 75.0% 0.0%	0 0.0% 0.0% 0.0%	1 1.3% 25.0% 100.0%	4 5.1%
English	11 14.1% 52.4% 20.8%	10 12.8% 47.6% 41.7%	0 0.0% 0.0% 0.0%	21 26.9%
French	13 16.7% 68.4% 24.5%	6 7.7% 31.6% 25.0%	0 0.0% 0.0% 0.0%	19 24.4%
isiXhosa	24 30.8% 80.0% 45.3%	6 7.7% 20.0% 25.0%	0 0.0% 0.0% 0.0%	30 38.5%
Other	2 2.6% 50.0% 3.8%	2 2.6% 50.0% 8.3%	0 0.0% 0.0% 0.0%	4 5.1%
TOTAL	53 68.0%	24 30.8%	1 1.3%	78 100%

Table 5.78: Chi-square test of comparisons (First language vs. P102)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between first language and P102				
2. To use mobile devices for learning purposes would safe me a lot of time.	78	24.8939	8	0.0016**

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The Chi-square test in Table 5.78 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more learners who use isiXhosa or French as a first language, strongly agree with the statement “To use mobile devices for learning purposes would save me a lot of time”, when compared to the learners whose first language is English. It is of importance to note that the numbers for those learners that speak Afrikaans or any other first language are not taken into consideration as their numbers are too small to make statistically correct conclusions. It is of further importance to note that the difference lies only in the degree in which they agreed with this statement and not in whether they agree or disagree with this statement. Table 5.77 and Figure 5.122 reflect the comparison between respondents' first language and whether they believe that the use of mobile devices for learning purposes would save them a lot of time.

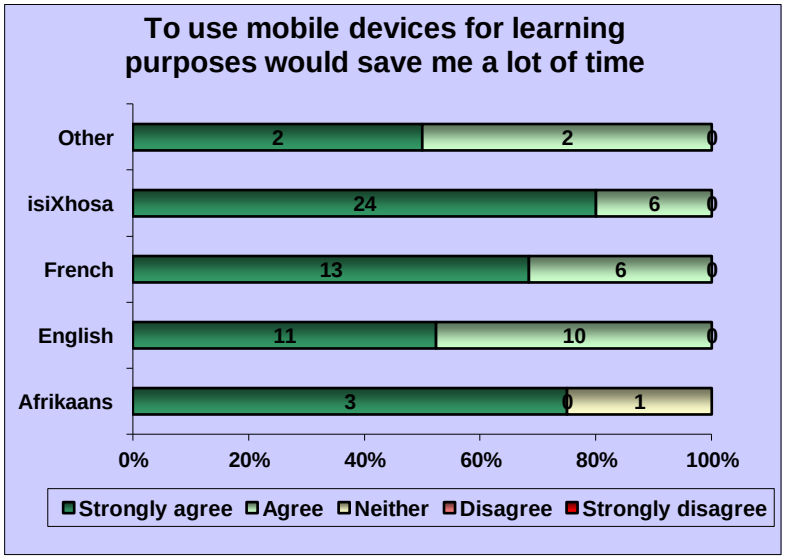


Figure 5.122: First language vs. P102

Table 5.79: Contingency table for First language vs. whether it would be easier to ask for help if learners could communicate through mobile devices (P123)

Frequency / Cell Percentage / Row Percentage / Column Percentage /	Strongly agree	Agree	Neither agree nor disagree	Disagree	TOTAL
Afrikaans	3 3.8% 75.0% 5.9%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	1 1.3% 25.0% 100.0%	4 5.1%
English	13 16.7% 61.9% 25.5%	6 7.7% 28.6% 27.3%	2 2.6% 9.5% 50.0%	0 0.0% 0.0% 0.0%	21 26.9%
French	13 16.7% 68.4% 25.5%	6 7.7% 31.6% 27.3%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	19 24.4%
isiXhosa	20 25.6% 66.7% 39.2%	8 10.3% 26.7% 36.4%	2 2.6% 6.7% 50.0%	0 0.0% 0.0% 0.0%	30 38.5%
Other	2 2.6% 50.0% 3.9%	2 2.6% 50.0% 9.1%	0 0.0% 0.0% 0.0%	0 0.0% 0.0% 0.0%	4 5.1%
TOTAL	51 65.4%	22 28.2%	4 5.3%	1 1.3%	78 100%

Table 5.80: Chi-square test of comparisons (First language vs. P123)

Question / Statement	Sample Size	Chi-Square	DF	P-Value
Comparisons between first language and P123				
23. It would be easier for me to ask for help if I could communicate through mobile devices	78	22.9936	12	0.0278*

The Chi-square test in Table 5.80 reflects that the modes of classification were not independent and therefore indicates a correlation/relationship between the two variables. The analogy can be drawn that statistically significant more learners who have isiXhosa or French as a first language, strongly agree with the statement “It would be easier for me to ask for help if I could communicate through mobile devices” when compared to the learners who have English as a first language. It is of importance to note that the numbers for those that speak Afrikaans or any other first language are not taken into consideration as their numbers are too small to make statistically correct conclusions. It is of further importance to

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

note that the difference lies only in the degree of which they agreed with this statement and not in whether they agree or disagree with this statement. Table 5.79 and Figure 5.123 reflect the comparison between respondents' first language and whether learners feel that it would be easier for them to ask for help if they could communicate by means of mobile devices.

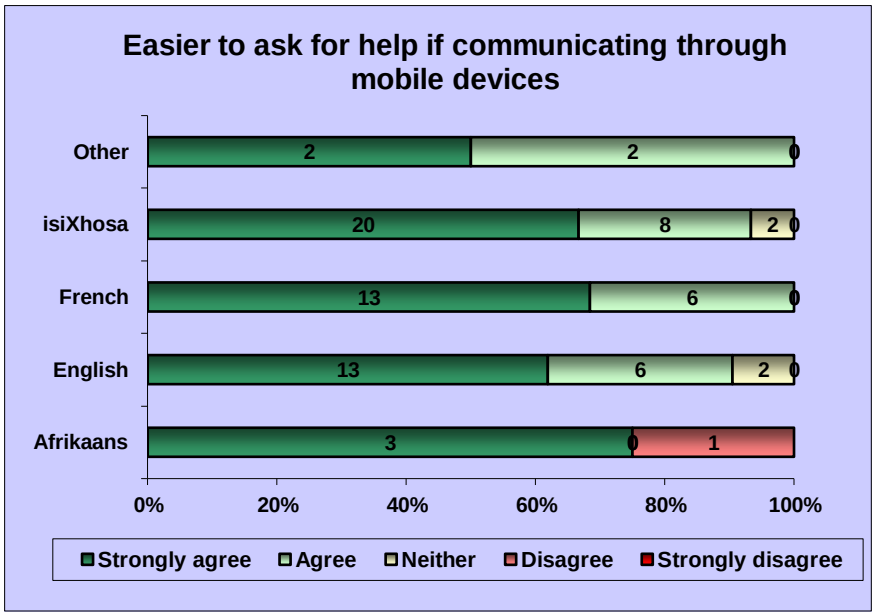


Figure 5.123: First language vs. P123

5.3.10 Research-specific questions

5.3.10.1 Pre-mobile learning (2007 - 2010) and m-learning (2011 - 2012) formative and summative assessment comparison

This paragraph will address and expand upon all research-specific questions regarding formative and summative assessments for the pre-m-learning group (2007 - 2010), who received no m-learning, and the 2011 - 2012 m-learning group who utilised mobile technology in a technology-based subject.

As discussed in Chapter 1, it has become evident that first-year undergraduate computer science programming learners in the FIS programme at the CPUT found it difficult to design, develop, test and electronically submit their computer science programming assignments both on and off-campus. As a result, the formative and summative assessment marks of these learners over the past few years indicate a disconcerting downward trend year on year. This can be attributed to a plethora of obstacles that impede on learners' ability to complete

and electronically submit their programming assignments, especially off-campus, as well as the inability to practice their programming skills outside the boundaries of the classroom. Upon investigation it was determined that this trend is primarily attributed to the limited availability of computers with the required software needed to complete programming assignments on campus, as well as the absence of the required software and the limited availability of Internet access off-campus.

Results reflect that only 44.95% of the 2011 - 2012 m-learning group own a computer/laptop computer, of which furthermore only 26.0% of the 2012 m-learning group have access to the Internet off-campus. This implies that these learners cannot view and download any course-related material or programming assignments from the Blackboard LMS, nor electronically submit any programming assignments when they are not on campus. In addition, and more importantly, none (0%) of the 2011 learners, and only 45.7% of the 2012 learners had off-campus access to the required Visual Basic 2005 application that allows them to practice their programming skills, as well as complete their programming assignments. It is however of importance to note that this tremendous hike (due to two learners who distributed illegal Visual Basic 2005 software copies amongst learners within the class) had no significant impact on this research study, since learners where instead only exposed to the mobile and desktop Basic4PPC application during the 2011 - 2012 research period. Learners as a result were therefore dependent on campus computer laboratories whose access is not always practical due to time, distance and location constraints. This fact had a significant impact on especially learners' practical performance (assignment marks). The researcher is of the opinion that to mitigate this adverse situation lies in the application of mobile technology in a technology-based subject.

Table 5.81 depicts the comparative design used in this research study for both formative and summative assessments. It indicates that the pre-m-learning group (2007 - 2010) was accessed by means of two summative assessments (T1 and T2), as well as by means of formative assessment consisting of practical programming assignments (A) and class tests (CT). During this period these learners were not exposed to any form of m-learning. Conversely, two groups were exposed to m-learning from 2011 to 2012. The 2011 m-learning group (first action research cycle) was assessed by means of the same formative and summative assessment types as the 2007 - 2010 group, however they were partially exposed to m-learning during the course of their studies. Learners only started utilising mobile technology after the first summative assessment (T1) and several formative assessments which included practical assignments (A1) and class tests (CT1). This m-learning intervention was primarily due to the sudden and extreme drop in learners' formative and summative assessment marks from 2007 to 2010. After these initial assessments,

learners were exposed to m-learning over a six month period, and were then again assessed by means of a second summative assessment (T2), and various formative assessments consisting again of practical assignments (A2) and class tests (CT2). It is however of importance to note that these learners were only exposed to m-learning on campus, as discussed in Chapter 2, Paragraph 2.5.3.1. The 2012 m-learning group was fully exposed to m-learning since the commencement of their computer science programming course. In contrast with the 2011 m-learning group, the 2012 m-learning group was also allowed to utilise mobile technology off-campus, therefore allowing these learners a true m-learning experience. This group was assessed, as was the case with the previous two groups (2007 - 2010 and 2011), by means of two summative assessments (T1 and T2), as well as various formative assessments that include practical assignments (A) and class tests (CT). Assessments not shaded indicate that learners were not exposed to m-learning prior to the assessment(s), whereas shaded assessments indicate that learners were exposed to some form of m-learning prior to the assessment(s).

Table 5.81: Comparative design for formative and summative assessment for the pre-m-learning group (2007-2010), and post-m-learning group (2011-2012)

	=	No m-learning
	=	M-learning

Pre-m-learning groups (2007 - 2010)	T1	T2	A	CT		
FIRST ACTION RESEARCH CYCLE M-learning group (on campus only) (2011)	T1	T2	A1	A2	CT1	CT2
SECOND ACTION RESEARCH CYCLE M-learning group (on and off-campus) (2012)	T1	T2	A	CT		

T1	=	Test 1 (Summative assessment)
T2	=	Test 2 (Summative assessment)
A	=	Assignments (Formative assessment)
A1	=	Assignments (Formative assessment)
A2	=	Assignments (Formative assessment)
CT	=	Class Tests (Formative assessment)
CT1	=	Class Tests (Formative assessment)
CT2	=	Class Tests (Formative assessment)

Figure 5.124 provides a summary of learner demographics, as well as formative and summative assessment marks gathered during the longitudinal (2007 - 2012) action research study.

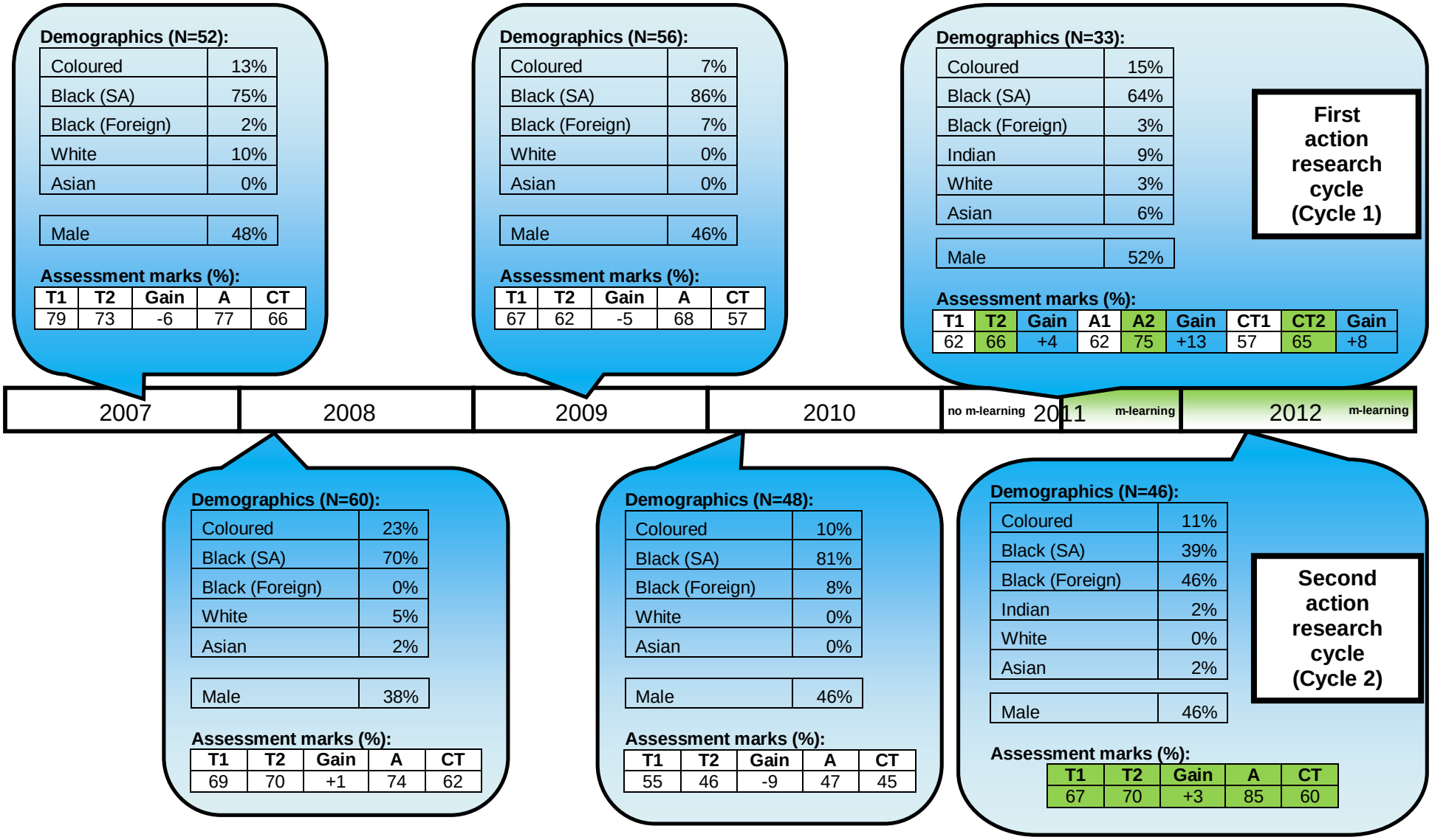


Figure 5.124: Longitudinal (2007 - 2012) action research study indicating learner demographics and assessment results

The following research-specific questions are expanded upon and statistics are reflected in Appendix S, Appendix T and Appendix U (CD-ROM: Supporting Data):

1. *As depicted in Table 5.81, the 2011 m-learning group was not exposed to any form of m-learning prior to the first summative assessment (T1), as well as some of the formative assignments (A1) and class tests (CT1). How do these marks differ when it is compared to their marks after the m-learning intervention?*

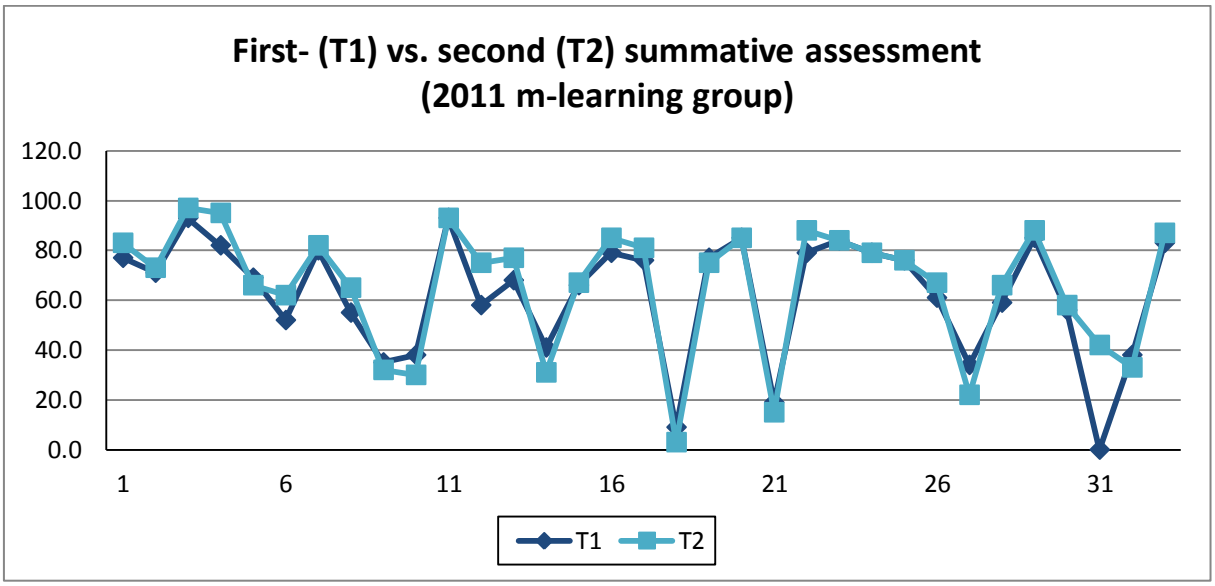


Figure 5.125: First- (T1) vs. second summative assessment (T2) for the 2011 m-learning group

Figure 5.125 provides a comparison between the first- (T1) and second summative assessments (T2) for the 2011 m-learning group. A paired t-test was performed to compare the two marks to determine whether there was a significant difference between the summative assessment marks prior to the m-learning intervention (T1) and after the m-learning intervention (T2). The t-test results indicate $t(33) = 1.9223$ and $p = 0.0635$. The p value of 0.0635, indicates that there is not a statistically significant difference (gain) in the post-m-learning test marks (T2).

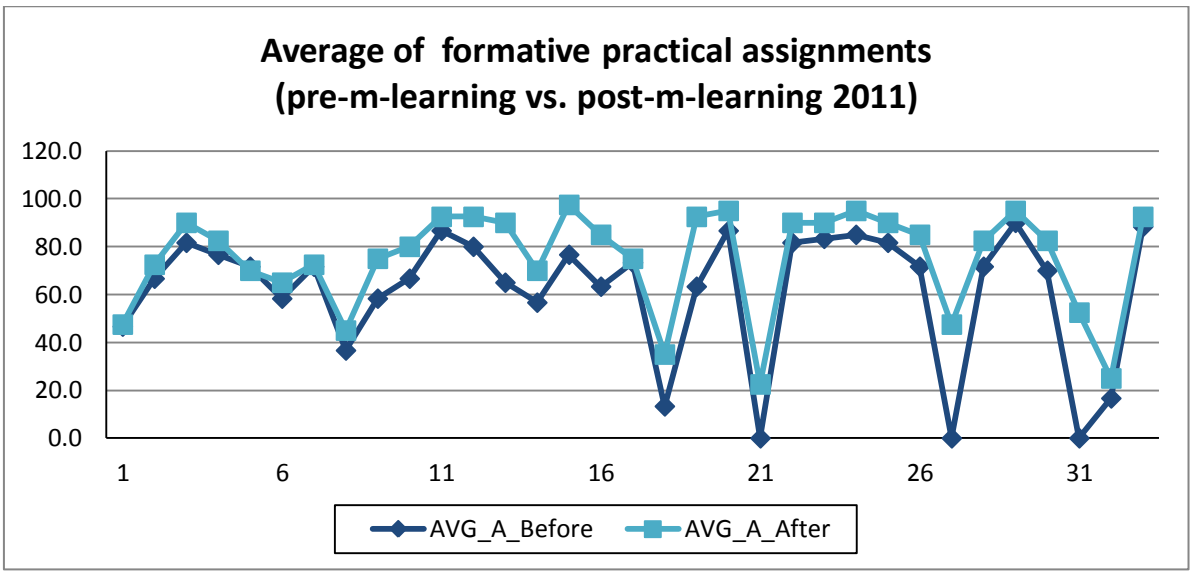


Figure 5.126: Average of practical assignment marks (pre-m-learning vs. post-m-learning 2011)

Figure 5.126 provides a comparison between the average of the formative practical assignment marks prior to (A1), and after m-learning (A2) for the 2011 m-learning group. A paired t-test was performed to compare the two average practical assignment marks in order to determine whether there was a significant difference between the assignment marks. The t-test results indicate $t(33) = 6.2945$ and p-value < 0.0001, which shows that there is a statistically significant gain in the post-m-learning practical assignment marks (A2).

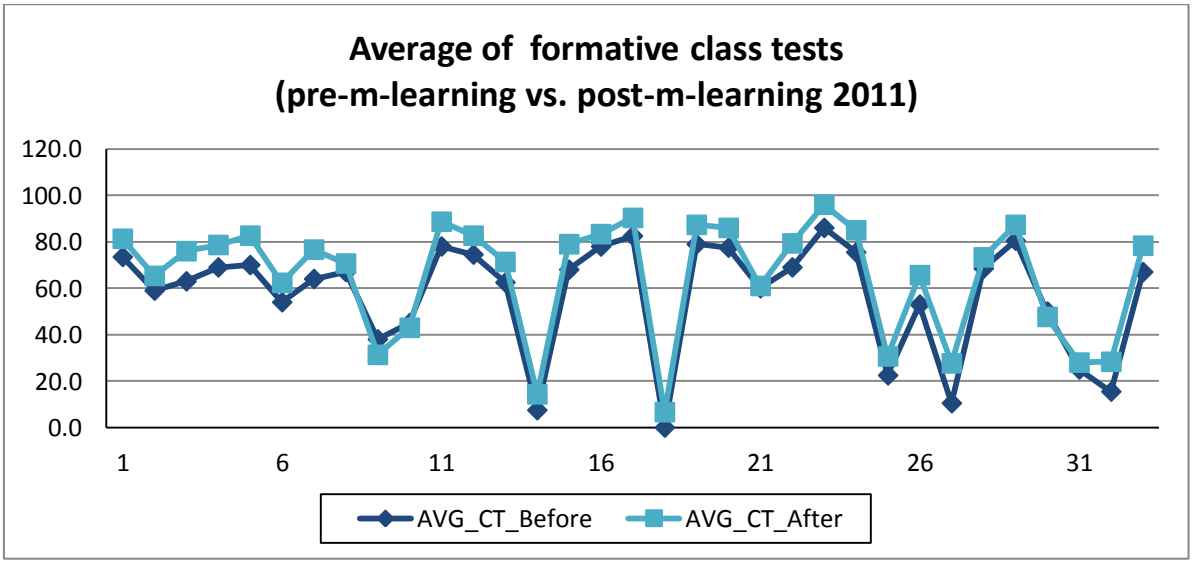


Figure 5.127: Average of class test marks (pre-m-learning vs. post-m-learning 2011)

Figure 5.127 provides a comparison between the averages of the formative class test marks prior to (CT1), and after the m-learning experience (CT2) for the 2011 m-learning group. A paired t-test was performed in order to determine whether there was a significant difference between the class test marks. The t-test results indicate t(33) = 8.9429 and p-value < 0.0001, which shows that there is a statistically significant gain in the post-m-learning class test marks (CT2).

To summarise: Results indicate that though the 2011 m-learning group did not show a statistically significant difference (gain) between the pre-m-learning summative assessment (T1) and the post-m-learning summative assessment (T2), there was a statistically significant gain in the post-m-learning practical assignment marks (A2) as well as the post m-learning class test marks (CT2).

2. *Is there a significant difference in formative and summative assessment marks when comparing the 2011- and 2012 m-learning groups?*

Table 5.82: Analysis of variance to compare 2011 assessments vs. 2012 assessments

Question / Statement	2011		2012		F-Value	P-Value
	N	Mean	N	Mean		
1. T1 2011 vs. T1 2012	33	62.33	48	66.79	0.8362	0.3633
2. T2 2011 vs. T2 2012	33	65.52	47	70.47	0.8181	0.3685
3. Average of pre-m-learning practical assignments 2011 vs. Average of post-m-learning practical assignments 2012	33	61.82	48	85.19	24.5121	<0.0001***
4. Average of post-m-learning practical assignments 2011 vs. Average of post-m-learning practical assignments 2012	33	75.00	48	85.19	6.2392	0.0146*
5. Average of pre-m-learning class tests 2011 vs. Average of post-m-learning class tests 2012	33	57.36	48	60.28	0.3489	0.5564
6. Average of post-m-learning class tests 2011 vs. Average of post-m-learning class tests 2012	33	65.03	48	60.28	0.8929	0.3476

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

Table 5.82 indicates that there was no significant difference between the first summative assessment marks (T1) of the 2011 and 2012 m-learning groups. Conversely, there were significant differences between the average pre-m-learning formative assignment mark of 2011 (A1) and the average of the post-m-learning formative assignments marks of 2012 (A), as well as the average marks of the post-m-learning practical assignments of 2011 (A2) and the average of the post-m-learning practical assignment marks of 2012 (A). In both cases the 2012 group scored statistically significant better than the 2011 group.

3. *Is there a significant difference in formative and summative assessment marks when comparing the 2007 - 2010 pre-m-learning and 2011 - 2012 m-learning groups?*

An analysis of variance was performed to determine whether there are differences between the years (2007 - 2010 vs. 2011 - 2012) concerning the formative and summative assessment marks. The results are depicted in Table 5.83.

Table 5.83: Analysis of variance to compare the year groups (2007 - 2012) with regard to formative and summative assessment marks

Variable	DF	ANOVA SS	Mean Square	F-value	P-value
1. Test 1 (T1) mark	5	15315.9311	3063.1862	9.11	<0.0001***
2. Test 2 (T2) mark	5	23764.1294	4752.8259	13.05	<0.0001***
3. Average of practical assignment mark before m-learning	5	41856.6204	8371.3241	12.58	<0.0001***
4. Average of practical assignment mark after m-learning	5	40268.4554	8053.6911	12.67	<0.0001***
5. Average of class test mark before m-learning	5	13505.8456	2701.1691	7.49	<0.0001***
6. Average of class test mark after m-learning	5	14793.5679	2958.7136	8.09	<0.0001***

It is of importance to note that the average of the formative practical assignment marks and the average of the formative class test marks for the 2007 - 2010 group, is compared to the pre-m-learning and post-m-learning average practical assignment- and class test marks of the 2011 group. In addition, the post-m-learning formative assessment marks of the 2012 group, is compared to the pre- and post-m-learning average of the practical assignment- and class test marks of the 2011 group. Thus, the description of the variables in points 3, 4, 5 and 6 in Table 5.83 is describing the 2011 group variables. In the case of the 2007 - 2010 group

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

there are only pre-m-learning assessment marks, whereas in the 2012 group there are only post-m-learning assessment marks.

It is evident that there is a difference between the means of the assessment marks for the different years, however the ANOVA does not indicate between which years these differences lie. Therefore, the Tukey's Studentized Ranged test is performed to indicate between which years these differences lie (Appendix T - CD-ROM: Supporting Data).

Table 5.84 to Table 5.89 show the difference between the means and the statistically significant differences at the 0.05 level of significance, in a matrix for the six year study period (2007 - 2012) for each variable.

Table 5.84: Difference in means matrix for the first summative assessment (T1) (2007 - 2012)

Year	2007	2008	2009	2010	2011	2012
2007		79.1 – 69.0 = 10.1*	79.1 – 67.3 = 11.8*	79.1 – 55.2 = 23.9*	79.1 – 62.3 = 16.8*	79.1 – 66.8 = 12.3*
2008			69.0 – 67.3 = 1.7	69.0 – 55.2 = 13.8*	69.0 – 62.3 = 6.7	69.0 – 66.8 = 2.2
2009				67.3 – 55.2 = 12.1*	67.3 – 62.3 = 5.0	67.3 – 66.8 = 0.5
2010					55.2 – 62.3 = -7.1	55.2 – 66.8 = -11.6*
2011						62.3 – 66.8 = -4.5

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

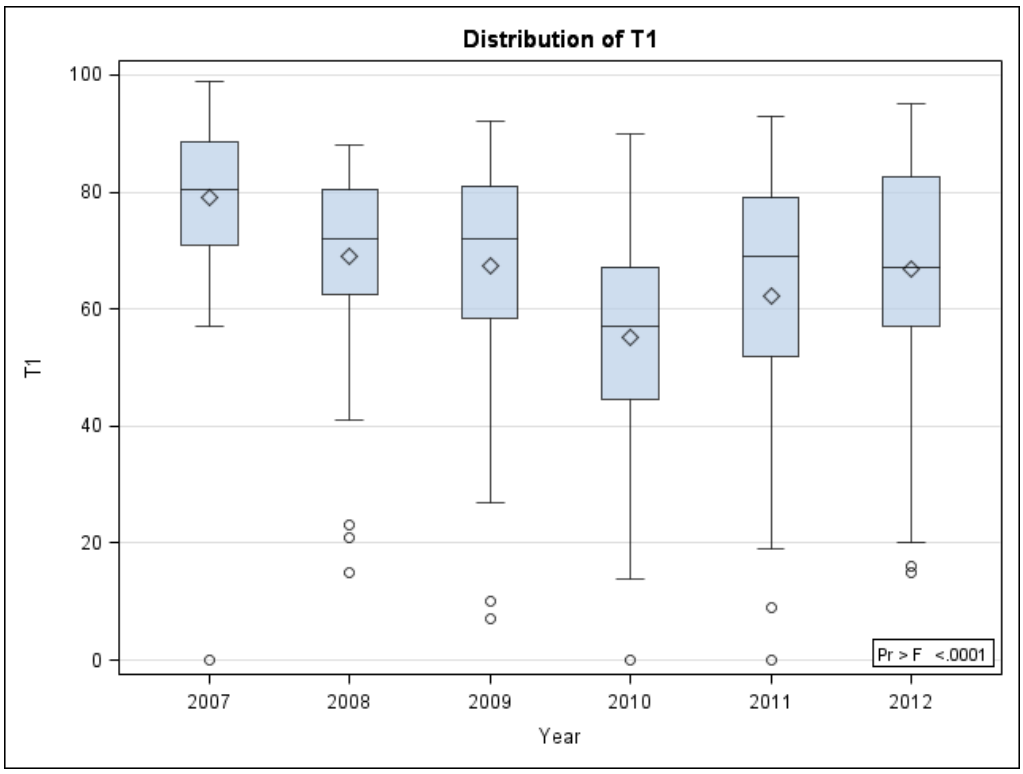


Figure 5.128: Decrease and increase in marks for the first summative assessment (T1) (2007 - 2012)

According to Table 5.84 and Figure 5.128, it is obvious that there is a statistically significant decrease in the first (T1) summative assessment marks from 2007 to 2010, and a statistically significant increase from 2010 to 2012. It is however important to note that the increase in marks between the 2010 and 2011 groups is not statistically significant.

Table 5.85: Difference in means matrix for the second summative assessment (T2) (2007 - 2012)

Year	2007	2008	2009	2010	2011	2012
2007		72.6 – 69.7 = 2.9	72.6 – 61.6 = 11.0*	72.6 – 46.0 = 26.6*	72.6 – 65.5 = 7.1	72.6 – 70.5 = 2.1
2008			69.7 – 61.6 = 8.1	69.7 – 46.0 = 23.7*	69.7 – 65.5 = 4.2	69.7 – 70.5 = -0.8
2009				61.6 – 46.0 = 15.6*	61.6 – 65.5 = -3.9	61.6 – 70.5 = -8.9
2010					46.0 – 65.5 = -19.5*	46.0 – 70.5= -24.5*
2011						65.5 – 70.5 = -5.0

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

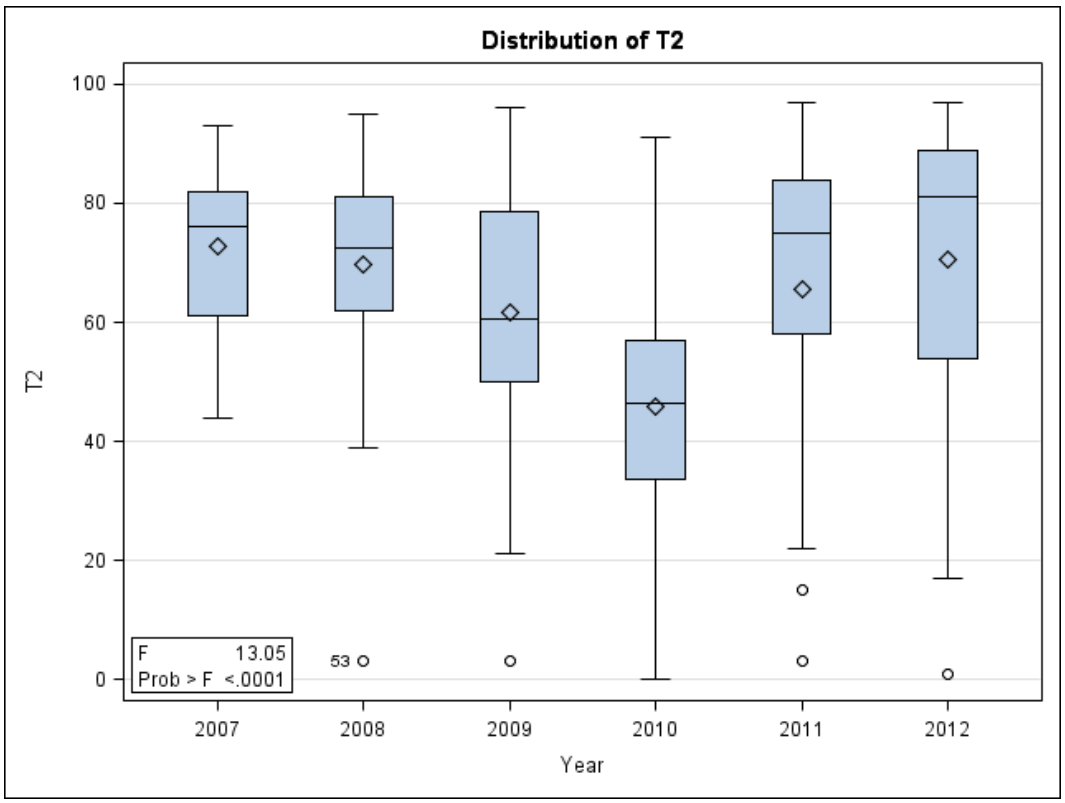


Figure 5.129: Decrease and increase in marks for the second summative assessment (T2) (2007 - 2012)

Table 5.85 and Figure 5.129 reflect that there is a statistically significant decrease in the second (T2) summative assessment marks from 2007 to 2010, and a statistically significant increase from 2010 to 2011 and from 2010 to 2012. It could therefore be argued that m-learning had a positive effect on learners performance, since this was the only change in learners' teaching and learning experience between the 2007 - 2010 (no m-learning) and the 2011 - 2012 groups (m-learning).

Table 5.86: Difference in means matrix for average of formative practical assignment marks before m-learning

Year	2007	2008	2009	2010	2011	2012
2007		77.4 – 73.9 = 3.5	77.4 – 67.5 = 9.8	77.4 – 47.4 = 30.0*	77.4 – 61.8 = 15.6	77.4 – 85.2= -7.8
2008			73.9 – 67.5 = 6.4	73.9 – 47.4 = 26.5*	73.9 – 61.8 = 12.1	73.9 – 85.2 = -11.3
2009				67.5 – 47.4 = 20.1*	67.5 – 61.8 = 5.7	67.5 – 85.2 = -17.7*
2010					47.4 – 61.8 = -14.4	47.4 – 85.2= -37.8*
2011						61.8 – 85.2 = -23.4*

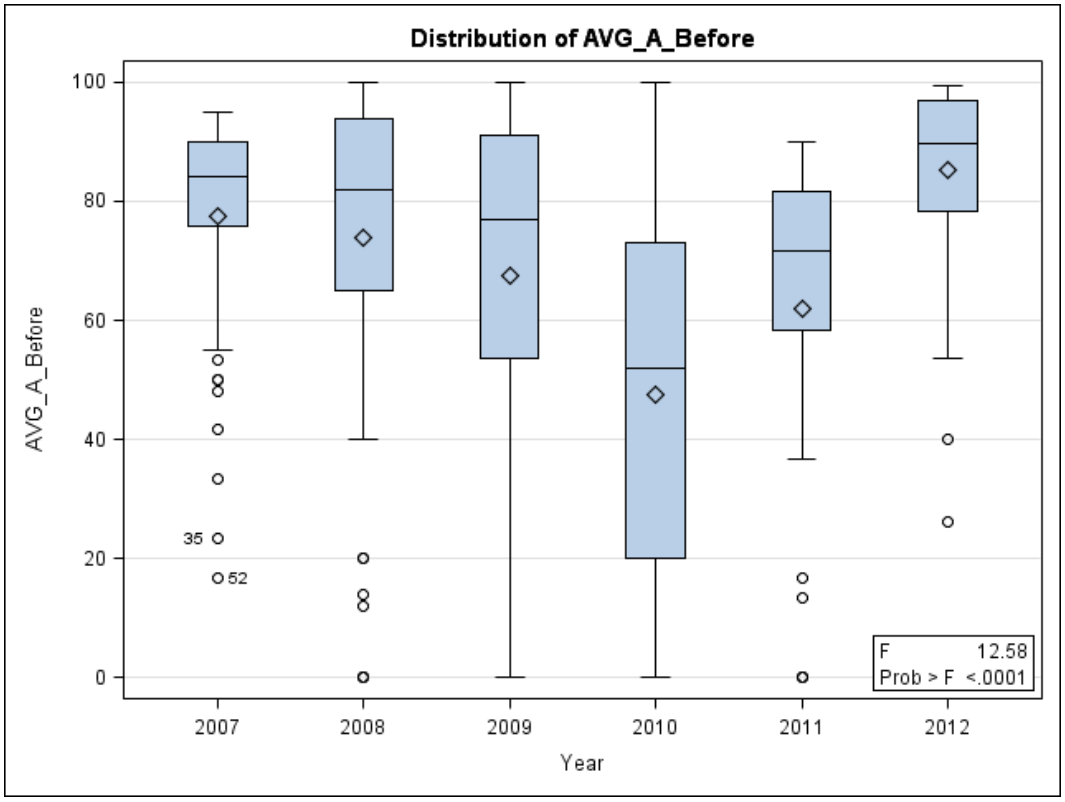


Figure 5.130: Decrease and increase in formative practical assignment marks before m-learning (2007 - 2012)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

It is of importance to note that the formative practical assignment marks for 2007 to 2010 are compared with the practical assignment marks before the implementation of m-learning in 2011, as well as with the practical assignment marks after m-learning implementation in 2012. Table 5.86 and Figure 5.130 reflect that there is a statistically significant decrease in the practical assignments marks from 2007 to 2010, and a statistically significant increase from 2010 to 2012 and from 2011 to 2012. It could therefore be argued that m-learning had a positive impact on learners' formative practical class test performance/results.

Table 5.87: Difference in means matrix for formative practical assignment marks after m-learning

Year	2007	2008	2009	2010	2011	2012
2007		77.4 – 73.9 = 3.5	77.4 – 67.5 = 9.8	77.4 – 47.4 = 30.0*	77.4 – 75.0 = 2.4	77.4 – 85.2= -7.8
2008			73.9 – 67.5 = 6.4	73.9 – 47.4 = 26.5*	73.9 – 75.0 = -1.1	73.9 – 85.2 = -11.3
2009				67.5 – 47.4 = 20.1*	67.5 – 75.0 = -7.5	67.5 – 85.2 = -17.7*
2010					47.4 – 75.0 = -27.6*	47.4 – 85.2= -37.8*
2011						75.0 – 85.2 = -10.2

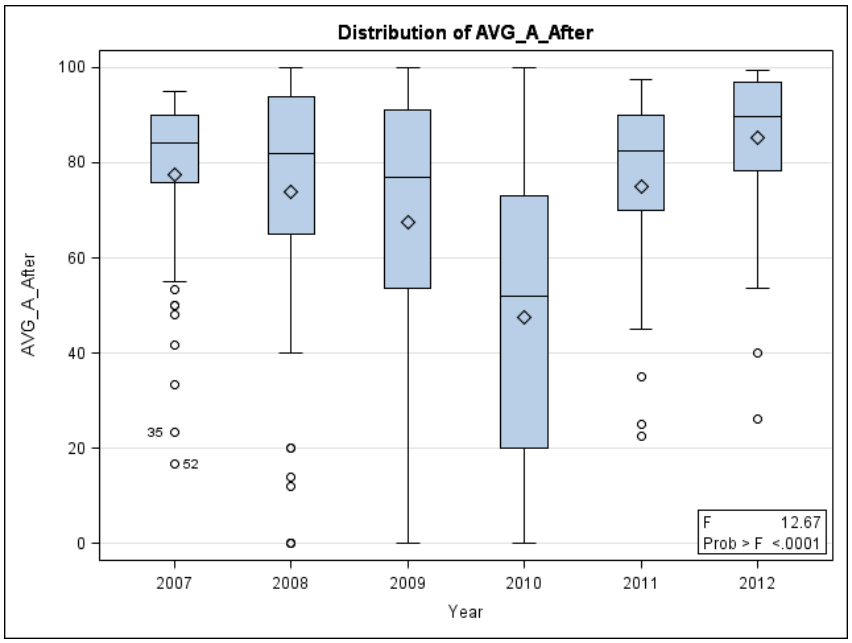


Figure 5.131: Decrease and increase in formative practical assignment marks after m-learning (2007 - 2012)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

It is of importance to note that the formative practical assignment marks for 2007 to 2010 are compared with the practical assignment marks after the implementation of m-learning (2011 - 2012). Table 5.87 and Figure 5.131 reflect that there is a statistically significant decrease in practical assignment marks from 2007 to 2010, and a statistically significant increase from 2010 to 2011 and from 2010 to 2012. Furthermore, it is also of importance to note that the practical assignment marks for 2010 did not increase statistically significant from 2010 to 2011 prior to the m-learning experience, but they did increase statistically significant from 2010 to 2011 after the m-learning experience.

Table 5.88: Difference in means matrix for average of formative class test marks before m-learning

Year	2007	2008	2009	2010	2011	2012
2007		66.4 – 62.1 = 4.3	66.4 – 56.7 = 9.7	66.4 – 44.7 = 21.7*	66.4 – 57.4 = 9.0	66.4 – 60.3= 6.1
2008			62.1 – 56.7 = 5.4	62.1– 44.7 = 17.4*	62.1 – 57.4 = 4.7	62.1 – 60.3 = 1.8
2009				56.7 – 44.7= 12.0*	56.7 – 57.4 = -0.6	56.7 – 60.3 = -3.5
2010					44.7 – 57.4 = -12.6*	44.7 – 60.3 = -15.6*
2011						57.4 – 60.3 = -2.9

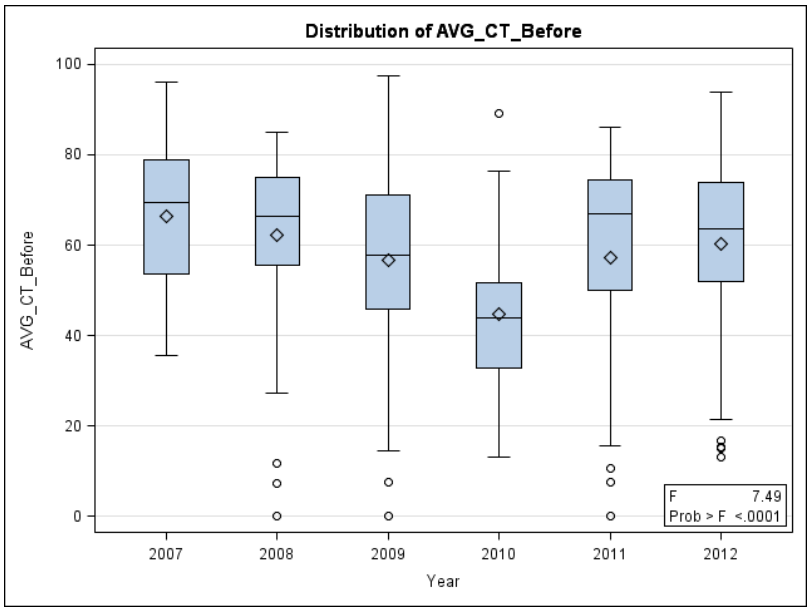


Figure 5.132: Decrease and increase in marks for formative class test marks before m-learning (2007 - 2012)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

It is of importance to note that the formative class test marks for 2007 to 2010 are compared with the class test marks before the implementation of m-learning for 2011 and with the scores of the class test marks after the implementation of m-learning for 2012. Table 5.88 and Figure 5.132 reflect that there is a statistically significant decrease in the class test marks from 2007 to 2010, and a statistically significant increase from 2010 to 2011 and from 2010 to 2012.

Table 5.89: Difference in means matrix for average of formative class test marks after m-learning

Year	2007	2008	2009	2010	2011	2012
2007		66.4 – 62.1 = 4.3	66.4 – 56.7 = 9.7	66.4 – 44.7 = 21.7*	66.4 – 65.0 = 1.4	66.4 – 60.3= 6.1
2008			62.1 – 56.7 = 5.4	62.1– 44.7 = 17.4*	62.1 – 65.0 = -2.9	62.1 – 60.3 = 1.8
2009				56.7 – 44.7= 12.0*	56.7 – 65.0 = -8.3	56.7 – 60.3 = -3.5*
2010					44.7 – 65.0 = -20.3*	44.7 – 60.3 = -15.6*
2011						65.0 – 60.3 = 4.7

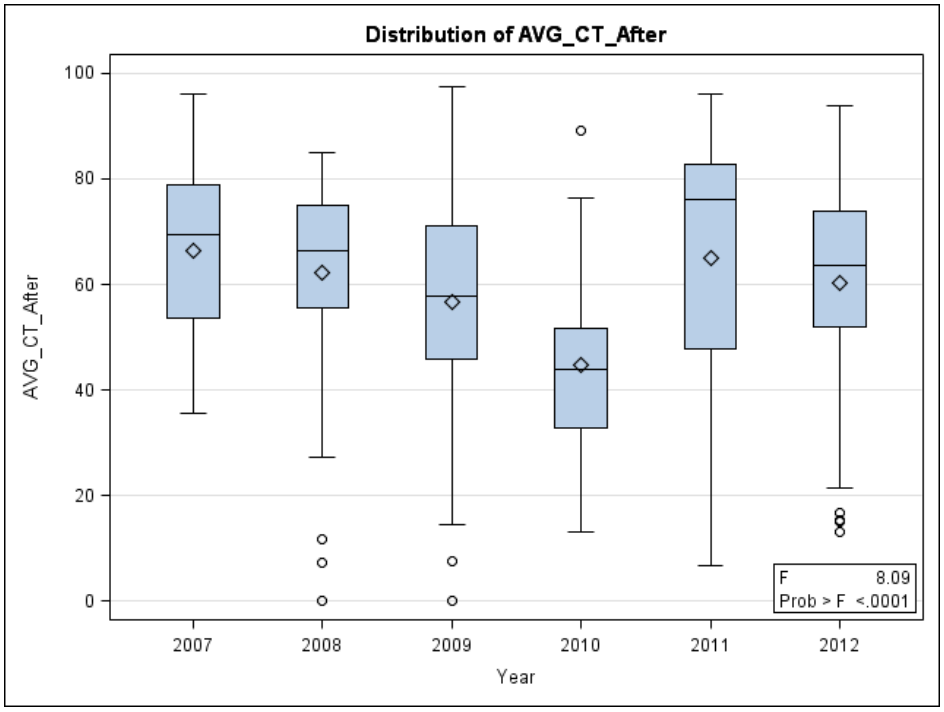


Figure 5.133: Decrease and increase in formative class test marks after m-learning (2007 - 2012)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

It is of importance to note that the formative class test marks for 2007 to 2010 are compared with the class test marks after m-learning implementation during 2011 and 2012. Table 5.89 and Figure 5.133 reflect that the class test marks were deteriorating from 2007 to 2010 and a statistical significant increase from 2010 to 2011 and from 2010 to 2012. Therefore, an improvement of class test marks were shown from 2011 when m-learning was introduced. It could therefore be argued that m-learning had a positive impact on learners' formative class test performance/results.

5.3.10.2 Formative and summative assessments versus pre-mobile learning- and post-mobile learning questionnaires (2011 - 2012)

This paragraph will discuss all research-specific questions regarding formative and summative assessments versus some variables from the pre-m-learning- and post-m-learning questionnaires completed during 2011 and 2012.

4. *Formative and summative assessment marks (gain) vs. Attitude (A09, A10) and Perceived Usefulness (A11, A12) before being exposed to m-learning.*

Regarding the gain in formative and summative assessment marks, there were no statistically significant correlation with Attitude (A09) and Perceived Usefulness (A11, A12). An Analysis of Variance was performed to see whether the gain in marks differed for the different answers on questions A09, (A10 was left out as all the learners had the same answer), A11 and A12. None of the tests were significant (see Appendix T – CD-ROM: Supporting Data).

5. *Formative and summative assessment marks (gain) vs. Attitude (P124 to P130; P225), Perceived Usefulness (P102 to P110), Perceived Output Quality (P134 to P140) and Usage (P205; P207) after being exposed to m-learning.*

There were no statistically significant differences concerning the gain in summative assessment marks (T1 and T2) for any of the Attitude, Perceived Usefulness or Perceived Output Quality variables.

The following indicates statistically significant differences for the marks-gain for formative practical assignment marks:

- There was a significant difference (ANOVA; F=5.7118; P-value=0.0079**) between the means of the practical assignment marks for the answers of P125 (I would like to be able to use mobile devices as a method for learning, since it will allow me to learn in places I could normally not learn/study in), which was a question under the original "Attitude" header. It seems that the learners who indicated "Neither agree nor disagree" had statistically significant higher practical assignment marks than the learners who "Strongly agree" and "Agree" to this statement, however it is of importance to note that the sample of learners who "Neither agree nor disagree" consists of only three learners. This implies that if a nonparametric test (Kruskal Wallis test; Chi-square=4.0670; DF=2; P-value=0.1309) is performed on the data, these higher marks for the "Neither agree nor disagree" group were not statistically significant higher.
- Although there was not a significant difference (ANOVA; F=1.9324; P-value=0.1624) between the means of the practical assignment marks for the answers of P129 (I would feel ready for m-learning if the university implements it now) which was a question under the original "Attitude" header; a nonparametric test (Kruskal Wallis test; Chi-square=6.0342; DF=2; P-value=0.0489*) indicate that there is statistically significant higher practical assignment marks for the "Neither agree nor disagree" group. It is evident that the learners who indicated "Neither agree nor disagree" had statistically significant higher practical assignment marks than the learners who "Strongly agree" and "Agree" to this statement, however it is of importance to note that the sample of learners who "Neither agree nor disagree" consisted of only three learners. This implies that a nonparametric test (Kruskal Wallis test) may be a more appropriate test as doubt existed whether the data is normally distributed (N to small to determine distribution).
- Although there was not a significant difference (ANOVA; F=3.1015; P-value=0.0597) between the means of the practical assignment marks for the answers of P105 (To use mobile devices for learning would be ubiquitous and useful), which was a question under the original "Perceived Usefulness" header; a nonparametric test (Kruskal Wallis test; Chi-square=6.4937; DF=2; P-value=0.0389*) indicate that there is statistically significant higher marks for the "Neither agree nor disagree" group. It seems that the learners who indicated "Neither agree nor disagree" had statistically significant higher practical assignment marks than the learners who "Strongly agree" and "Agree" to this statement, however it is of importance to note that the sample of learners who "Neither agree nor disagree" consisted of only three learners and a nonparametric test (Kruskal Wallis test) may be a more appropriate test as doubt existed whether the data is normally distributed (N to small to determine distribution).

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* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

The following indicates statistically significant differences for the marks-gain for formative class tests marks:

- There was a significant difference (ANOVA; F=3.6280; P-value=0.0388*) between the means of the formative class tests marks for the answers of P127 (I would feel in control when using mobile devices in teaching and learning), which was a question under the original "Attitude" header. It is evident that the learners who indicated "Neither agree nor disagree" had statistically significant higher class tests marks than the learners who "Strongly agree" and "Agree" to this statement, however it is of importance to note that the sample of learners who "Neither agree nor disagree" consisted of only four learners, and if a nonparametric test (Kruskal Wallis test; Chi-square=5.3996; DF=2; P-value=0.0672) is performed on the data the higher marks for the "Neither agree nor disagree" group was not statistically significant higher.

6. *Which type of learner (gender, first language, race) shows the best marks-gain?*

An analysis of variance was performed to determine whether the males and females have the same gain with regards to their summative test marks, formative practical assignment marks, and formative class test marks. Due to the fact that doubt existed whether the data is normally distributed, a non-parametric test (Mann Whitney test) was also performed. Only statistics, which were statistically significant are discussed in the thesis, however all the results can be found within the ambit of Appendix T (CD-ROM: Supporting Data).

Table 5.90: Gain of summative tests and formative assignments and class tests according to gender

	Male		Female	
	N	**Mean (SD)**	**N**	**Mean (SD)**
Gain_T (Summative tests)	38	6.26(13.32)	40	0.75(13.28)
Gain_A (Formative practical assignments)	17	12.40(12.39)	16	14.01(11.98)
Gain_CT (Formative class tests)	17	6.53(5.71)	16	8.88(3.73)

* *Statistically significant at level 0.05*
** *Statistically significant at level 0.01*
*** *Statistically significant at level 0.001*

In terms of Table 5.90, there were no statistically significant differences for the different gains between the genders of the 2011 and 2012 m-learning groups. This means that the larger gain in summative test marks (Gain_T) for the males are not significantly larger than those of the females. Even though the females show a greater gain than the males for the formative practical assignment marks, as well as the formative class test marks, it is not a statistically significant greater gain than that of the males.

Table 5.91: Gain of summative tests, formative practical assignments and formative class tests according to first language

	Afrikaans		English		French		IsiXhosa	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
Gain_T (Summative tests)	4	17.00(17.68)	21	2.19(10.10)	19	1.42(16.21)	32	5.06(11.41)
Gain_A (Formative practical assignments)	3	24.44(24.39)	10	9.33(5.37)	1	0.83(.)	19	14.08(11.75)
Gain_CT (Formative class tests)	3	8.06(5.00)	10	7.40(4.81)	1	12.67(.)	19	7.48(5.22)

Table 5.91 reflects that there were no statistically significant differences for the different gains between the different first languages. Thus, although for instance there was a larger gain for the Afrikaans speaking learners than for the other first language groups, it is not statistically significant.

Table 5.92: Gain of summative tests, formative practical assignments and formative class tests according to race

	Black		Coloured		Indian		Other	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N2	Mean (SD)
Gain_T	60	2.13(13.82)	10	8.40(12.71)	4	-0.75(3.30)	2	6.50(0.71)
Gain_A	22	13.26(11.18)	5	19.5(19.58)	3	7.22(1.92)	2	5.83(7.07)
Gain_CT	22	7.56(5.47)	5	7.60(5.26)	3	9.28(3.15)	2	6.33(2.12)

There were no statistically significant differences for the different gains between the different races. It is of importance to note that there was one Asian learner who had a gain of 29% between the two summative tests that is not reflected in Table 5.92.

7. *Which type of learner (gender, first language, race) indicated that mobile devices would increase the quality of computer programming teaching and learning (P108) as well as whether they would buy a mobile device if it will be useful in their course (P110)? How do these compare to their formative and summative assessment results after being exposed to m-learning?*

The formative and summative assessment marks of learners according to their gender, first language and race) do not differ statistically significant after the m-learning intervention with regards to whether learners believe that the quality of computer programming teaching and learning would increase, and whether they will buy a mobile device if it will be useful in their course (see Appendix T - CD-ROM: Supporting Data).

8. *Did the Perceived Enjoyment (P115 to P117)) of learners regarding the utilisation of mobile devices for teaching and learning purposes, have an effect on formative and summative assessment marks?*

There was no statistical significant correlation between Perceived Enjoyment (PE) and the formative and summative assessment marks of learners (see Appendix T - CD-ROM: Supporting Data).

9. *Did the frequency of mobile device use (P205) have an effect on formative and summative assessment marks?*

There was no statistical significant correlation between the frequency of mobile device usage and the formative and summative assessment marks of learners (Appendix T - CD-ROM: Supporting Data).

10. *Did the time learners spent per week using mobile devices (P207) have an effect on formative and summative assessment marks?*

There was no statistical significant correlation between the time spent per week using mobile devices and the formative and summative assessment marks of learners (see Appendix T - CD-ROM: Supporting Data).

5.3.10.3 Pre-mobile learning questionnaire

This paragraph will discuss all research-specific questions regarding the pre-m-learning questionnaire that was conducted before the implementation of m-learning during 2011 and 2012.

11. *Black learners represent the largest portion of both the 2011 and 2012 m-learning groups. What is the first language of these learners?*

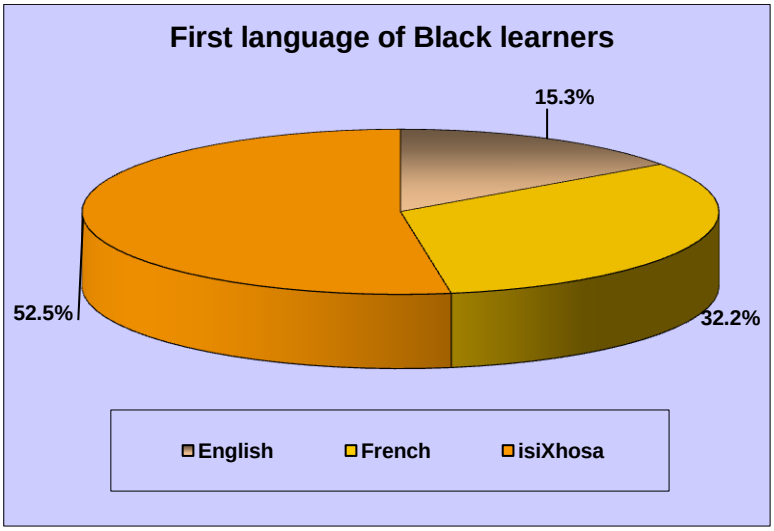

Figure 5.134: First language distribution of black learners

The reason why this question was of importance was to determine whether these learners were South African black learners or foreign black learners. Figure 5.134 reflects that the majority of black learners (52.5%) used isiXhosa as their first language, followed by foreign French speaking learners (32.2%), and English speaking learners (15.3%). This implies that the majority of learners have English as a second, or even a third language. It furthermore, suggests that the majority of the learners are mainly from a previously disadvantaged background.

12. *What type of learner (gender, first language, race) owns a desktop computer, laptop computer, tablet and/or mobile phone (A15a, A15b, A15d and A15e)?*

Chi-square tests were performed to determine whether there is a correlation between gender and the ownership of desktop/mobile technology. Table 5.93 indicates that there was no

statistically significant correlation between the gender of learners and the ownership of desktops computers/mobile technology.

Table 5.93: Ownership of desktop and mobile technology by gender

	Male		Female	
	N	%	N	%
Desktop computer	16	42.1%	10	24.4%
Laptop computer	22	57.9%	23	56.1%
Mobile phone	37	97.4%	36	87.8%
Tablet	5	13.2%	5	12.2%
TOTAL	38		41	

Table 5.94: Ownership of desktop and mobile technology by first language

	Afrikaans		English		French		isiXhosa	
	N	%	N	%	N	%	N	%
Desktop computer	3	75.0%	12	54.6%	3	15.8%	7	21.9%
Laptop computer	1	25.0%	17	77.3%	14	73.7%	12	37.5%
Mobile phone	4	100.0%	21	95.4%	17	89.5%	29	90.6%
Tablet	0	0.0%	4	18.2%	3	15.8%	1	3.%
TOTAL	4		22		19		32	

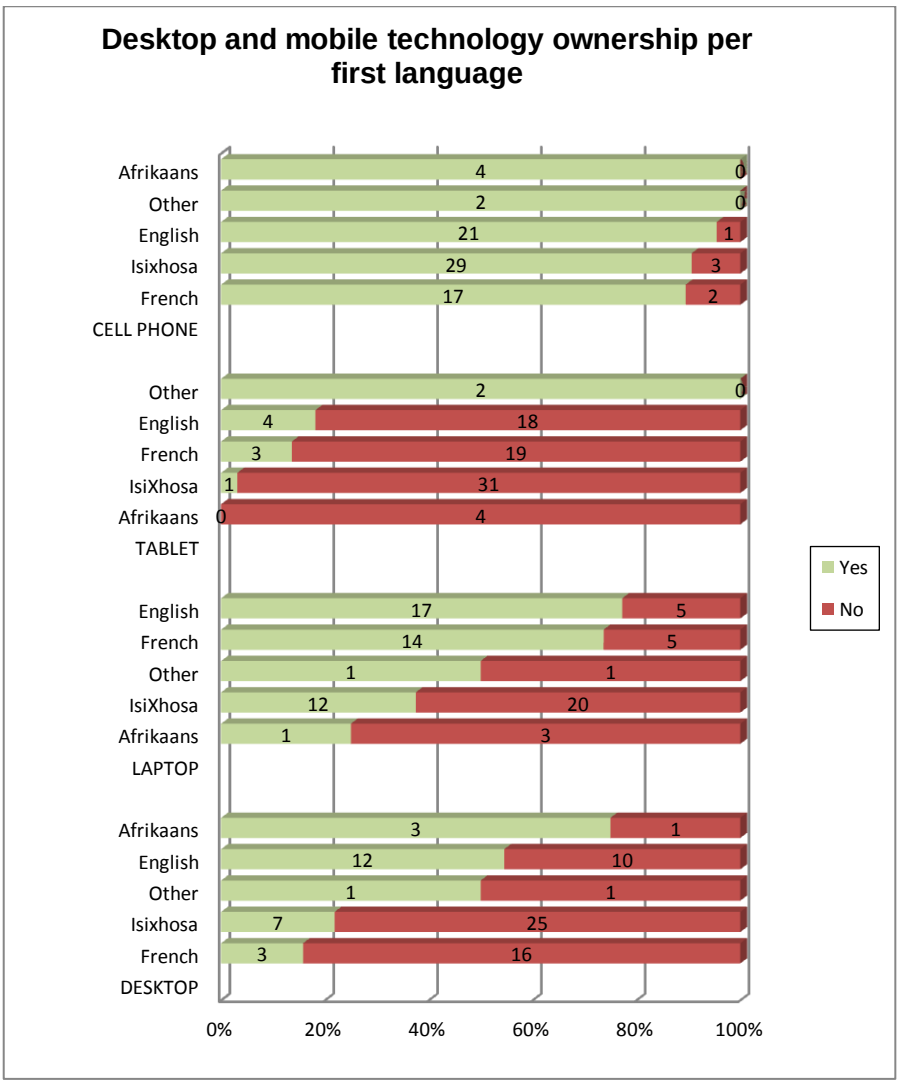

Figure 5.135: Desktop and mobile technology ownership per first language distribution

Of the two learners who spoke other first languages, one owned a desktop computer, laptop computer and tablet. Both learners owned a mobile phone. The Chi-square test indicates that there is a statistically significant correlation between a learner's first language and the ownership of desktop computers, laptop computers and tablets. In terms of Table 5.94 and Figure 5.135, it is evident that more Afrikaans- and English speaking learners own a desktop computer than French- and isiXhosa speaking learners. Furthermore, more English- and French speaking learners own a laptop computer or a tablet than the Afrikaans- and isiXhosa speaking learners. Most learners (92.4%) own a mobile phone. There is no statistically significant correlation between first language and the ownership of mobile phones. This implies that all the first language groups show the same expected frequency for owning a mobile phone.

Table 5.95: Ownership of desktop and mobile technology by race

	Asian		Black		Coloured		Indian		Other		White	
	N	%	N	%	N	%	N	%	N	%	N	%
Desktop computer	1	100.0	12	19.7	7	70.0	4	100.0	1	50.0	1	100.0
Laptop computer	1	100.0	33	54.1	7	70.0	3	75.0	1	50.0	0	0.0
Mobile phone	1	100.0	7	11.5	2	20.0	0	0.0	0	0.0	0	0.0
Tablet	1	100.0	55	90.2	10	100.0	4	100.0	2	100.0	1	100.0
TOTAL	1		61		10		4		2			

Table 5.95 shows that there was no statistically significant correlation between the ownership of mobile technology and race.

13. *What type of learner (gender, first language, race) spends the most money on mobile data usage and airtime per month (A44)?*

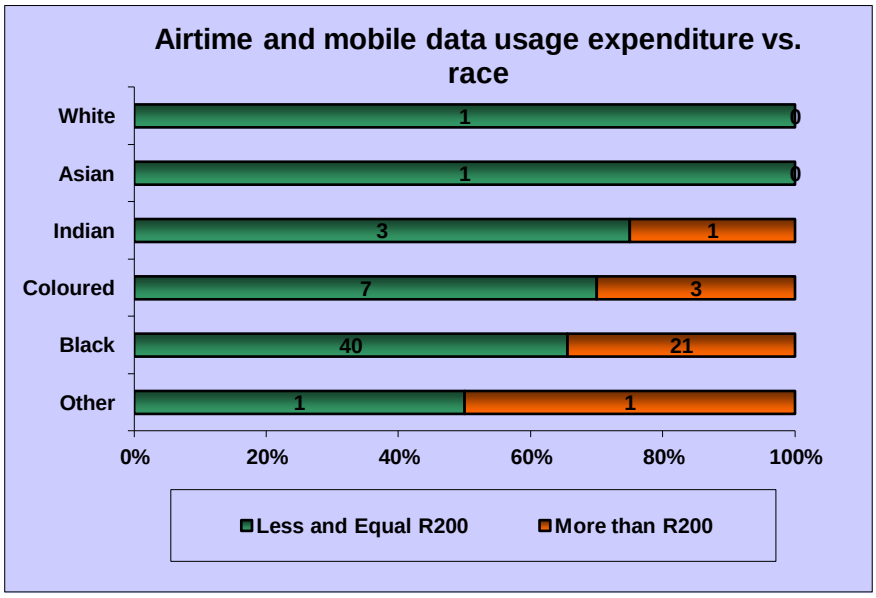

Figure 5.136: Airtime and data usage expenditure per month vs. race

As reflected in Appendix T (see CD-ROM: Supporting Data), there is no statistically significant correlation between the first language, gender, race, and the average amount of money learners spend on airtime and data usage per month. Therefore, all learners did not respond statistically significant different to this question. Figure 5.136 reflects the

expenditures for the different race groups. It is of importance to note that there are only four Indian learners, one White learner, and one Asian learner in the survey (2011 - 2012). As there were not sufficient learners in the survey to have valid testing of that many groups, it was deemed necessary to aggregate the categories of this variable to two groups “Up to R200” and “More than R200”; where the “More than R200” category suggests the learners who spend more on airtime and mobile data usage per month.

14. *How did learners (gender, first language, race) who have spend the most money on mobile data usage and airtime per month (A44) obtain their mobile phones (A27)?*

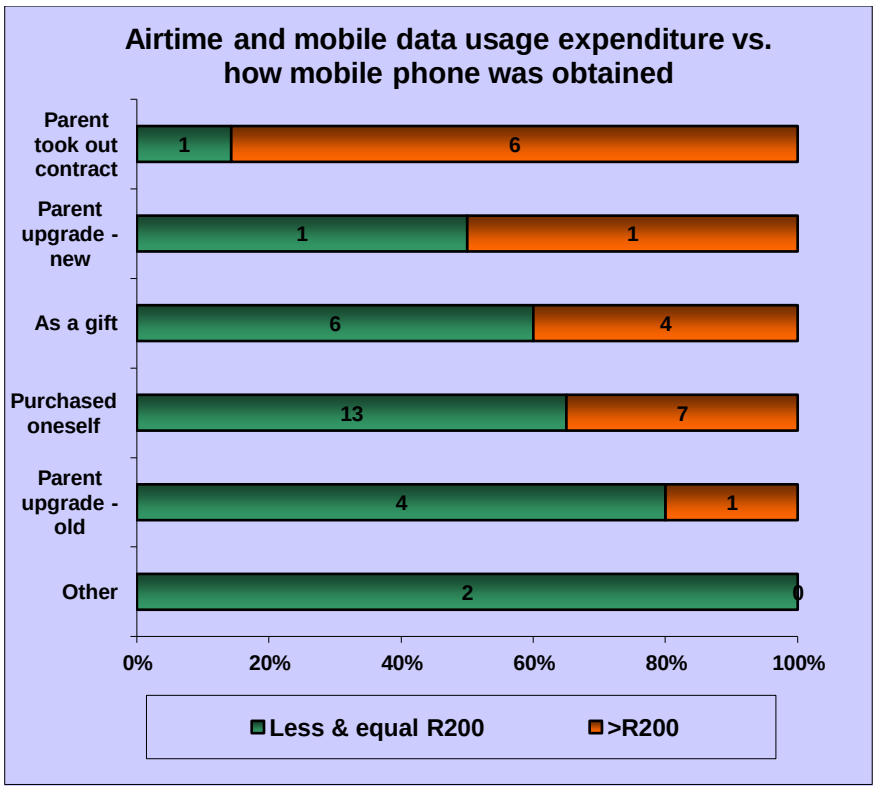

Figure 5.137: Airtime and mobile data usage expenditure per month vs. how mobile phone was obtained

Statement A27 (How did you obtain your current cell phone?) was only posed to the 2012 m-learning group. Due to the number of categories, the expected cell counts are all less than five, and testing then becomes invalid, even with just two expenditure groups. Therefore, cross tables of airtime and data usage expenditure per month (the more than R200, and less than and equal to R200 categories), are used together with the means by which the mobile phone was obtained for each gender, first language and race (see Appendix T - CD-ROM: Supporting Data). Figure 5.137 depicts this distribution. It is of importance to note that no

statistics were executed to confirm statistical significance as the expected frequencies were less than five for most of the cells and the test then becomes invalid.

15. *Who (A45) is responsible for the expenditure of learners (gender, first language, race) who have spent the most on mobile data usage and airtime per month (A44)?*

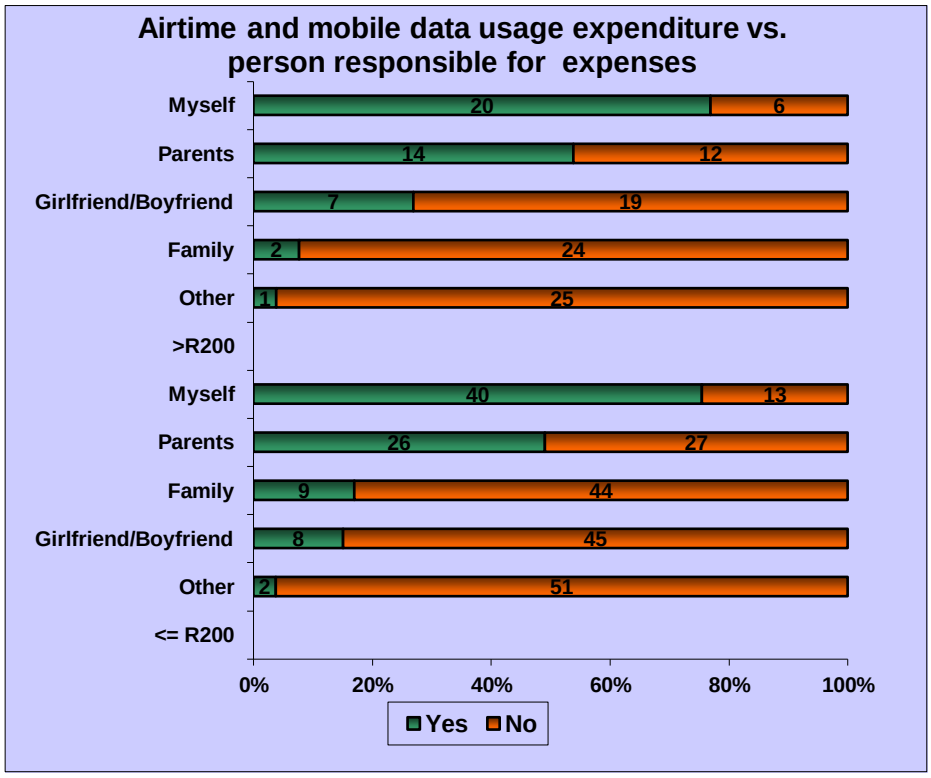

Figure 5.138: Airtime and data usage expenditure per month vs. person responsible for expenses

The cross tables of expenditure on mobile data and airtime (the more than R200 and less and equal than R200 categories are used) together with whom the person taking responsibility for the monthly expenses, can be found in the ambit of Appendix T (CD-ROM: Supporting Data) for each gender, first language group and race. Figure 5.138 reflects the total graph distribution for the expenditure on airtime and mobile data usage per month versus the person who is responsible for the expenses. It is of importance to note that no statistics were executed to confirm statistical significance as the expected frequencies were less than 5 for most of the cells and the test then becomes invalid.

16. *What are the activities performed most often on a desktop computer (A87a) and a mobile phone (A49a)?*

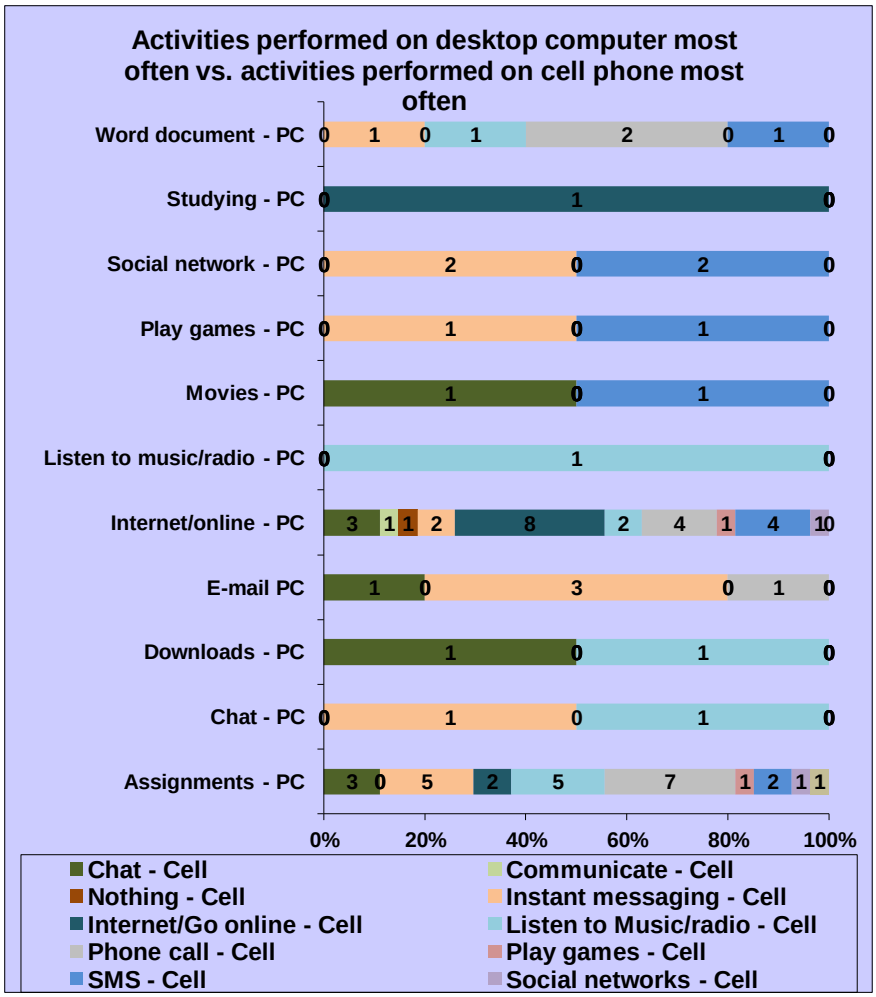

Figure 5.139: Activities performed most often on a desktop computer vs. activities performed most often on a cell/mobile phone

Figure 5.139 reflects the activities performed most often on a desktop computer versus the activities performed most often on a cell/mobile phone (see Appendix T - CD-ROM: Supporting Data). The Y-axis for example indicates that five respondents used a PC most often for Word documents. Conversely, the colour codes indicate that one of these respondents do instant messaging on a mobile phone most often, one listens to music or radio on a mobile phone most often, two use a mobile phone most often for calls, and one use a mobile phone most often for sending SMS text messages.

17. *Which type of learner (gender, first language, race) made use of the instant messaging applications WhatsApp or MXit?*

There is one statistically significant difference between the groups of gender, first language and race with respect to the use of WhatsApp/MXit. The first language groups differed with respect to the statement (A62) “Have you ever used MXit on a cell phone”. It seems that more French speaking learners never used MXit on their cell phones than the other language speaking learners. This is primarily attributed to the fact that MXit, a South African developed instant messaging application, is not known to most foreign learners. With respect to the statement (A64) "Have you ever used WhatsApp on a cell phone", more French speaking learners have used WhatsApp when compared to other language speaking learners.

5.3.10.4 First post-mobile learning (post 1) questionnaire

This paragraph will discuss all research-specific questions regarding the first post-m-learning questionnaire that was completed by learners after the m-learning experience during 2011 and 2012.

18. *Which variables (PU, PMV, PSIV, PEOU, ATT, PAB, BI, POQ) of the post 1 m-learning questionnaire are related?*

The correlation coefficients are calculated to determine which of the variables are related, and a factor analysis was performed to determine the constructs that describe the data. This is explained in Paragraph 5.3.5, and the statistics are reflected in Appendix N (see CD-ROM: Supporting Data).

19. *Are male learners more likely to accept and enjoy the use of mobile technology for teaching and learning purposes when compared to females?*

The only statement in the post 1 questionnaire where the genders statistically significant differed is the statement (P116) “I would enjoy learning if I could use mobile devices”. More males strongly agree with this statement and more females were unsure with regards to this statement. This is explained in Paragraph 5.3.5, and the statistics are reflected in Appendix P (see CD-ROM: Supporting Data).

5.3.10.5 Pre-mobile learning- versus first post-mobile learning (post 1) questionnaire

This paragraph will discuss all research-specific questions regarding the pre-m-learning- versus the first post-m-learning questionnaire that was completed by learners after the m-learning experience during 2011 and 2012.

20. *What was the attitude of learners before m-learning (A09, A10) when compared to the attitude of learners after the m-learning experience (P124 to P130)?*

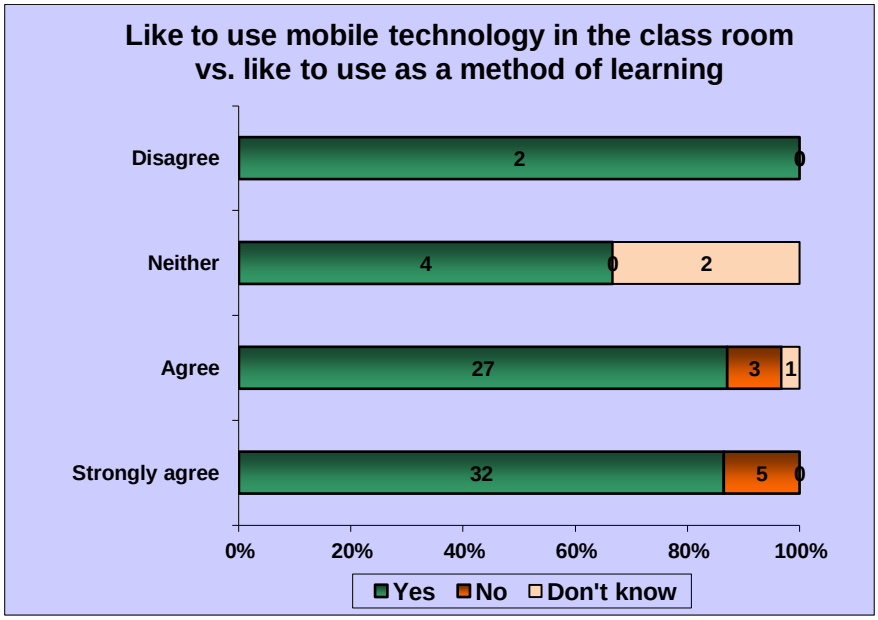

Figure 5.140: Learners would like to use mobile technology in the classroom (A09) vs. Learners would like to use mobile devices as a method of learning (P125)

Figure 5.140 indicates that there was a statistically significant correlation between learner attitudes before the implementation of m-learning (A09: "Would you like to be able to use mobile technology in the classroom as a tool to help you with your university work?") and their attitudes after m-learning (P125: "I would like to be able to use mobile devices as a method for learning, since it will allow me to learn in places I could normally not learn/study"). It is of importance to note that question A10 could not be tested as all the learners indicated 'Yes' for the statement "Would you like to be able to use mobile technology at home/residence as a tool to help you with your university work?".

21. *What is the relationship between P108 (mobile devices would increase the quality of computer programming teaching and learning), P110 (would you buy a mobile device if it would be useful in your studies,) as well as formative and summative assessment marks after being exposed to m-learning within each gender, first language and race group?*

There is no correlation between gender, first language, race and P108. Formative and summative assessment marks after the implementation of m-learning also do not differ statistically significant with respect to whether a learner will buy a mobile device if it will be useful in their course.

22. *How do questions A9 to A12 of the pre-questionnaire regarding learner use and attitudes toward mobile technology use both in and out of the classroom compare with the variables PU, ATT, BI, and POQ of the post 1 m-learning questionnaire?*

The latent variables PU (Perceived Usefulness), ATT (Attitude), BI (Behavioural Intention to use) and POQ (Perceived Output Quality) are constructed by adding the questions under the different headings together. The higher the value, the less the learners agreed with the statement. The results of the comparison of these variables with statements A09, A11 and A12 are as follow:

- Figure 5.141 indicates that the responses on question A11 (Do you believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of your university work?) differ from the “Perceived Usefulness” (PU) variable. The mean score of PU for the learners that answered 'No' on A11 is statistically significant higher than those who answered 'Yes'. Thus, the respondents who believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of their university work, agreed more with regards to the "Perceived Usefulness" of mobile technology in a technology-based subject, than the respondents who did not believe so.

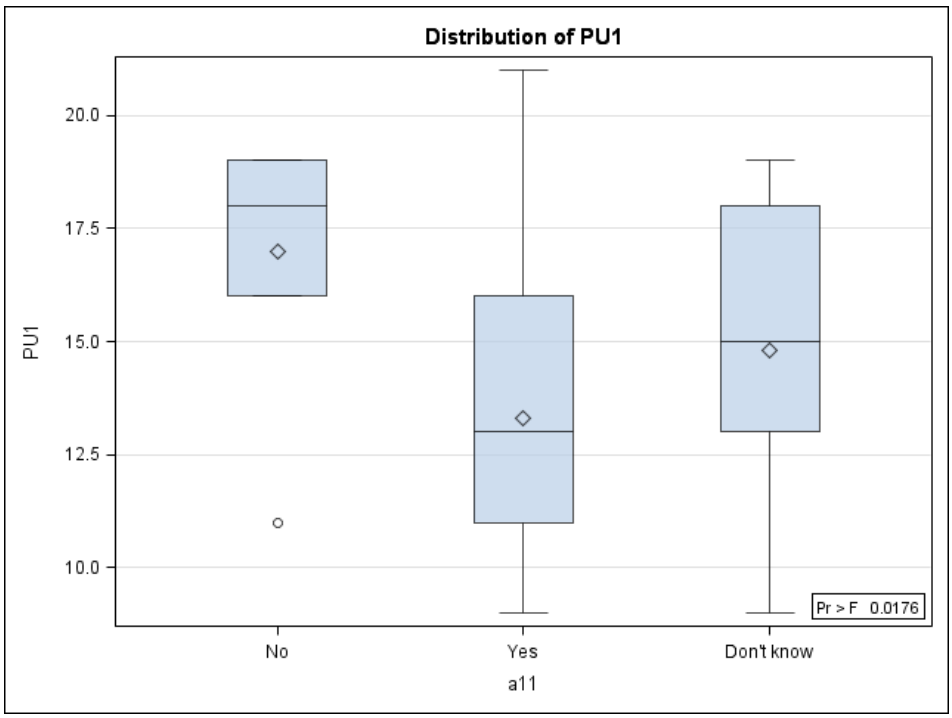

Figure 5.141: Mobile technology in the classroom will make a difference to the quality of university work (A11) vs. Perceived Usefulness (PU)

- Figure 5.142 reflects that the responses on question A11 (Do you believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of your university work?) differ from the “Attitude” (ATT) variable. The mean score of ATT for the learners that answered 'Don’t know' on A11 is statistically significant higher than those who answered 'Yes'. Therefore, the respondents who believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of their university work, agreed more with regards to the "Attitude" variable than the respondents who did not know.

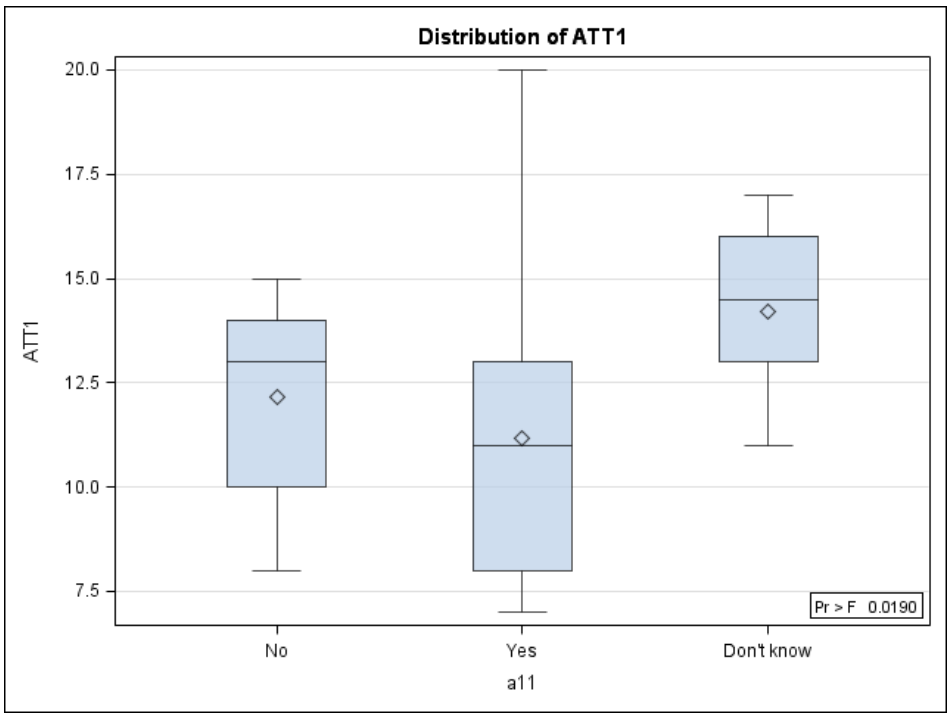

Figure 5.142: Mobile technology in the classroom will make a difference to the quality of university work (A11) vs. Attitude (ATT)

- In terms of Figure 5.143, the responses on question A11 (Do you believe that the use of mobile technology as a tool in the classroom will make a difference to the quality of your university work?) differ from the “Perceived Output Quality” (POQ) variable. The mean score of POQ for the learners that answered 'Don’t know' on A11 is statistically significant higher than those who answered 'Yes'. Thus, the respondents who think that the use of mobile technology as a tool in the classroom will make a difference to the quality of their university work, agreed more with regards to the "Perceived Output Quality” than the respondents who did not know.

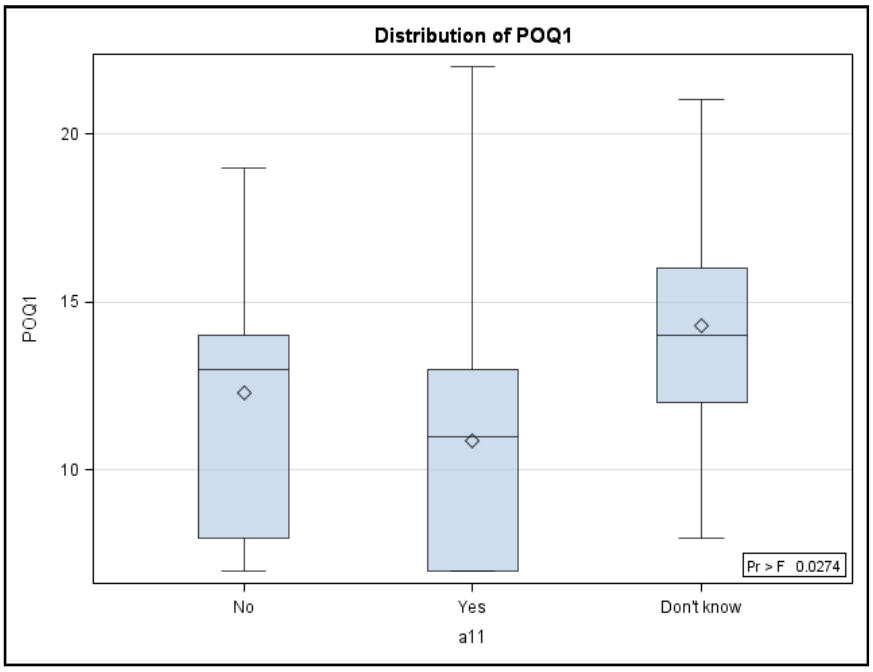

Figure 5.143: Mobile technology in the classroom will make a difference to the quality of university work (A11) vs. Perceived Output Quality (POQ)

5.3.10.6 Second post-mobile learning (post 2) questionnaire

This paragraph will discuss all research-specific questions regarding the second post-m-learning questionnaire that was completed by learners after the m-learning experience during 2011 and 2012.

23. *What type of learner (gender, first language, race) bought Secure Digital (SD) memory cards (P212) at their own cost to expand a PDA's storage capacity?*

There was no statistically significant correlation between race, first language, gender and whether a learner bought a SD memory card to extend the storage capacity of a mobile device (PDA).

24. *Did SD memory card users (P212) use the PDA more for formal subject-related activities (P208d) or entertainment (P208i)?*

Figure 5.144 reflects that for those learners who purchased a SD memory card, statistically significant more learners used the mobile devices for formal subject-related activities than for entertainment. This implies that these learners bought SD memory cards primarily for educational purposes.

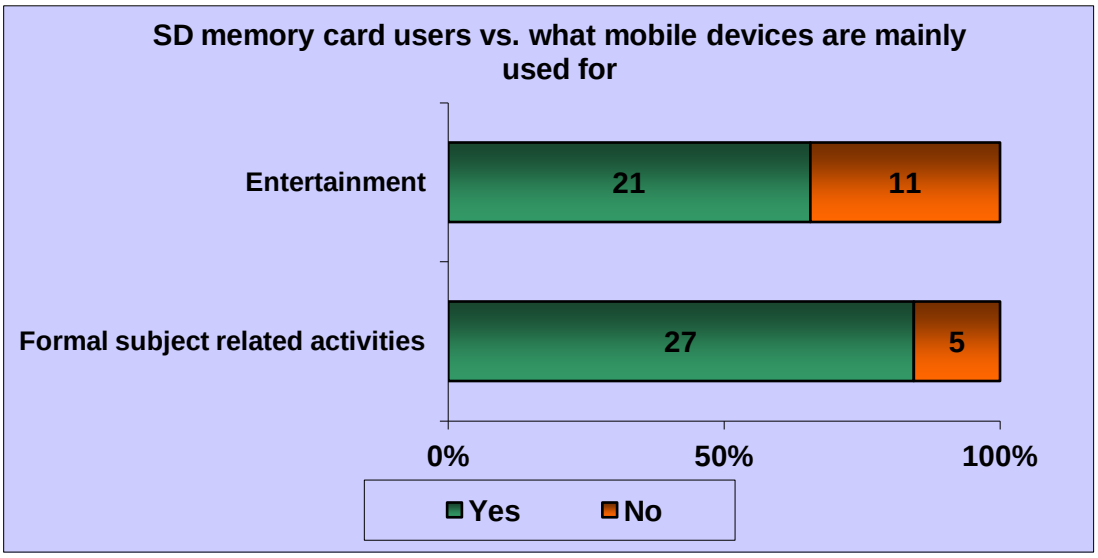

Figure 5.144: SD memory card users (P212) vs. whether mobile devices are mainly used for formal subject-related activities (P208d) or entertainment (P208i)

25. *What is the current location for mobile device use (P204) when compared to intended future location use of mobile devices (P213)?*

In terms of Figure 5.145, statistically significant more learners who indicated that they currently use mobile devices in a “Computer laboratory”, or “While commuting” will not use mobile devices at these locations again in the future. Learners were probed on why they intend not to use mobile devices in these locations in the future. From their responses it was clear that if they could use mobile devices (i.e. tablets) that can wirelessly connect to the Internet both on and off-campus, and as a result allow them to download and submit course-related work anywhere and at anytime, they would not be so dependent on mobile devices in a "computer laboratory" in the future. The main reason for the current high use of mobile devices in computer laboratories are directly related to the fact that learners cannot connect to the Internet, and therefore primarily need to be in a computer laboratory on campus to submit programming assignments (the mobile device must be synchronised with the

computer by means of a cable in order to electronically submit practical programming assignments). Upon further investigation it was determined that learners will also not utilise mobile devices "while commuting" simply because it becomes more dangerous to use these devices year on year, especially if they would use tablets, since these mobile devices are more visible to criminals, and therefore more likely to be stolen.

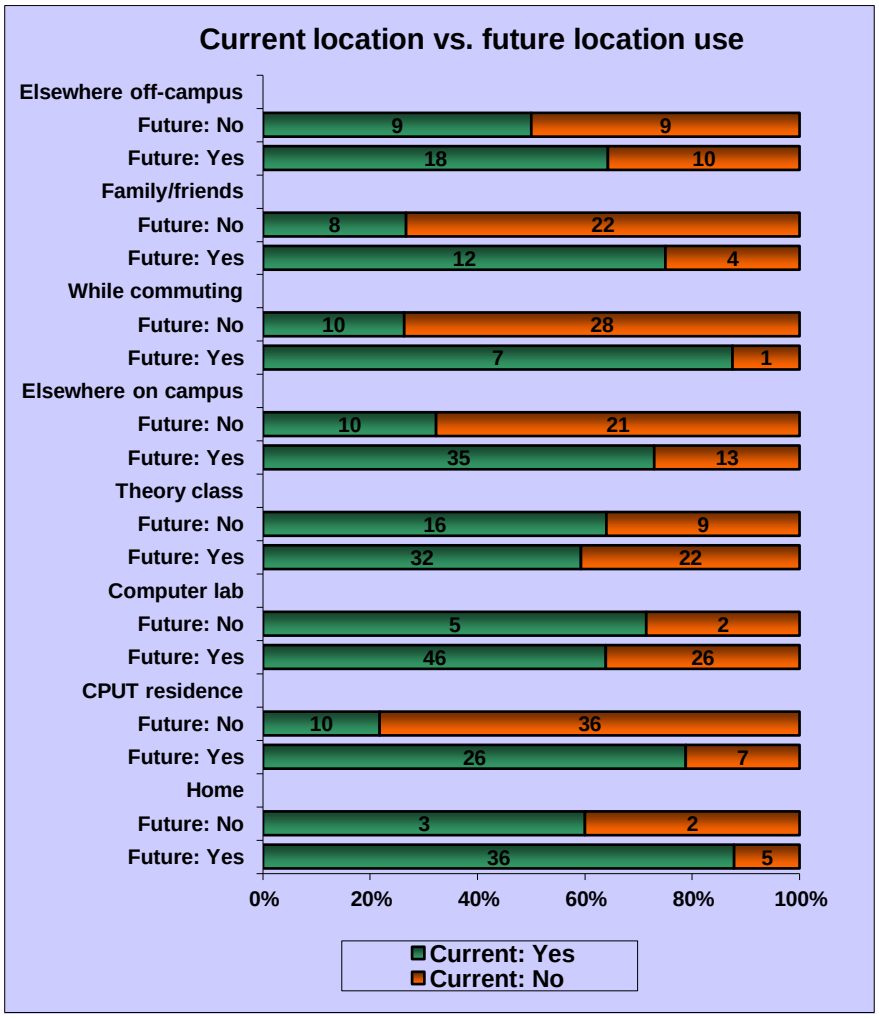

Figure 5.145: Current mobile device location use (P204) vs. intended future location use (P213)

5.3.10.7 Pre-mobile learning- versus second post-mobile learning (post 2) questionnaire

This paragraph will discuss all research-specific questions regarding the pre-m-learning- versus the second post-m-learning questionnaire that was completed by learners after the m-learning experience during 2011 and 2012.

26. *What is the relationship between whether the university should buy mobile devices for learners (P214), the financial means of learners and their families (A96), and the amount of money spent on airtime and mobile data usage (A44) for learners within each gender, first language and race group?*

Figure 5.146 reflects that for all the learners who indicated that the university should pay for mobile devices there was nearly a statistically significant correlation between the financial means of learners and their families (A96), and the amount of money spent on airtime and mobile data usage per month (A44). Results indicate Chi-square=3.6399; P=Value=0.0564. The right sided statistics for the Fisher Exact Test indicated that there is a statistically significant correlation (P-Value=0.0435). If the column percentages are evaluated for the cross table of A44 versus A96, it is evident that 85% of the learners who believe they are financially curtailed, paid less than R200 for airtime and mobile data usage per month, whilst only 15% of the learners who believes that they are in the same financial situation, paid more than R200 for airtime and mobile data usage per month.

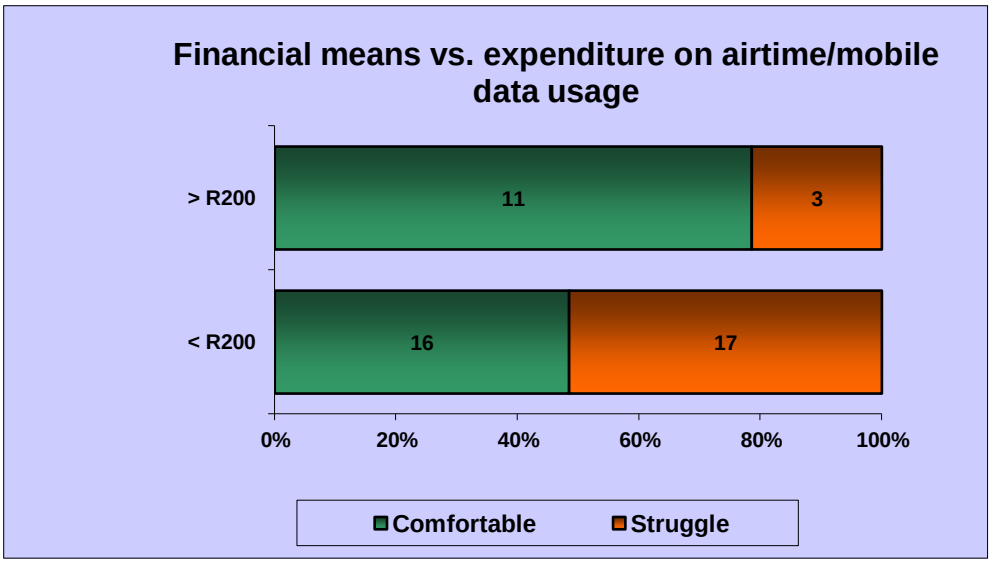

Figure 5.146: Financial means of learners (A96) vs. expenditure on airtime/mobile data usage (A44)

If the data is split into the two genders, the trend of those who are "financially comfortable" and spent more than R200 on airtime and data usage per month, is statistically significant for the females, but not for the males (Figure 5.147). If the data is split into the first language groups there were no statistically significant correlations between the financial means of learners and their families, and their expenditure on airtime and mobile data usage on a monthly basis.

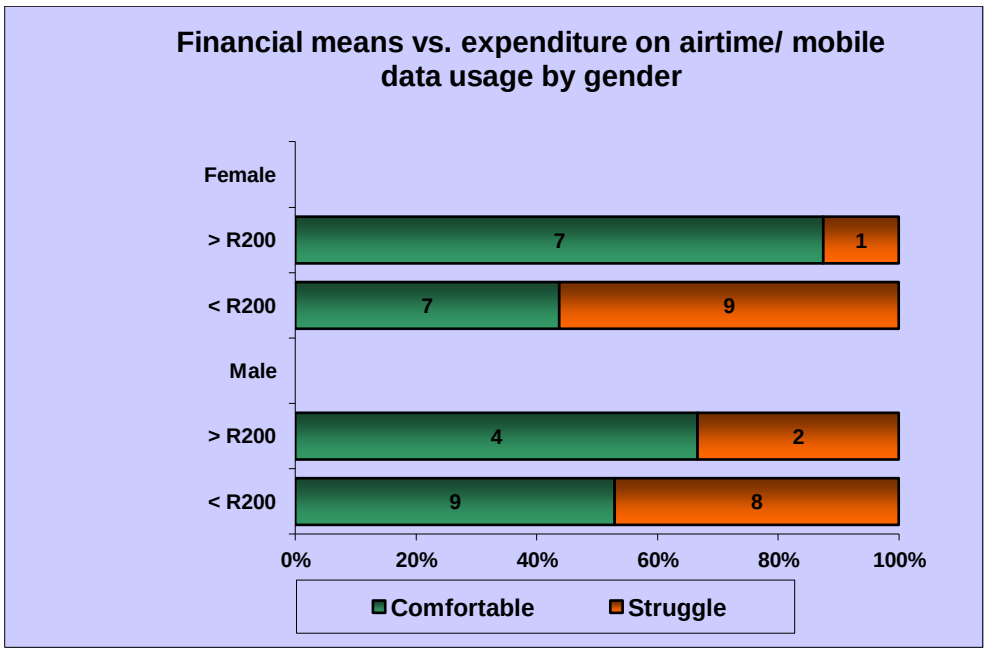

Figure 5.147: Financial means of learner vs. expenditure on airtime/mobile data usage by gender

Figure 5.148 reflects that if the data is split into the race groups, those who are "financially comfortable" and spent more than R200 on airtime and mobile data usage, is statistically significant for the Black race group but not for any of the other race groups. This however is attributed to the fact that there is only a few Coloured and Indian learners in the sample group.

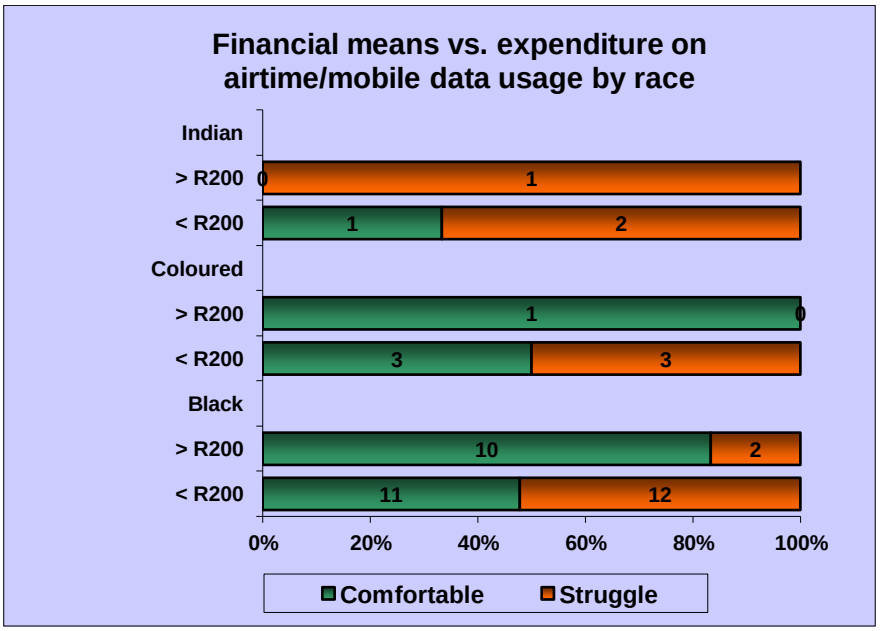

Figure 5.148: Financial means of learner vs. expenditure on airtime/mobile data usage by race

5.3.10.8 Second post-mobile learning (post 2) questionnaire versus learner journal

This paragraph will discuss all research-specific questions regarding the second post-m-learning questionnaire that was completed by learners after the m-learning experience during 2011 and 2012, and the learner journal that was kept by learners on their daily m-learning activities and experiences.

27. *What is the correlation between the frequency of mobile device use (P205), the time when mobile devices are mostly utilised (learner journal entry), and the average time spent during the week utilising mobile devices (P207)?*

After the learner journal entries were merged with the post 2 m-learning questionnaire by means of an ID number, the “Frequency of use” (P205) and “Time spent per week” (P207) was compared with the variable “Time of use” in the learner journal by using the Pearson Chi-square test for correlation. As there were only a few learners who indicated for P205, “less than once a week” and “once a week”, they were aggregated into a lower category “Once a week and less”. Furthermore, as there were only two learners who indicated for P207 “Less than 30 minutes”, it was aggregated with the category “30 minutes to 1 hour” to form the category “Less than one hour”. This is executed in order to perform valid testing.

There was no statistically significant difference between the average time spent per week on using a mobile device and the time span it was used for as noted in the learner journal.

From Figure 5.149 it is evident that of those learners who indicated that they use the mobile device during the night statistically significant more, did so on a daily basis, and of those learners that indicated that they use mobile devices more during the afternoon, did so a few times a week.

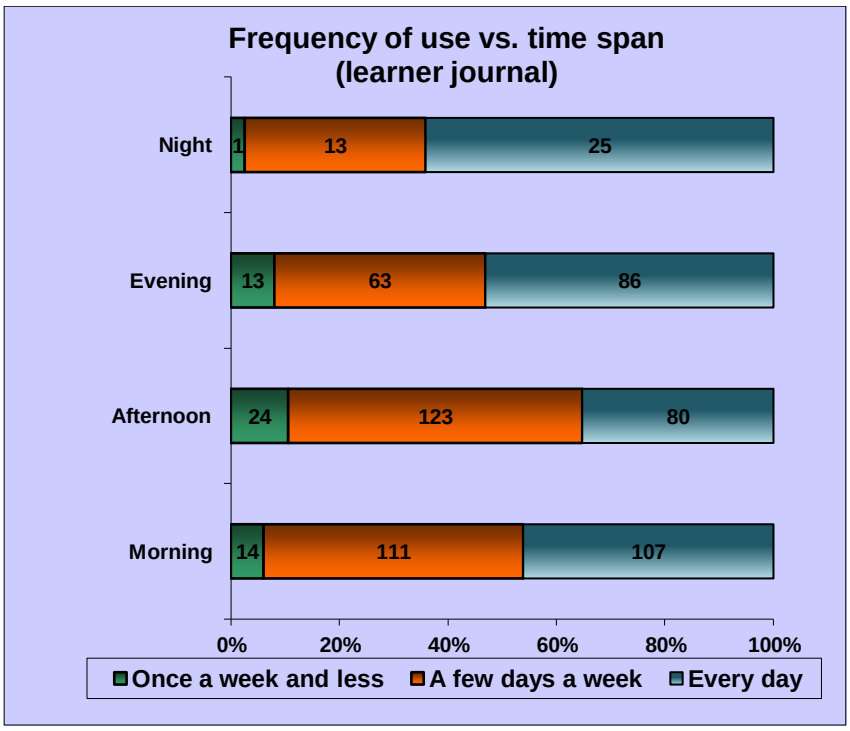

Figure 5.149: Frequency of use vs. time span (learner journal)

From Figure 5.150 it is evident that there was a statistical significant difference between the average time spent per week on using a mobile device, and the frequency of use of such a device. It seems that for those learners that spent more than four hours on average per week utilising a mobile device, do so during the night, and those who spent between one and two hours on average per week using a mobile device, do so a few days a week.

If the frequency of mobile device use is controlled, there are no statistically significant differences between the time span and the average time spent per week using a mobile device.

Conversely, if the average time spent using a mobile device is controlled, there is a statistically significant difference between the time span and the frequency of mobile device use if the learner spends between one and two hours on average per week using a mobile device.

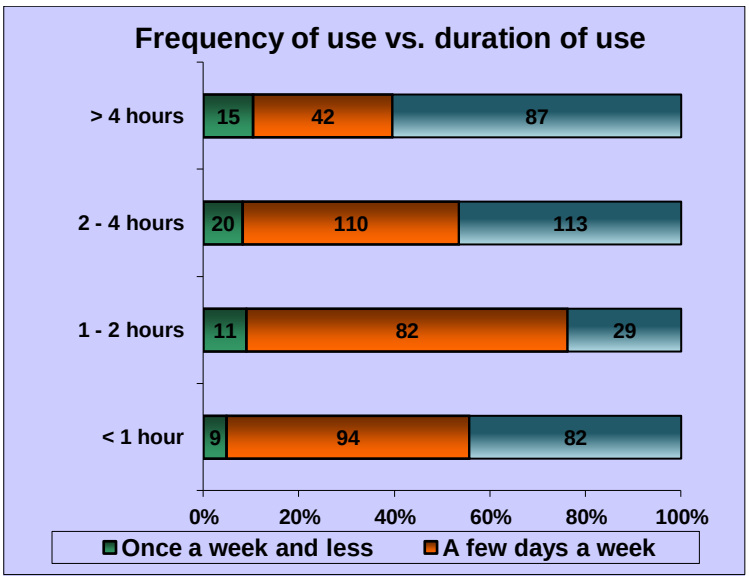

Figure 5.150: Frequency of use vs. time spent utilising mobile devices (learner journal)

Figure 5.151 reflects that if the time span is controlled when using a mobile device, there is a statistically significant difference between the average time spent using a mobile device, and the frequency of mobile device use if it is utilised in the morning, afternoon or evening. There was not a statistically significant difference if a mobile device was utilised during the night.

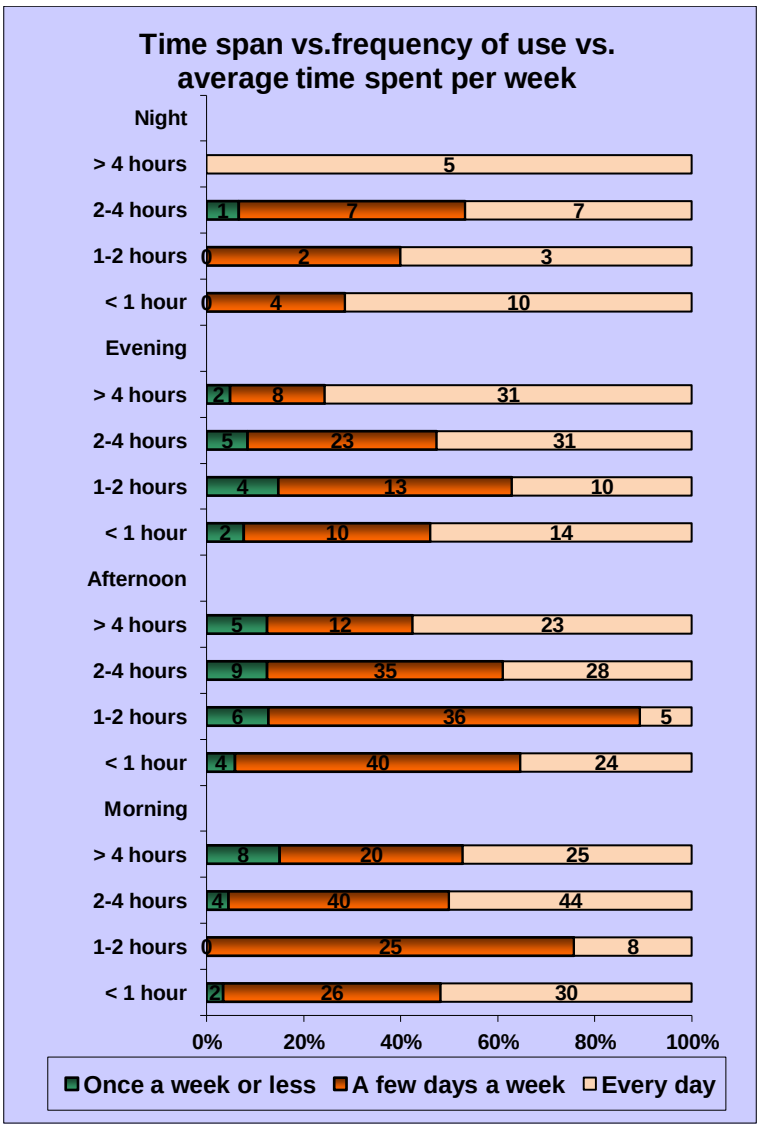

Figure 5.151: Time span vs. frequency of use vs. average time spent utilising mobile devices

28. *What is the correlation between device usage (P208a to P208j) vs. the device usage indicated in the learner journal (Event)?*

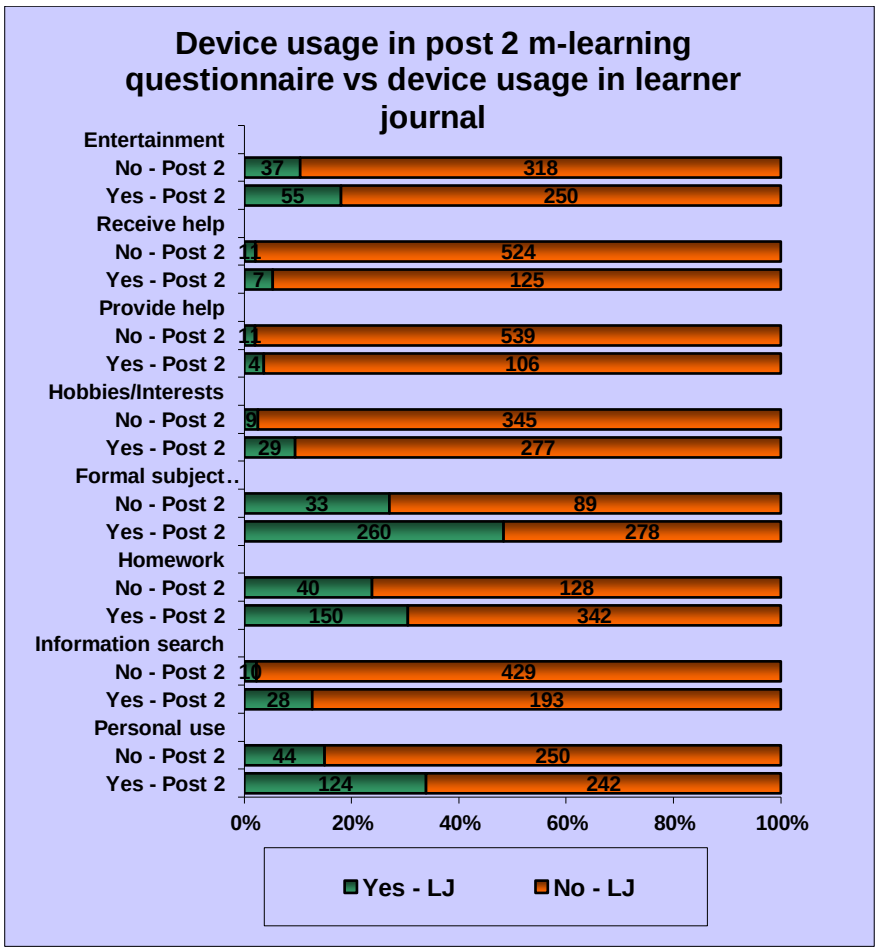

Figure 5.152: Mobile device usage (P208a - P208j) vs. device usage indicated in the learner journal (EV01 - EV10)

The MacNemar's test was used to determine whether the learners agree in their responses with regards to mobile device usage as indicated in both the post 2 m-learning questionnaire and the learner journals. The McNemar tests for device usage between the post 2 questionnaire and the learner journals differed statistically significant for all the events they have used it for as indicated in Figure 5.152.

29. *People involved (P209a to P209i) vs. People involved as indicated in the learner journal (People_involved).*

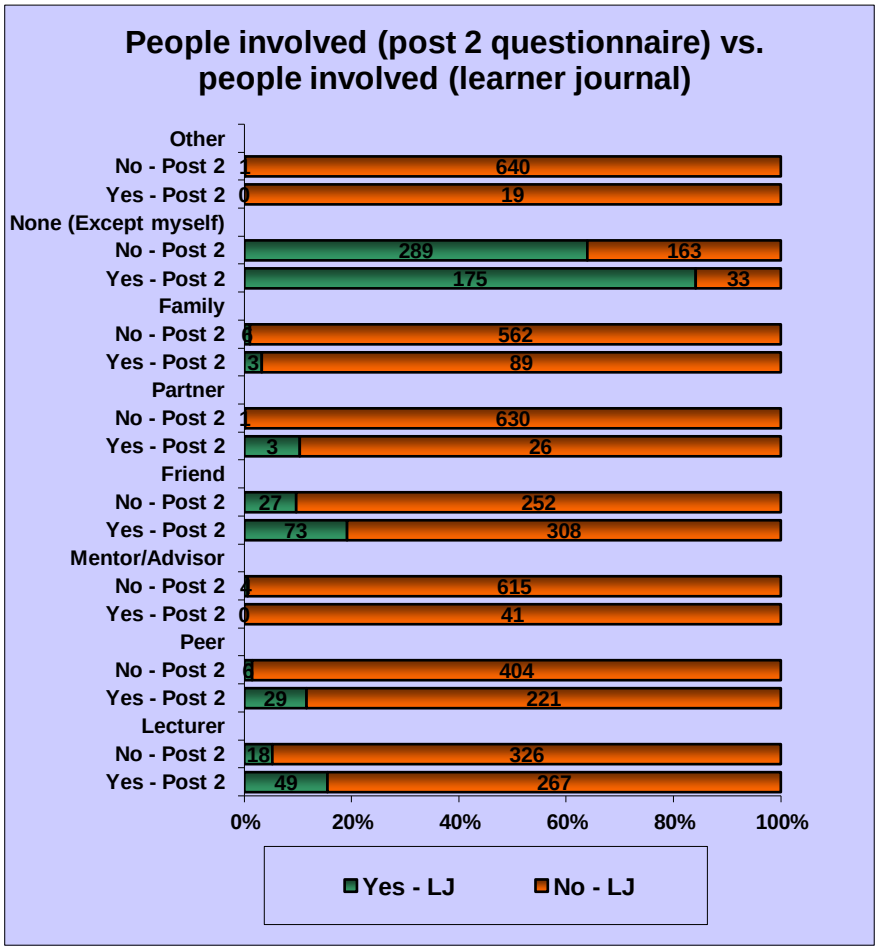

Figure 5.153: People involved (post 2 questionnaire) vs. People involved as indicated in the learner journal (PE1 - PE9)

The MacNemar's test was used to determine whether the learners agree in their responses with respect to people involved in the post 2 m-learning questionnaire and the learner journal. According to the tests, learners did not agree in their responses. The McNemar tests for people involved between the responses from the post 2 m-learning questionnaire and the learner journal differed statistically significant for all the types of people involved as indicated in Figure 5.153.

5.3.10.9 Learner journal (2012)

This paragraph will discuss research-specific questions regarding to the learner journals that were completed by learners during the m-learning experience in 2012.

30. *When people were involved while learners utilised the mobile device (People_involved), where did this occur (Location)?*

Cross tables were compiled in order to show where people were involved, and in which location this involvement occurred. Testing became invalid due to expected frequencies of less than 5 in most of the cells.

As reflected in the ambit of Appendix T (CD-ROM: Supporting Data), the following became apparent:

- When an educator/lecturer was involved, it was mainly on the campus (97.1%).
- When a peer was involved, it generally occurred on the campus (61.1%), secondly at the residence (19.4%), and thirdly at home (16.7%).
- In total a mentor/advisor was only involved four times, and included on campus (1), at home (1) and at the residence (2).
- When a friend was involved, it was mostly on campus (59.6%), secondly at home (22.1%) and thirdly at residence (14.4%).
- When family was involved, it was mainly at home (77.8%).
- When only the learner was involved, it was primarily at home (51.8%), secondly on campus (32.9%), thirdly at residence (8.6%) and fourthly on public transport (5.2%).
- The rest of the people involved is not worth mentioning.