

Correlation Between Internet Usage and Academic Performance Among University Students

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DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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_____ day of _____ 20____.

Abstract

The Internet is a technology that has become a big part of people's daily living. Through its ability to act as a support medium in the different functions for which people use it, the Internet was introduced to academic institutions as a tool to enhance students' academic experience in the mid 1990s. Today, the Internet plays a major role in the classroom, from course materials being available online to larger ranges of academic resources being a few clicks away, the influence of the Internet on campus is incontestably felt.

This dissertation looks at finding evidence of an association between Internet usage and academic performance among university students. It addresses the need to evaluate whether the Internet is fulfilling the role it was initially brought on campus for.

In this dissertation, a qualitative and a quantitative study were developed to measure students' Internet usage on campus, the reasons for which they use it and how the Internet influences their academic grades. 389 3rd year students from different academic disciplines participated in this study.

In summary, the results of this study show that the Internet exerts some influence on students' academic performance but no link of causality between the two could be established.

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Chapter 1

INTRODUCTION

The Internet has become an essential component of people's everyday life throughout the world. This ranges from its support in improving the way people seek information, conduct research, perform business transactions, and communicate with others and various other features [Chou 2001]. The number of Internet users in the world has experienced a growth of 480.4% between 2000 and 2011 with the number of Internet users around the world estimated to be over 2 billion people within a world population of approximately 6.93 billion by March 31, 2011 [World Internet Users and Population Stats 2011].

With a growing demand for Internet access on campuses, universities have contributed to this growth as they perceive the Internet to be a valuable source of information for students and a tool to enhance their productivity [Scherer 1997; Lubans 1999; Jones 2002; Metzger *et al.* 2003; Kirschner and Karpinski 2010]. This has made students to be heavy users of the Internet compared to the general public [Kandell 1998; Jones 2002; Choi *et al.* 2009; Ni *et al.* 2009; Judd and Kennedy 2010]. According to Jones [2002], 86% of university students in America are Internet users compared to only 59% of the general American population. Fifteen years since its introduction on campus, the Internet's main purpose is still to enhance students' collegiate experience as an educational support tool. However, we believe it should be assessed to determine whether it is meeting its expectations today.

Young [1996] shows in her study that the Internet has become a cause of concern among the general population because of its addictive-like applications and services. The Internet just like any addictive substance can therefore have a negative influence on its extensive users. Due to a growing demand for Internet access on campuses, students are regarded as heavier users of the Internet compared to the general public [Kandell 1998; Perry *et al.* 1998; Jones 2002; Ni *et al.* 2009]. Although this remains a perception, not much research has been conducted on the influence of the Internet on students' lives [Metzger *et al.* 2003; Johnson 2009; Hazelhurst *et al.* 2011]. A general consensus exists amongst researchers that the adoption of the Internet and its technologies does have a negative influence on students' collegiate experience [Morahan-Martin and Schumacher 2000; Anderson 2001; Kubey *et al.* 2001; Chen and Peng 2008; Kirschner and Karpinski 2010; Hazelhurst *et al.* 2011]. However, little emphasis has been put on investigating its influence on academic performance even though this aspect remains the main reason the Internet was brought to campus. Johnson [2009] and Hazelhurst *et al.* [2011] stipulate that previous studies have relied on self-reported data from students, therefore, as Young [1996] suggested, there is a high probability of students being in denial about their Internet surfing habits, thus the need to have standardized and more reliable research instruments [Rumbough 2001; Gross 2004; Fortson *et al.* 2007]. It is against this backdrop that we investigated whether a correlation between Internet usage and academic performance among university students exists.

A mixed methodology approach was developed to compare what students reported about their Internet usage and what the university recorded. A qualitative study was conducted first, which started off with the handing out of a questionnaire to 389 3rd year students at Wits University which helped measure students' daily Internet usage on campus, the reasons for which they use it and how they perceive it influences their academic performance. This study was followed by a quantitative study which used 359 students from the previous study that made use of students' Squid proxy logs Internet data for the same

purpose as the qualitative study mentioned above. A comparison of the results of the two studies was performed to enable us to shed light on the reliability of people's reports when it comes to their surfing habits. Does the Internet help students perform better academically or worse? This is the question that was expected to have been answered at the end of this study.

The results of our conducted studies reveal that students who were identified as 'heavy' on campus Internet users performed significantly worse academically than those identified as 'light' on campus Internet users but there was no strong evidence found to argue that Internet usage could be associated with academic performance for either type of Internet users. Similarly, it was found that students identified as 'good' students use the Internet significantly less than those identified as 'bad' students but again, no strong evidence could be found to associate Internet usage with academic performance for these types of students either. However, it was found in the quantitative study that recreational activities was the main purpose for which students use the Internet as opposed to academic work as found in the qualitative study. These divergent findings were highlighted when the cross-triangulation of the results of the two studies was performed, which subsequently helped realize that 70% of our participants were in denial about the reasons for which they use the Internet as well as the influence it exerts on their academic performance.

By the methodology used, this research addressed the issue of the unreliability of research instruments when using self-reported data as expressed by Rumbough [2001], Gross [2004], Fortson *et al.* [2007], and Johnson [2009]. The use of Squid proxy logs helped reveal more reliable results and identify the shortcomings of research that only use self-reported data to make way for future work that would use stronger research instruments. The cross-triangulation of this studies' results helped reveal that there is a strong phenomenon of denial among university students which would have never been exposed were self-reported data solely used. Therefore, apart from answering the research problem posed and developing a stronger research instrument in the field of ICT in Education, this research added value by helping Wits university identify the issue of students' denial about their Internet usage habits and its consequences on their academic grades so that the university could find a way to develop support structures to help its students deal with this issue.

Chapter two of this document reviews the literature on areas ranging from user acceptance of technology and its impact on individual performance; to evidences of Internet addiction among students, to the purposes for which students use the Internet and finally the influence of the Internet on academic performance. Chapter three consists of the research hypothesis, chapter four, the research methodology which gives a view of the adopted mixed research methodology, chapter five presents the core of this research, chapter six provides further analysis outside the scope of the research but which we deemed necessary, chapter seven, the limitations of the study and recommendations for future work and chapter eight is the conclusion to this research.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

Research conducted on the possible negative effects of the Internet usage on students have so far been divergent as far as their results are concerned. Apart from agreeing on the existence of Internet dependency among university students, previous studies have not been unanimous on aspects such as the reasons for which students use the Internet or even how the Internet influences students' academic performance. Early studies conducted on the negative effects of the Internet, made use of the general public such as Young's [1996]. Studies that followed further investigated the role played by the Internet on campus as it was in its early years in academic institutions to help students with their academic work.

Metzger *et al.* [2003] showed that limited research has been conducted on the influence of the Internet on students' lives. Young [1996] was among the first scholars to investigate the existence of Internet addiction and the possible problems linked to its extensive use. As the adoption of the Internet and its technologies grows rapidly, its usage has not been without any consequences on students' collegiate experience [Morahan-Martin and Schumacher 2000; Anderson 2001; Kubey *et al.* 2001; Chen and Peng 2008; Ogedebe 2010]. The observed consequences, range from physical and mental problems, development and maintenance of relationships, to academic performance impairments. The study conducted by Young [1996] revealed that students who were identified as Internet 'dependent' reported more negative effects on their lives due to their excessive Internet usage than 'non-dependent' users. Subsequent studies have revealed mixed results on this topic, except for Hazelhurst *et al.* [2011], these studies have strongly relied on qualitative data gathered from students' self-reports about their Internet usage habits. However, Gross [2004] found that research combining both quantitative and qualitative data could yield more enlightening results when investigating students and their Internet usage behaviours due to the inconsistency that arises from what students report and what they actually do.

Although the Internet was brought to university to improve students' collegiate experience by expanding the information sources reservoir, enhancing students' productivity and research skills among others, limited research has been conducted on the use of the Internet as an educational tool for students and its correlation with their academic performance. We believe that the most important contribution the Internet has to make into students' collegiate experience is towards improving their academic grades and unfortunately limited studies have put an emphasis on this particular aspect. In this section we review the literature on user acceptance of technology and its effect on individual performance, followed by the existence of Internet dependency among university students, then we review the studies which investigated the reasons for which students use the Internet and then conclude by reviewing the studies that have addressed the influence of the Internet on students' academic performance as part of their research focus.

2.2 User acceptance of technology and its effect on individual performance

A study conducted by Davis [1989] argues that perceived usefulness and perceived ease of use of a technology are fundamental determinants of user acceptance and unfortunately, research in this field have been affected by a shortage of reliable measures for these determinants of user acceptance. The author used the conceptual definitions of perceived usefulness and perceived ease of use to generate pre-test interview items involving 15 experienced computer users to assess the reliability and validity of the resulting scales. After conducting a field study that involved 112 participants which allowed the author to scale down each construct to 14 items using the Spearman-Brown Prophecy formula, the author conducted a lab study involving 40 participants to further scale down the measurements items of these two constructs to 6 items. Each of the two conducted studies involved respectively two different interactive computer systems and two graphics systems. The author then used data from the two studies to assess the relationship between usefulness, ease of use, and self-reported usage. The study reveals that a .63 correlation coefficient was found between perceived usefulness and self-reported current use in Study 1 while a .85 correlation coefficient was found between perceived usefulness and self-predicted use in Study 2. Furthermore, perceived ease of use was correlated .45 with use in Study 1 and .69 in Study 2. The author also found that there was a stronger relationship between perceived usefulness and usage than perceived ease of use and usage. We judged necessary to review this study in this document because we believe that the adoption of the Internet by students just like with any other technology is highly dependent on whether it has been accepted by them which in turn is determined by how useful and easy to use the students find the Internet. Recognizing that these factors may vary depending on the reasons for which students use the Internet play an important role in arguing about the reliability of the results of the studies that look into the reasons for which students use the Internet.

Igbaria and Tan [1997] investigated the implications and consequences of IT acceptance by examining the relationship between IT acceptance and its impact on the individual user. The authors' study made use of a model involving three components: user satisfaction, system usage, and impact on individual. The study made use of a questionnaire on computer acceptance to collect data from 625 employees of a large organization. 371 of the 625 employees successfully completed the questionnaire. The authors hypothesized that user satisfaction affects system usage and individual impact and that system usage has a direct effect on individual impact. The authors' analysis reveals that there is no significant difference across demographic groups and functional areas in terms of their user satisfaction level, system usage, and individual impact. The measure of overall user satisfaction included: measurement of the satisfaction of the extent to which computer applications meets the end user needs with regards to information content, accuracy, timeliness, format and ease of use. Two indicators of system usage were used by the authors in this study to measure the system usage variable: number of computerized applications used by employees and number of business tasks for which the system is used. The latter was used to measure the extent to which respondents use a computer in their work. The individual impact variable was measured by perceived performance impact in areas such as productivity and effectiveness of the job. The results to the study reveal that user satisfaction is directly correlated to System usage, a correlation coefficient of 0.39 was found between the two variables and furthermore, user satisfaction and system usage were directly positively correlated to individual impact. The resulting correlation coefficients were respectively 0.40 and 0.28 with a probability $p < 0.01$. Through the finding that user satisfaction is positively correlated to system usage, the authors have proven that a system acceptance is dependent on its perceived usefulness and ease of use as argued in the study by Davis [1989] since we believe the above mentioned two constructs drive user satisfaction. We believe it was therefore important before reviewing the role played by the Internet and its effect on students' lives to review if its usage is not affected by satisfaction which is proven in this study.

Gelderman [1998] investigated the validity of the usage and user satisfaction in measuring the success of Information Systems. The author made use of a questionnaire distributed to 1024 Dutch managers, information managers, and controllers. Of the 1024 questionnaires handed out, only 172 were successfully

completed. The questionnaire developed by the author measured: satisfaction with contents, accuracy, format, timeliness of information and satisfaction with the system's ease of use for the user satisfaction variable, and for the usage variable, the questionnaire measured: the number of hours of direct usage, the number of hours of indirect usage, the frequency of direct usage and the frequency of indirect usage. The author assessed performance using the Van de Ven and Ferry measure. The results of the study reveal a significant relationship between usage satisfaction and performance as found in Igbaria and Tan's [1997] study with ease of use having a 0.44 coefficient of correlation with performance. This substantiates finding by Davis [1989] that perceived ease of use is a fundamental determinant of acceptance of a technology and subsequently this affects how well a user performs at a job related task. However, the findings to this study suffer from a lack of reliability because self-reports of performance were used just like in the study conducted by Igbaria and Tan [1997]. Therefore, there is a need for the development of a more reliable instrument to measure performance as the author acknowledges.

The study conducted by Devaraj and Kohli [2003] proposed that the driver of IT impact is not the investment in the technology, but the actual usage of it by looking at the application of strategic technology in decision support systems (DSS) and their impact on organizational performance. In the case of this study financial performance was used as a mean of measuring the impact of IT on the organization. This study collected data for 36 monthly periods from eight hospitals of a health system network that had implemented a DSS. The measured usage data consisted of DSS reports with a strategic value excluding reports that ran over business hours. The actual usage was based on user resource consumption records stored in a log created by a utility program. The usage variables recorded by the utility program were: Reports, Disk I/O, and CPU time. Hospitals revenues were used as variables to measure performance. Revenues were divided into two categories: net patient revenue per day (NPRDAY) and net patient revenue per admission (NPRADM). The study reveals that there is a positive and significant association between technology usage and NPRDAY and NPRADM. The calculated correlation coefficients were 3.122 and 14.437 for NPRDAY and NPRADM respectively for usage measured by executed number of reports while for usage measured as CPU time, these coefficients were: 0.379 and 0.178 respectively. The study further consolidates the above two mentioned findings by revealing that for usage measured as Disk Input/Output, the correlation coefficient were 69.02 for NPRDAY and 270.79 for NPRADM. These positive and significant relationships found between usage variables and financial performance variables confirm the authors' propositions that the actual usage of technology has a significant positive impact on financial performance. Devaraj and Kohli's [2003] study confirms findings by Gelderman [1998] in that system usage is associated to system performance in the case of this study that meant financial revenues. However, unlike in the study conducted by Igbaria and Tan [1997], the authors failed to consider in their study the user acceptance variable to see how/if it influences the actual usage of DSS and/or organizational performance. We believe that not considering this variable could lead to organizations not considering improving their systems for the users but rather for enhancing organizational performance when it has been proven that user acceptance of a system is also associated with organizational performance [Igbaria and Tan 1997; Gelderman 1998].

Burton-Jones and Straub Jr. [2006] presented a two stages systematic approach for reconceptualizing the system usage construct. These stages are: a definition stage, which requires the researcher to define system usage and explain its underlying assumptions; and a selection stage where the authors suggest the system be conceptualized in terms of its structure and function whereby the structure of system usage will consist of a user, system and a task components. The authors investigated the relationship between system usage and short-run task performance in cognitively engaging tasks to provide evidence of the viability of the presented approach. The chosen cognitively engaging tasks were analysts' use of spreadsheets for financial analysis because of the popularity of these applications. For this purpose 229 accounting university students were required to build an MS Excel spreadsheet to determine the best approach for financing an asset purchase. The authors defined two measures of system usage: cognitive absorption (that captures a user's employment of an Information System), and structure usage (that captures the use of a system for the task). Of the two types of system usage defined by the authors: explorative and exploitive, the authors chose exploitive usage (which refers to usage that involves routine

execution of knowledge) as a reference for their measures of system usage because their performance focus is on short-run tasks. In the same line of thoughts, the authors measured task performance as an assessment of task outcome in terms of its effectiveness. Cognitive absorption was measured by a handed post-task questionnaire which items required the participants to report how distracted and absorbed they got when using MS Excel to perform the task while questionnaire items used to measure structure usage measured data analysis, assumptions testing and deriving of conclusions. The participants' marks were used as a measure of performance. The study reveals that cognitive absorption and structure usage both positively impact performance which supports findings by Gelderman [1998] and Devaraj and Kohli [2003] that system usage has a positive relationship with performance. We believe this study made a very valuable contribution to this field of study because it proposed a reliable and valid approach that researchers could use to define system usage and how to precisely measure it and its impact on performance. Moreover, the approach developed by the authors in this study encourages researchers to define the theory and assumptions behind the choices of usage measures they propose to use as this depends on the context the system is being used for as the authors have successfully shown in their study.

2.3 The existence of Internet Dependency among university students

Young [1996] was among the early supporters of the existence of Internet dependency among Internet users of different ages. This study developed an eight item questionnaire referred to as a Diagnostic Questionnaire (DQ) which she used to define addictive from normal Internet usage. This questionnaire required respondents to indicate whether they feel preoccupied with the Internet, how they feel when attempting to reduce their Internet use, to the time they spend online among many other criteria. Young [1996] further indicated that respondents who answered 'yes' to at least five items in this eight item list would be classified as Internet 'dependent'. The results of this study revealed that out of a sample of 496 respondents, 396 of them filled the criterion for being labeled as Internet 'dependent'. The author reveals that an increasing familiarity with the Internet is at the origin of the development of dependency characteristic to Internet usage, which in turn is exacerbated by the level of interactivity of the online application used by an individual. She concluded that excessive Internet usage could result in problems with one's academic performance, relationships maintenance and developments.

Scherer [1997] narrowed the research by Young [1996] by focusing on the existence of Internet dependency among college students. This study developed a list of 10 clinical symptoms of Internet dependency and students who reported at least three of these symptoms were classified as Internet 'dependent'. In this study, Scherer [1997] revealed that 13% of the 531 respondents were found to fit the classification of Internet 'dependent'. Furthermore, Scherer [1997] shows in contradiction to Young [1996], that Internet dependency is not related to how long an individual has been using the Internet but concurs with Young [1996] that interactive online services like chat rooms or online multi-users dungeons were more attractive to Internet 'dependent' users. Both studies revealed a significant difference in time spent online between the 'dependent' and the 'non-dependent' categories although Scherer [1997] emphasized that this difference is only noticeable when measuring time spent online for leisure activities. Both Scherer [1997] and Young [1996] concur that excessive Internet usage has an impact on scholastic performance among students. Of importance, Scherer's [1997] results apply more to college students while Young's [1996] focuses on the general public. Most participants in Scherer's [1997] study reported a more positive than negative perception of the influence the Internet has had on their lives, however self-reported data used in this study could in no way identify students who suffer from a great amount of denial about their dependency to the Internet as it has become a major component of their everyday lives.

The study by Morahan-Martin and Schumacher [2000] wanted to establish the effects of pathological use of the Internet among college students. They developed a pathological use scale consisting of 13 questions to assess the level of dependency to the Internet among the 277 undergraduate Internet users that they surveyed. Among the three levels of pathology identified by this study (No symptoms, limited symptoms and pathological symptoms), they found that 8.1% of the participating students reported four or more symptoms and were considered pathological Internet users. This study reveals that 72.8% of the

students surveyed reported at least one symptom indicating problems caused by their Internet usage in addition to the 8.1% who were found to be pathological users. This study also supports Scherer's [1997] and Young's [1996] findings in that pathological users use the Internet more than others as it found an average weekly hours online being of 8.48 for pathological users, 3.18 for those with limited symptoms and 2.47 for those not displaying any symptoms of pathological Internet usage. In agreement with Scherer [1997], this study found that pathological Internet users were more likely than those showing limited symptoms or no symptoms at all to use the Internet for interactive online applications and for multiple other reasons such as wasting time or staying abreast of new developments. In opposition to Young [1996], the authors show that comfort and competence while using the Internet was not a contributing factor to excessive Internet usage which supports Scherer's [1997] hypothesis that Internet dependency is not associated with the number of years students have been using the Internet.

A paper-and-pencil survey conducted by Kubey *et al.* [2001] used self-reported evidence to support the existence of Internet dependency in college students and its correlation with students' academic problems. It employed a five-point Likert scale to assess students' self-reported dependency on the Internet. 9.26% of the 576 respondents reported being Internet 'dependent' and as reported by Scherer [1997] these students spent more time online (nearly three times) than 'non-dependent' Internet users. In contradiction with Scherer [1997], Kubey *et al.* [2001] support Young's [1996] finding that Internet 'dependent' users are more experienced Internet users with regards to length of time having used the Internet than 'non-dependent' users. They report 79.2% of 'dependent' students having used the Internet for 2 to 3 years or longer compared with 55.1% of 'non-dependent' students and also 35.9% 'dependent' students have been using the Internet for 4 years or longer compared to only 7.5% of 'non-dependent' students. These findings support Scherer's [1997] results that showed that Internet dependency is more associated with interactive Internet applications as it found the 'dependent' students averaging 2.81 hours per week using synchronous communication Internet applications compared with 20 minutes on average for 'non-dependent' students. Similar studies by Young [1996] and Scherer [1997], Kubey *et al.* [2001] found that Internet dependency could cause some problems in students' life; it has found for instance a 0.563 Pearson correlation coefficient between Internet dependency and academic impairment as discussed in a later section. Kubey *et al.*'s [2001] study shows that Internet dependency is associated with length of time having used the Internet as opposed to Scherer's [1997] unsupported contradictory results which suggests that the longer students have been using the Internet, the more likely they are to be Internet 'dependent' and thus the more they are subjected to the impaired academic performance caused by extensive Internet usage. As Internet usage is becoming a major educational support tool on campus and assuming that senior year students have more experience using the Internet than their junior counterparts, we believe attention could be directed to investigating whether among Internet 'dependent' students, senior students report more academic performance problems than junior level students due to their extensive Internet usage.

A study by Anderson [2001] identified students as susceptible to problems related to excessive Internet usage because of factors such as easy accessibility to the Internet as mentioned by Kandell [1998], along with the sense of security provided by the anonymity of the Internet, which allows some students who are less socially inclined to develop virtual relationships. This study surveyed 1,078 Internet users and identified 9.8% of this sample as Internet 'dependent' as they responded positively to at least three of the seven questions the author used as criteria for Internet dependency. This study confirms findings from Kubey *et al.* [2001] and Scherer [1997] that Internet 'dependent' students spend more time on the Internet than other students as it actually found Internet 'dependent' students to be averaging 229 minutes per day for Internet usage compared to only 73 minutes per day for 'non-dependent' students. Although in contrast to Scherer [1997] who found most students to report a positive influence of the Internet on their lives, in this study, Anderson [2001] found that Internet 'dependent' students were more likely to report negative effects on various aspects of their lives due to their extensive Internet usage than the rest. It is important to note that of all the above-mentioned studies, the one conducted by Scherer [1997] is the only one that did not only measure students' Internet usage for recreational online activities. We view this to have led to a biased categorization of students under either Internet 'dependent' or 'non-dependent' users

because by not excluding the time students spend online for school related work, Scherer's [1997] study might have falsely included students who spend a lot of time online for school related purposes into the Internet dependent class. Thus, this sampling bias might have affected the generalization of his finding that Internet 'dependent' students spend more time online using interactive applications such as online multi-users dungeons as mentioned by Young [1996]. The latter's findings were supported by Kubey *et al.* [2001] and Anderson [2001] and in these studies, we are led to question if students, 'dependent' or not, use the Internet for the intended purpose it was brought to campus; as an educational enhancement tool or as an entertainment tool.

Fortson *et al.* [2007] assessed Internet use, abuse and dependence among 411 students from a South-eastern regional American university. This study made use of a 9 item demographics questionnaire to assess the Internet abuse and dependency level among the participants drawn from the model used by Anderson [2001] in his study. The study considered respondents to be Internet 'dependent' if they endorsed at least three or more symptoms of dependency such as withdrawal, impairment in social, occupational activities due to extensive Internet usage amongst others. The study reveals that 26.3% of the respondents met the criteria for Internet dependence. The study found that participants meeting the criteria for Internet dependency spend more time online than those not meeting the criteria as argued by previous studies like the ones conducted by Young [1996], Scherer [1997], Morahan-Martin and Schumacher [2000]. It also supports the findings of Scherer [1997] and Young [1996] that Internet 'dependent' users access the Internet more for its interactive applications than for any other purposes. This study although using a model similar to the one used by Anderson [2001] to evaluate pathological Internet use and building its questionnaire around Scherer's [1997] work, found that 22% of its participants were Internet 'dependent' whereas with regards to the same characteristic, Anderson [2001] found 9.8% and Scherer [1997] 13%. As the author suggests, more rigorous survey instruments need to be developed and researchers need to agree on common criteria to use when evaluating pathological Internet usage among students. This suggestion in our opinion supports the findings of Gross [2004] that a combination of qualitative and quantitative data will shed more light into students' Internet usage behaviours since previous studies which have been using qualitative data only reveal inconsistencies when comparing their findings. This observation clearly indicates that standardized measures of Internet usage and Internet dependency need to be agreed on for future research in the field.

Choi *et al.* [2009] examined the association of Internet use with excessive daytime sleepiness among 2336 high school students in South-Korea. The authors developed a questionnaire which items measured evidences of Internet addiction, excessive daytime sleepiness, durations of Internet use and night sleep and other sleep-related problems such as insomnia symptoms. The level of Internet addiction was measured using the instrument developed by Young [1996]. The study identified three types of Internet user groups: Internet addicted, possibly addicted, and non-addicted. Daytime sleepiness was measured using the Epworth Sleepiness Scale (ESS) which is a frequently used sleepiness questionnaire consisting of eight items. The study reveals that 50.3% of the participants were classified as 'Non-addicted' Internet users, while 47.4% and 2.3% of the participants were respectively classified as 'possibly addicted' and 'addicted' Internet users. The study also reveals that 11.2% of its participants showed symptoms of excessive daytime sleepiness with 37.7% of them being 'Internet addicts', 13.9% being 'possible Internet addicts' and 7.4% being 'non-addicts' Internet users. The study further reveals that 'addicted' users used the Internet significantly more than the 'possibly addicted' and 'non-addicted' counterparts. Their respective daily average Internet usage were: 3.5hours, 2.3 hours and 1.7 hours. Furthermore, 'addicted' Internet users were found to perform significantly worse academically than 'possibly addicted' Internet users and 'non-addicted' Internet users. They were in the respective proportions of : 37.7%, 31.5%, and 29.3%. 'Internet addicted' users were found to sleep on average less than their 'possibly addicted' and 'non-addicted' counterparts at night. They were found to respectively sleep for 5.4 hours, against 6.1 hours and 6.1 hours. These findings were similar to the revealed evidences of insomnia. 35.9% of 'Addicted' Internet users showed symptoms of insomnia, compared to 26.1% and 19.3% of 'possibly addicted' and 'non-addicted' Internet users. This study confirms that Internet addiction is well-existent and is a problem among students [Young 1996; Scherer 1997; Morahan-Martin and Schumacher 2000;

Kubey *et al.* 2001; Anderson 2001; Fortson *et al.* 2007]. However, as argued by Fortson *et al.* [2007], the results of this study might suffer from a lack of reliability as they were based on self-reported data. Furthermore, we believe the authors should have developed stronger measures of Internet addiction to determine whether a user is 'addicted' or 'not-addicted' to the Internet because 'possibly addicted' is a term which does not reliably describe what type of Internet user a student really is. We believe the term 'moderate' Internet user would have been academically more acceptable, provided that the authors defined what they understood by 'moderate' Internet user.

The study by Ni *et al.* [2009] investigated evidence of Internet addiction and influential factors associated with Internet addiction among 3557 first year university students. The study made use of Young's [1996] study questionnaire to measure the level of Internet addiction among the participants. The study reveals that 6.44% of its participants showed symptoms of Internet addiction confirming therefore the existence of Internet dependency among students [Young 1996; Scherer 1997; Morahan-Martin and Schumacher 2000; Kubey *et al.* 2001; Anderson 2001; Fortson *et al.* 2007]. The study further reveals that students who surf the Internet more than 4 hours per day had a higher probability of Internet addiction and subsequently showed more significant, severe psychiatric symptoms compared to those not addicted to the Internet. The self-rating depression and self-rating anxiety scales used in this study substantiate this finding by finding that 'addicted' students had significantly higher scores on these scales than the 'non-addicted' group and also, positive correlation coefficients between these psychiatric syndroms and the level of Internet addiction were found. They were respectively 0.338 and 0.3555 with both having a p value $p < 0.0001$. Ni *et al.* [2009] further argue that early exposure to the Internet can be associated with Internet addiction. They found a probability $p < 0.05$ between the age of first exposure to Internet factor and Internet addiction. We believe that this latter finding brings into play the importance of investigating the user acceptance of a system factor as reviewed in the previous section of this chapter as it is probable that the age of exposure to the Internet might influence its usage and subsequently its acceptance as demonstrated by Davis [1989] and Gelderman [1998].

Ko *et al.* [2009] study aimed at developing diagnostic criteria of Internet addiction using 216 college students who had to answer which assessed the frequency of Internet use and time spent online weekly. This questionnaire was divided into three main sections that measured: characteristics symptoms of Internet addiction, functional impairment secondary to Internet use, and the exclusive criteria. The study reveals that 43.1% of its participants were classified as the addictive group and 56.9% as the non-addictive group. This finding confirms the finding by Young [1996] and Scherer [1997] that there is an existence of Internet dependency among students. The study further reveals that 113 of its participants, mostly from the addictive group were found to show at least one symptom of functional impairment due to Internet use. Of these 113 participants, 78.8% were suffering from academic performance impairment, 48.7% relationships break-ups, 3.5% have failed to fulfill family obligations. The authors did not demonstrate in their study what was the primary use of the Internet for the students. We believe failing to do this prevents one from seeing if the extensive usage of the Internet for any purpose can be linked to a particular impairment. For instance, it would have been informative to see if the drop in students' recreational activities or in relationships maintenance is not caused by students building new relationships or being involved in recreational activities online. Doing this would have allowed the authors to pin-point the actual online activities being at the center of the found impairments and directly address them.

2.4 What do students use the Internet for?

Preliminary findings on the main reasons for which students use the Internet can be attributed to Young [1996] which revealed that students who were identified as being Internet 'dependent' had different surfing behaviours than those who were identified as being 'non-dependent' users of the Internet. Furthermore, this study found that chat rooms and Multi-Users Dungeons (MUDs) were the most used applications with scores of 35% and 28% respectively for the 'dependent' population while between the 'non-dependent' population, e-mail and the World Wide Web were the most used services with scores of

30% and 25% respectively. The author argues that the Internet is attractive to its users for its interactivity and its ease of use which links to Davis's [1989] study in that the general public has quickly adopted the Internet and its technologies because among other reasons, it is easy to use.

In contrast to Young [1996], Scherer [1997] revealed that MUDs and chat rooms were the less popular services used by students, 9.1% and 1.8% respectively for the surveyed students population, while the most used applications were e-mail (98.7%); the World Wide Web (85.2%) and library services (54.0%) for the surveyed population. Moreover, Scherer's [1997] study reveals that weekly Internet users accessed the Internet mostly to maintain relationships with family and friends (97.9% of the respondents) and for academic work (91.9% of the respondents). Although Scherer's [1997] study does not differentiate in details the purposes of using the Internet between 'dependent' and 'non-dependent' Internet users as illustrated by Young's [1996] study, which revealed that 'non-dependent' users predominantly used those online services which allowed them to gather information, Scherer [1997] supports this finding by revealing that 'dependent' users mostly used the Internet for entertainment purposes as they were shown to be the predominant users of chat rooms, MUDs, news groups and others similar applications. Interestingly, when comparing both studies, there are significant differences in weekly Internet usage between 'dependent' and 'non-dependent' Internet users for personal or recreational activities. Scherer [1997] found that 'dependent' Internet users spent on average 7.8 hours per week online for personal or leisure activities against 3.7 hours per week for 'non-dependent' users while Young [1996] found that 'dependent' Internet users spent on average 38.5 hours per week online for recreational activities compared to only 4.9 hours for 'non-dependent' users. Young [1996] classified almost 80% of her respondents (396 out of a sample of 496 respondents) as Internet 'dependent' while Scherer's [1997] study classified only 13% of its respondents (taken from a total of 531 respondents) as Internet 'dependent' users. Although the samples in both studies were very similar regarding the number of respondents, the remarkable difference observed in the average time spent online for recreational activities between 'dependent' Internet users in both studies as illustrated earlier supports in our opinion the results by Fortson *et al.* [2007] that there is a need for researchers in the field to develop and agree on standardized instruments to measure Internet usage and Internet dependency among students.

Perry *et al.* [1998] investigated the potential existence of differences in Internet usage among 548 students belonging to various age groups who use the Internet at least once a week. 43.8% of the respondents self-identified themselves as regular Internet users. The study considers as a regular Internet user any person who uses the Internet for at least one hour per week. The study reveals that 80% of its self-identified regular Internet users use the Internet for email compared to 48.3% who use it to obtain university information. 28.3% of the respondents were found to use the Internet for a maximum of an hour per week while 2.1% of them were found to use it for at least 20 hours per week. Although this study supports findings by Scherer [1997] and Young [1996] in that e-mail is among the most predominant online applications used by students, we believe that the study should have specified which type of Internet usage it was measuring together with a larger number of most used online applications as described by the aforementioned studies. By failing to do so, the authors are unable to show whether the Internet is mostly used for recreational activities or other types of activities such as academic research. The study by Perry *et al.* [1998] fails to show the difference in Internet usage behaviours among the different groups of regular users. Their study presumes that these groups might be using online services similarly and therefore the Internet may affect all aspects of these different groups of users' lives the same way irrespective of whether they are 'dependent' to the Internet or not and whether they perceive the Internet as useful or easy to use as suggested in Davis's [1989] study.

The majority of the 226 7-10th graders students surveyed by Lubans [1999] reported using the Internet for academic/learning purposes. This supports findings by Scherer [1997] which reveal that over 90% of its survey responding students used the Internet for academic work. However, Lubans [1999] found that as a group, freshmen significantly use the Internet more than 7-10th graders yet the latter students rated themselves more expert in using the Internet than did the former. This finding supports the results by Scherer [1997] that Internet dependency is not related to Internet experience because if it was, by following both Scherer's [1997] and Lubans [1999] logic, even though freshmen would have

been exposed to the Internet longer than junior students, it does not imply that the former would be more effective Internet users than the latter because a common belief is that comfort and effectiveness using an application comes with the experience acquired while using it. Furthermore, Lubans [1999] found that 7-10th graders reported more academic benefits from their Internet usage than did the freshmen although the latter use the Internet more than the former. This finding by Lubans [1999] suggests a hypothetical association between Internet usage and academic performance which future research could support or reject as it showed that the students who used the Internet the least reported more benefits with regards to their academic performance than did those who used the Internet the most. In contrast to Young's [1996] findings, Internet dependency was found not to be associated with Internet experience, we suggest that Scherer [1997] and Lubans [1999] should have investigated in their studies the differentiating characteristics of an Internet 'dependent' student from an Internet experienced student with regards to their Internet usage as both groups may also have a different perception of the usefulness of the Internet and how easy for them it is to use it .

Morahan-Martin and Schumacher [2000] investigated types of Internet sites used and reasons for use among 277 undergraduate Internet users. The survey they used included 11 questions which asked participants to indicate their average weekly use of Internet applications such as emails, World Wide Web, Instant relay chat and MUDs. The participants were also asked to indicate how frequently they used the Internet for multiple reasons ranging from communication, academic work, to recreational activities as well as requiring those who have used the Internet to indicate for how long they have used it. The study reveals that pathological Internet users used more Internet sites and all Internet sites more than other students. Email was found to be the least used application. This study confirms findings by Young [1996] and Scherer [1997] that pathological Internet users were more likely than other users to use the Internet mostly for the interactive services it provides, such as platforms to meet new people, playing games or relaxation. Although the authors support the findings by Scherer [1997] and Lubans [1999] which show that Internet experience is not associated with Internet dependency, they found that besides a difference in average weekly Internet usage, pathological Internet users have been using the Internet for the same length of time as other users. The study thus fails to capture the activities performed by 'non-dependent' Internet users online. The fact that the study found pathological users to be more likely to use the Internet more for recreational activities than 'non-dependent' users as opposed to Scherer [1997] and Lubans [1999] who found academic work to be one of the main reasons students go online, does not show that 'non-dependent' users are using the Internet for academic purposes either. We suggest that it is crucial to study the Internet usage behaviours of both 'dependent' and 'non-dependent' Internet users and assess its effects on their lives. By doing so, it would enable us to determine whether 'dependent' users happen to be reporting more negative problems due to their Internet usage, if it means that excessive Internet usage is correlated to students' impairments in areas such as academic performance.

A study conducted by Odell *et al.* [2000] analyzed in detail gender differences in Internet usage among 843 college students. 385 respondents were males and 458 were females. The study confirmed findings by Morahan-Martin and Schumacher [2001] and Gross [2004] in that there is no persisting gender gap in Internet usage among students. The study also reveals that female students used the Internet by a smaller weekly average than their male counterparts, for 5.4 hours and 7.1 hours respectively. E-mail was found to be the most predominant Internet application used by both genders as showed by Scherer [1997] and Perry *et al.* [1998] although more females (91%) used it than males (85.7%). The authors' finding also supports Scherer's [1997] and Lubans's [1999] results that academic work is also a major reason students use the Internet as it found its usage between both genders being of 91.7% for females against 84.9% for males. Although male students were found to be using the Internet for more other purposes than female students, those other reasons were not as major as students' use of the Internet for e-mail and academic research. For instance, the study revealed that 43.6% of males against 26.6% of females were more likely to use the Internet for playing games. This study also confirms findings from Kandell [1998] and Anderson [2001] that students majoring in hard sciences use the Internet far more than students from other academic disciplines such as arts. This finding could actually as suggested by Johnson [2009] be a basis of a research that would seek to determine the possible existence of a difference

in Internet usage patterns among students from different academic disciplines.

Rumbough [2001] explored controversial online behaviours of 985 college students enrolled in different academic disciplines. The study reveals that 53.8% of its participants use the Internet 'several times a day'. The main reasons students used the Internet were for downloading music, as indicated by 62.4% of the respondents and to play games, as indicated by 29.1% of the respondents. A total of 17.7% were found to use the Internet for academic cheating. In contrast to Rumbough [2001], studies by Scherer [1997] and Lubans [1999] reveal that academic work is a major reason why students use the Internet. These studies induce us to ask the question, whether the use of the Internet as an educational tool is more for students to cheat for their academic tasks or to perform genuine research. This suggestion could trigger future research that would investigate whether students who claim to be performing well academically because of the Internet do not do so because they use it as an academic cheating tool. Had the study categorized students into either Internet 'dependent' or 'non-dependents', it would have been able to reveal if both categories engage in similar controversial surfing behaviours to the same extent; this could have provided an answer to our previously mentioned research suggestion. The author similarly recommends, as do Gross [2004] and Fortson *et al.* [2007], that future studies should use other methods of research to triangulate the findings as the responses to the survey may suffer from a lack of validity.

The Internet applications mostly used by 83 Taiwanese college students were explored by Chou [2001] to evaluate the excessive and addictive usage of the Internet among Taiwanese students. Those 83 students were selected from the pool of Internet addicts identified by a similar study the author previously conducted [Chou and Hsiao 2000]. 'Heavy' users were identified as those students whose weekly Internet usage exceeded 30 hours and self-identified 'heavy' Internet users. The research focuses of Chou [2001] were: Internet use, reasons and features of that use and impact of heavy Internet usage. As showed by Scherer [1997], Odell *et al.* [2000] and Perry *et al.* [1998], email was found to be among the main applications used by most subjects. Ninety five percent (95%) of the respondents reported using the Internet mainly for electronic bulletin boards systems (BBS), email and the World Wide Web as well as for other applications such as games and MUDs. It also supports findings from Young [1996], Scherer [1997], Lubans [1999] that the World Wide Web was used for academic research, personal interests and entertainment. As showed by Young [1996], this study reveals that among the attractive features of the Internet are its interactivity and ease of use which in our opinion suggest that Internet 'dependent' users may feel more comfortable using the Internet because of its perceived ease of use as illustrated by Cheung and Huang [2005]. The latter argument hypothesizes that Internet 'dependent' users may perceive the Internet as being more easy to use than 'non-dependent' and thus perceived ease of use of the Internet could also be considered as a biasing factor when classifying Internet users into either 'dependent' or 'non-dependent' users. In the same line of thought it would also be interesting to measure the influence of time spent using the Internet on perceived ease of use of the Internet as it is probable that experienced Internet users have a more positive perception of the ease of use of the Internet than less experienced users.

Jones [2002] investigated the impact of Internet usage on students' academic and social lives. The study made use of two surveys distributed to 2,054 college students from 27 higher learning institutions in America. The study reveals that 86% of college students use the Internet compared to 59% of the general population and that 19% of them use it for at least 12 hours per week which support claims that students are heavy Internet users [Kandell 1998; Anderson 2001; Kubey *et al.* 2001]. The author found that 60% of its respondents are likely to use the Internet to download music as supported by Rumbough [2001]. Jones [2002] found that the main reasons students use the Internet are for: social communication (42% of the respondents), engaging in work for classes (38%), entertainment (10%), professional communication (7%), do not know/not sure (2%). These results support findings by Scherer [1997], Lubans [1999] and Chou [2001] that the Internet is mostly used by students for academic work and for maintaining relationships. Email was the most predominant Internet application used by students, as indicated by 62% of the study's respondents, followed by instant messaging, 29% of the respondents like previous studies reported [Young 1996; Scherer 1997; Perry *et al.* 1998; Odell *et al.* 2000; Chou 2001]. The study also reveals that 73% of its respondents use the Internet more than the library as a source of academic

information. This finding which has never been supported will enable us to evaluate the influence of the Internet as an educational tool on students' academic performance by finding out which one of the two sources of information allows students to perform better academically. Furthermore, this study reveals that students spend more time on the Internet than studying as 62% of the respondents reported studying for classes for a maximum of 7 hours per week while only 14% of them reported studying 12 or more hours per week. While there is no literature in the field which supports this suggestion, it would have been necessary for the study to investigate if differences were observed between both these groups in this respect and to determine the impact the Internet has had on these students' lives.

Metzger *et al.* [2003] examined the nature of students' use of the Internet and how it influences their education. This study surveyed 356 undergraduate students from different year levels who had to fill in a questionnaire with open and close ended items. These items were related to students' frequency of Internet use, the general purposes for which they accessed the Internet and how often they used the Internet for academic related purposes compared to other information sources. The study reveals that students are heavy users of the Internet similar to studies by Scherer [1997], Kandell [1998], Anderson [2001], Kubey *et al.* [2001], and Jones [2002]. They found that 51% of the respondents were using the Internet on a daily basis and as showed by Odell *et al.* [2000], Morahan-Martin and Schumacher [2001] and Gross [2004], no difference between genders in the frequency of Internet usage was found. However as opposed to Lubans [1999], the authors did not find a difference in frequency of Internet usage between students from different year levels. This study's close ended questions showed that students use the Internet more for entertainment than for academic research as opposed to studies by Scherer [1997], Lubans [1999], Odell *et al.* [2000], Chou [2001], and Jones [2002] which made a contradictory suggestion. However, the responses to open ended questions related to the reasons students use the Internet and these supported the findings from the previously mentioned studies by Scherer [1997], Lubans [1999], Odell *et al.* [2000], Chou [2001], and Jones [2002] as students reported using the Internet more for school purposes than any others. This significant difference found between the answer to students' purposes for which they used the Internet when using close ended and open ended questions support the recommendation by Rumbough [2001], Gross [2004] and Fortson *et al.* [2007] that more accurate instruments need to be used when measuring students' Internet usage as well as their purposes for using it. This study also found that students mostly used books when looking for information related to academic work as opposed to Jones [2002] who suggested that 73% of his study's respondents reported using the Internet more than other media in this regard. The authors also found that both genders used the Internet equally for schoolwork as opposed to Odell *et al.* [2000] who found that 91.7% of its responding female students used the Internet for academic related purposes compared to 84.9% of its male respondents. Moreover, this study contradicts the findings by Lubans [1999] that freshmen used the Internet less than junior students as it found no major difference between the two groups in this regard and thus the authors found that students felt the Internet was slightly useful to improve their grades or the quality of their written work. Metzger *et al.* [2003] similarly to Young [1996] and Chou [2001] showed that a positive perception of use of the Internet is a factor towards students' adoption of this technology. Therefore, the importance of this factor needs to be assessed when classifying students as either Internet 'dependent' or 'non-dependent' users.

As aforementioned, Fortson *et al.* [2007] assessed Internet use, abuse, and dependence among 411 undergraduate students from the same university. They made use of a paper and an Internet survey which respondents had to select any one of the two to complete. Both the paper and the Internet survey instruments contained an Internet usage questionnaire to determine the purposes students accessed the Internet. The authors report that no major differences were found between both survey-instruments for most questions except for the reasons why the participants used the Internet. Individuals completing the Internet version were found to be more likely to report using the Internet for academic purposes as with statistics being of ($M=3.4$, $SD=0.6$; $M=3.2$, $SD=0.7$, for Internet and paper respectively.) This difference in findings between the two instruments used supports the view that there is a need for standardized instruments to be developed by researchers in this field [Rumbough 2001; Metzger *et al.* 2003; Gross 2004]. As previously found by Scherer [1997], Lubans [1999] and Chou [2001], the study reveals that

academic and relationship maintenance were the most predominant reasons students use the Internet, with daily usage being of 41% and 57% respectively for the respondents. The study also found that email was the most used application as indicated by 80% of the study's respondents. This finding supports those of Young [1996], Scherer [1997], Perry *et al.* [1998], Odell *et al.* [2000], Chou [2001], and Jones [2002]. Moreover, Fortson *et al.* [2007] suggests that there is no difference in usage between male and female Internet users as supported in earlier research by Odell *et al.* [2000], Morahan-Martin and Schumacher [2001], Metzger *et al.* [2003], and Gross [2004].

A study conducted by Hazelhurst *et al.* [2011] investigated the association between academic performance and Internet usage among 2153 second year students by looking at the websites these students go to as well as their Internet usage. The study reveals that 51.6% of its participants are heavy Internet users although the figures in studies making similar suggestions were different because of the samples size used [Scherer 1997; Kandell 1998; Anderson 2001; Kubey *et al.* 2001; Jones 2002; Metzger *et al.* 2003]. After investigating the top 100 sites used, this study reveals that students' Internet use is non-academic in nature and that students use the Internet more for social purposes, in opposition to some studies we reviewed above by Scherer [1997], Lubans [1999], Chou [2001], and Fortson *et al.* [2007]. This study is very innovative compared to earlier mentioned studies as it made use of quantitative data as recommended by Rumbough [2001] who recommended that other instruments be used to triangulate the findings. This study could thus yield more accurate results because what students report might not be reflective of their actual web-surfing behaviours. However, this study did not measure the length of time respondents have been using the Internet as opposed to Young [1996], Scherer [1997], Lubans [1999] and Morahan-Martin and Schumacher [2000] and therefore like the mentioned studies it does not address the hypothesis that Internet experience just like perceived ease of use of the Internet as argued by Davis [1989] might be a contributing factor towards students' usage of the Internet and considering this factor could help having a fairly unbiased categorization of students as either 'heavy' or 'light' Internet users. Qualitative data collection instrument could have been used to support or not support the classification of students as either 'heavy' or 'light' Internet users. A survey for example could have been used to ask students to also report about their Internet usage at home since by only measuring students' Internet usage at university, this study might not have taken into account that those students found to be 'light' Internet users on campus might be 'heavy' Internet users at home. This suggestion supports recommendations by Gross [2004] and Fortson *et al.* [2007] that a combination of quantitative and qualitative collected data could yield more enlightening results when conducting research in the field of Internet usage and students.

Ogedebe [2010] examined the relationship between academic performance and Internet services among 350 students from different academic disciplines by using a questionnaire which requested students to report about the reasons for which they use the Internet and how often they use it on a weekly basis. His study reveals that 73% of its participants use it for a maximum of two days per week without being precise about how many hours they use the Internet during those days therefore making it impossible to tell whether they are 'heavy' or 'light' Internet users. Ogedebe's [2010] study supports findings by Scherer [1997] and Lubans [1999] by revealing that students mostly use the Internet for academic work as reported by 45% of them and for relationship maintenance as 13% of them reported using the Internet for sending and receiving emails. The author's study reveals that only 65% of its participants are computer literate. We believe that the author's failure to investigate the possibility that this may affect whether or not a student uses the Internet and the reasons for which he/she uses it raises doubt about the reported reasons for which students use the Internet. From our perspective, computer literacy can influence the perceived ease of use of the Internet which in return can influence the reasons for which one uses the Internet.

2.5 The influence of the Internet on students' academic performance

As illustrated in the previous sections, one major aspect of Young's [1996] study was to examine the extent of problems caused by excessive Internet usage among 496 volunteers taken from the general public.

Following a Diagnostic Questionnaire developed by Young [1996] to identify individuals who met the criteria for pathological Internet usage, the author later found that 396 individuals were Internet 'dependent' users while the remaining 100 were 'non-dependent' to Internet usage. The study reveals that while 'non-dependent' users mainly complained about poor time management when on-line, 'dependent' users reported a wider range of problems due to extensive Internet usage; these problems ranged from personal to occupational problems. The author classified problems related to extensive Internet usage into five categories: academic, relationship, financial, occupational and physical, and she further broke impairment level into four categories, from none to severe. Academic performance was the most affected aspect of the respondents' lives as 58% of them reported severe academic impairments due to extensive Internet usage. On the same impairment level, relationship, financial, occupational and physical had respective scores of 53%, 52%, 51% and 0% among the respondents. The author linked the academic problems discovered to student's irrelevant web site surfing, chat room gossiping, interactive game playing and not enough sleep. Furthermore, Young's [1996] findings as discussed in the previous chapter are consistent with the findings of the study by Chou [2001], Odell *et al.* [2000] revealing that 'dependent' users mostly used the Internet for its interactive services such as chat rooms and MUDs (multi-users dungeons), 35% and 28% respectively for the respondents; while, 'non-dependent' predominantly used Internet features that allowed them to collect information i.e: Information protocols, 24% of the respondents, the World Wide Web, 25% of the respondents and email, 30% of the respondents. Therefore, the assumption elucidated from the author's findings is that 'dependent' Internet users will see their academic performance suffering from more impairments than others due to their extensive Internet usage.

Scherer [1997] revealed that students mostly use the Internet for academic work. Scherer [1997] found that out of the study's 531 responding college students, 90% reported using the Internet for academic work and also 58% against only 2% of the respondents perceived the Internet as having a positive impact on their lives. Although the author found academic work to be a predominant reason students use the Internet, the author did not actually investigate whether this extensive academic usage of the Internet was helping students to perform better with regards to their grades, which is a conclusion not to be taken without evidence. The study of 226 7-10th graders by Lubans [1999] reveals similarly with Scherer's [1997] that the Internet is used for academic/learning purposes as indicated by a majority of weekly Internet respondents. Although Lubans [1999] found in his study, that freshmen claimed using the Internet more significantly than 7-10 graders, the former reported not seeing too many benefits from their Internet usage on their academic performance. The author actually found that for many students (mostly 7-10th graders), the Internet has helped them academically for completing required papers, to improving their grades as well as to helping them improving the quality of their written work. While Scherer's [1997] study does not reveal which between Internet 'dependent' and 'non-dependent' users reports more benefits on their academic performance due to their Internet usage, Lubans [1999] suggest that although freshmen use the Internet more than their 7-10th grade counterparts, the latter reports more academic benefits from their Internet usage than the former. From both studies, it is not yet possible to find an association between extensive Internet usage and academic performance. Moreover, the above-mentioned studies together with Young's [1996] do not clearly establish a link between extensive Internet usage and academic performance. Young [1996] found that academic impairments was the most reported problem caused by extensive Internet usage, but did not explicitly show that 'dependent' Internet users were the ones suffering the most in this aspect.

The study conducted by Morahan-Martin and Schumacher [2000] on 277 undergraduate Internet users supports findings from Young [1996] that Internet usage is causing problems among students as it found that 72.8% of the respondents to their study reported at least one problem related to Internet usage. The study reveals that 54.6% of its pathological Internet users reported that their Internet usage had not deteriorated their work and/or school performance compared to 44% of the users with limited symptoms of pathological Internet use. Moreover, they found 27.3% of pathological users reported to have missed classes or work because of online activities compared to 1.1% of those with limited symptoms. The study also found 22.7% of pathological Internet users to have been in trouble with their employer or school because of being online compared to only 1.7% of those with limited symptoms. Also, 36.2%

of pathological users reported cutting short on sleep to spend more time online compared to 2.8% of those with limited symptoms. The latter two findings correspond with Young's [1996] in that extensive Internet usage has a negative influence on students' academic performance because they shorten their sleeping time to stay online. According to the study's statistics, students with limited symptoms reported more impairment on their academic performance due to Internet usage than pathological Internet users. Besides the non-deterioration of school performance of most pathological Internet users compared to those with limited symptoms, the study does not provide information on whether it had helped them improve. Therefore, similar to Scherer [1997] and Lubans [1999], the authors do not establish an explicit correlation, either positive or negative between Internet usage and academic performance.

Anderson [2001] surveyed 1,300 college students to identify the social and academic effects of Internet usage. After dividing the participants into either 'high' or 'low' Internet users, the author found similar to Young [1996] that 'high' Internet users reported more negative effects from their extensive Internet use. Some of the negatively affected aspects of students' lives included academic work and sleeping patterns. The fact that this study requested that the participants only reported about their online recreational activities, in our opinion makes the finding that 'high' Internet users perform worse academically than others questionable. This limitation biases the previously mentioned finding because there is no way to determine whether the authors also measured online time dedicated to academic activities. Therefore, study says nothing about whether students who use the Internet the most for academic work perform better academically than others. This suggests a gap in previous research in that despite the fact that some studies have found an association between extensive Internet usage and academic performance impairment [Young 1996; Kubey *et al.* 2001; Metzger *et al.* 2003; Fortson *et al.* 2007; Hazelhurst *et al.* 2011], it is not possible to determine if a higher academic usage of the Internet means a better academic performance by students.

In the aforementioned study, Kubey *et al.* [2001] also investigated evidence that heavier Internet usage was associated with academic performance problems among college students. The paper-and-pencil survey they administered to the 572 respondents also measured whether respondents had experienced academic impairments by asking them to report how often, if at all, their schoolwork has been impaired because of the time they spend online. The study reveals that 14% of the total sample reported that their academic work has been negatively affected occasionally, frequently, or very frequently due to Internet use. The results of the study also shows that 56.6% of the Internet 'dependent' group belong to the 14% reporting academic impairment and that four times as many Internet 'dependent' students reported academic problems related to Internet usage than did the 'non-dependent'. This finding is consistent with Young's [1996] in that Internet 'dependent' students are more likely to suffer from the influence of extensive Internet usage than others. Moreover, 40% of the students in the academically impaired group reported that their Internet use had affected their sleeping patterns which has led them to miss classes as mentioned by Young [1996] and Anderson [2001]. Likert items used to compare opinions between the academic impaired subgroup versus their non-impaired counterparts about their Internet use reveal that academic impaired subgroup respondents were more likely to agree or strongly agree with the Likert items which support the suggestion that there is a relationship between Internet dependency and academic impairment. A 0.563 Pearson correlation coefficient found between Internet dependency and academic impairment later supported this. The findings of this study are consistent with claims by Young [1996] and Anderson [2001] in that it found an association between Internet usage and academic performance impairment as opposed to Scherer [1997], Lubans [1999] and Morahan-Martin and Schumacher [2000] who found that the Internet had more of a positive influence on students' lives. This study is innovative because unlike Young [1996] and Anderson [2001] who only found a positive correlation between Internet usage and academic impairment, this study further showed that 'heavy' Internet users are the ones mostly suffering from academic impairment due to their extensive Internet usage. Furthermore, Young [1996] and Anderson [2001] in their studies did not investigate how many of their Internet 'heavy' users were suffering from academic impairment and thus failed to establish a positive link between Internet dependency and academic performance decrement.

Chou [2001] also investigated the impact of excessive Internet use among 83 selected college students

'heavy' Internet users in Taiwan as mentioned in the previous section of this literature review. As found by Scherer [1997], Lubans [1999] and Morahan-Martin and Schumacher [2000], this study revealed that generally, subjects reported the Internet as being more of a positive component of their campus lives. However, the author suggests that about half of its subjects reported that their sleeping patterns had been impaired due to their Internet usage and this resulted in them being late for classes or appointments as Young [1996] also found. However several subjects reported that their excessive Internet use has resulted in poor grades, failure in courses which is consistent with Anderson's [2001] and Kubey *et al.*'s [2001] findings. The study also highlights the story of a master's degree candidate addicted to MUDs in his/her junior year who decided not to take an exam due to his/her inability to stop playing MUDs on the previous night until 6 in the morning. This finding is also consistent with Young's [1996] finding that Internet 'dependent' students are mostly into interactive online applications. The main limitation of this study is its very small sample size consisting of only 83 students, which makes its results difficult to be generalized for a larger population.

Jones [2002] evaluated the impact of Internet usage on the academic component of students' lives by surveying 2,054 students at 27 institutions of higher learning in America. His finding that 89% of college students have a positive attitude towards the Internet is consistent with what authors of earlier studies such as Scherer [1997], Lubans [1999], Morahan-Martin and Schumacher [2000], and Chou [2001] have suggested. Moreover, the author shows that approximatively 79% of the respondents agree or strongly agree that the Internet has had a positive impact on their collegiate academic experience as Lubans [1999] revealed in his study. The study also reveals that 46% of college students prefer expressing ideas to a professor via email rather than in class and that 68% of them report subscribing to one or more academic-oriented mailing list that relate to their studies so that they can carry on email discussions about topics covered in their classes. This study however, differs from that of Lubans [1999] and Scherer [1997] because they suggest that students mostly used the Internet for academic/learning purposes without actually having investigated students' academic uses of the Internet. The author found that the academic purposes students used the Internet for were mainly to communicate with their professors, search for information and for carrying on discussions related to classes with their classmates. Besides stating that 79% of the respondents agree or strongly agree that the Internet has had a positive impact on their collegiate academic experience, the author did not investigate how much of this positive impact was related to academic performance increment.

In Metzger *et al.*'s [2003] examination of the nature of students' Internet usage, 356 undergraduate students had to indicate the academic purposes for which they used the Internet as well as in what ways they perceived the Internet to impact their school work. Respondents had to indicate the extent to which they felt the Internet increased the quality of their written work, the use of their time for searching for information and their grades amongst other factors. The study reveals similar to Young [1996], Scherer [1997], Morahan-Martin and Schumacher [2000], Anderson [2001], and Kubey *et al.* [2001] that students are heavy Internet users as it found 51% of its respondents to be using it every day. The results of the investigation into the academic purposes for which the students used the Internet are consistent with Jones [2002] as it found 89% of its respondents to spend their school-related use of the Web to do research/get information, followed by emailing professors and viewing course web sites as indicated by 51% and 32% of the respondents respectively. The study also revealed that accessing library information and databases was another popular use as reported by 20% of the study's participants. This finding supports a similar finding by Lubans [1999] who however in his study did not mention whether students' usage of databases was to perform academic or non-academic searches. The study also reveals that students felt that the Internet was moderately helpful for saving time searching for information and also felt it was slightly useful in improving their grades and the quality of their written work. Regarding the latter finding, the authors' results contradicts the findings by Lubans [1999], which revealed that 7-10th graders reported more benefits towards their academic performance from their Internet usage than their senior level counterparts. This study differs from Young's [1996] and Anderson's [2001] in that it found a relatively neutral correlation between Internet usage and academic performance, yet similar in that it did not investigate if academic performance decrement can be associated with extensive Internet usage

as done in Kubey *et al.*'s [2001] study.

Cheung and Huang [2005] researched the benefits of the Internet for university education, the factors affecting its use, its impact on students' learning and how to foster a positive attitude in students towards using the Internet by exploring the antecedents and impacts the Internet has had on university education. The study made use of a questionnaire which was completed by 328 undergraduate students and included questions to measure factors such as students' Internet skills, perceived usefulness of using the Internet and impact on general learning. The study reveals that perceived usefulness and enjoyment of the Internet correlated positively with students' general learning and Internet usage as determined by Young [1996]. The authors also argue that greater Internet use in university could result in better learning performance as they found it was helpful to increase students' verbal communication skills. This finding contradicts findings by Young [1996], Anderson [2001] and Kubey *et al.* [2001] since it actually suggests that heavier Internet usage could improve students' general learning and thus also improve their academic performance. Although this study did not investigate the influence of the Internet on students' academic performance, we believe its findings are important to this question because it brings to light factors that affect students' usage of the Internet such as perceived usefulness and ease of use which have not been studied. This shows therefore a gap in the literature in that these factors might need to be taken into account when differentiating between students who are heavy Internet users and those who are not because it may be possible that light Internet users may not perceive the Internet as useful or easy to use as do the heavier users.

Suhail and Bargees [2006] investigated the effects (positive and negative) of extensive Internet use among 350 undergraduate students at a college in Pakistan who are regular Internet users. The participants were given a 28 item questionnaire that included two questions focusing on study-related problems due to excessive Internet use. The study reveals that in comparison with other negative subscales such as interpersonal or physical problems among others, fewer number of students reported educational problems due to Internet use. Thirty one percent of the students (31%) reported deterioration in their grades or college performance and another 21% admitted they were missing their classes or work due to time spent online. The authors also found that 78% of the respondents reported that the Internet actually helped them improving their grades, 74% reported improvement in their reading and writing skills by using the Internet similar to findings by Lubans [1999]. Moreover, 48% reported becoming better students due to the Internet. Since this study used respondents who were identified as regular Internet users, the latter mentioned result contradicts findings from Young [1996], Anderson [2001], Kubey *et al.* [2001] who suggest that excessive Internet usage leads to academic performance impairments.

Pierce and Vaca [2008] studied whether differences in academic performance between teen users and non-users of MySpace and other communication technologies existed. This study examined the influence of social networking sites and other communication technologies on teenagers' academic performance. This study chose MySpace for its reputation of being the most popular social networking site particularly among adolescents as well as other technologies such as Instant Messaging and cell phone. Five hundred and seventeen (517) high school students participated in the study. The study formulated research questions that asked students to indicate whether they had a social network site account so that it could investigate whether differences existed in grades among students using different social networking services. The study revealed that 72% of its respondents have a MySpace account and 68% of them reported having an Instant Messaging account which is consistent with results obtained in other studies which suggest that students are heavy users of interactive online applications [Young 1996; Scherer 1997; Morahan-Martin and Schumacher 2000; Hazelhurst *et al.* 2011]. Results of this study show that students who had a MySpace account reported lower grades than those who did not have a MySpace account or those who did not even possess a social networking site account. This result is consistent with findings from earlier studies which suggest that students who excessively use the Internet and its applications suffer from academic performance decrement [Young 1996; Anderson 2001; Kubey *et al.* 2001].

The study conducted by Chen and Peng [2008] investigated the relationships between Internet use and academic performance among 49,609 university students in Taiwan. Students were asked to com-

plete an online questionnaire with six sections. The different sections measured: demographics, online experience, interpersonal relationships, psychosocial adjustment, self-evaluation, and academic performance. The study made use of Young's [1996] instrument to classify students whose weekly time spent online was greater than 33.97 hours as 'heavy' Internet users while the rest were classified as 'non-heavy' Internet users. The study reveals that the primary reasons students use the Internet is for making friends or chatting, followed by the search for academic information, then playing online games and finally checking emails. These results contradicts finding by Scherer [1997] and Lubans [1999] that students primarily use the Internet for academic work. Men were found to use the Internet less for academic work than women but rather more for recreational activities as supported by Odell *et al.*'s [2000] study. The study further reveals that 'heavy' Internet users had lower grades than 'non-heavy' Internet users in accordance with Young's [1996] and Anderson's [2001] who found that extensive Internet usage can have a negative impact on aspects of students' lives such as on their academic performance. The study however, made use of self-reported data like most studies reviewed in this section and therefore the potential unreliability of the authors' findings strengthen the need for more reliable research instrument [Young 1996; Rumbough 2001; Gross 2004; Fortson *et al.* 2007].

As reviewed in the previous section of this document, Hazelhurst *et al.* [2011] investigated the association between Internet usage and academic performance among second year university students at a single university. The study used proxy logs and bandwidth utilization to measure students' Internet usage and focused on those students who live on campus because their surfing behaviours could effectively be collected. The authors used a weighted average mark and a performance index scaling each student's mark in a course by the average of that course to measure students' academic performance. The study separated the 2153 participants into 'good' students (those with a course weighted average mark of at least 65%) and 'bad' students (those with a course weighted average mark being less than 40%). The study reveals that 50.2% of the 'good' students fall in the bottom 40% of Internet users and 27.1% of them are heavy users. The authors also found that the number of passes and fails among heavy Internet users are 70.6% and 29.4% respectively while among light users they are 83.4% and 17.6% respectively. This study shows that 'good' students use the Internet less than 'bad' students furthermore, it shows that 'light' Internet users perform better academically than heavy Internet users as reported by Young [1996], Anderson [2001] and Kubey *et al.* [2001]. While this study is consistent with previous studies that found that extensive Internet usage causes academic performance impairments, little is shown to suggest that 'heavy' Internet users perform worse academically than 'light' users. A better knowledge of the influence of the Internet on students' academic performance is required and this could probably be acquired by investigating the Internet usage of 'heavy' Internet users and 'light' users and observe whether their academic performance will suffer from an extensive use of the Internet. An example would be to investigate the Internet usage patterns of a particular individual over a period of time and observe how his/her academic performance has been affected by it. Although a 'heavy' Internet user might perform worse academically than a 'light' user overall, his/her academic performance might have been improving or deteriorating due to his/her extensive Internet usage. This study is more innovative than the majority of the studies we reviewed in this section in that it makes use of quantitative data to measure students Internet usage as suggested in studies which recommend that the interpretation of data collected with different instruments could yield more reliable results since self-reported data might be affected by students suffering from a great amount of denial regarding their Internet habits [Young 1996; Rumbough 2001; Gross 2004; Fortson *et al.* 2007].

The study conducted by Ogedebe [2010] on the relationship between academic performance and Internet services among university students reveals that 79% of its participants reported a positive influence of the Internet on their academic grades such as found by Suhail and Bargees's [2006] and Lubans's [1999] studies. Unlike its title suggests, the study does not establish a relationship between academic performance and Internet services but between academic performance and the Internet in general. While the author identifies the reasons for which students use the Internet, the study fails to tell the reader whether there is a link of causality between the reported reasons for which the Internet is being used and the observed effects on academic performance. In other words, the author does not tell us if an extensive

usage of the Internet for academic purposes or for relationship maintenance causes a decrease or an increase in academic performance unlike in the study conducted by Hazelhurst *et al.* [2011]. However, by revealing just like Jones's [2002] study that the Internet is used more than the library for academic work, the author identifies the need to study further the role of other learning resources or facilities in helping students improve their academic performance. This study stresses the need mentioned above because it reveals that lecture notes were found to best serve students' interest in terms of improving their grades compared to the Internet as reported respectively by 35% vs 20% of the study's participants, yet 79% of them reported that the Internet has helped them enhance their academic performance.

Kirschner and Karpinski [2010] examined whether differences exist in the academic performance of 102 undergraduate and 117 graduate college student Facebook users and nonusers. The authors developed a five sections questionnaire which items measured: demographic information, academic information, computer and Internet use, hours of Facebook use, perceptions of the impact of Facebook on their own academic achievement. The results revealed that Facebook users (141 out of the total sample) reported a lower mean GPA than non-users ($M=3.06$ and $M = 3.82$ respectively). Also, Facebook users reported studying fewer hours per week on average than non-users ($M=1.47$ and $M= 2.76$ respectively). The authors also found that Facebook use and GPA and hours spent studying were not dependent on whether a student is an undergraduate or a graduate. 90.8% of the Facebook users claimed to use the Internet for academically related purposes. 73.8% of the Facebook users claimed that Facebook does not exert any influence on their GPA while the remainder reported perceiving some kind of influence either positive or negative. The study further reveals that of those who reported an impact of Facebook on their academic performance, 74.3% of them reported a negative impact while 25.7% reported a positive impact. This study confirms findings by Scherer [1997] and Lubans [1999] that academic work is the reason for which students use the Internet. Furthermore, the study supports the arguments that the Internet can play a negative impact on academic performance if used mainly for recreational activities as revealed in Pierce and Vaca's [2008] study which focused on MySpace, which is another popular Internet application like Facebook.

2.6 Conclusion

Although the Internet is a major component of people's lives due to the support it provides in the way people communicate, perform business transactions and conduct research; it has also become a cause of concern as its overuse influences the way people live [Young 1996; Kandell 1998]. Students in particular, are more avid users of the Internet and its technologies than the general population. The introduction of the Internet to campus was mainly envisaged for enhancing students' collegiate experience. However, students are easily exposed to the problems an excessive usage of the Internet brings as Kandell [1998] suggested. In the first section, we reviewed studies that supported the hypothesis that the Internet should be seen as a cause of concern for students because of some of its applications which are addictive-like. Young [1996] found that some Internet applications were addictive and as such many students were heavy users of such online services as later found by Kubey *et al.* [2001]. Young's [1996] study shows that students who were identified as being very heavy users of online services developed symptoms of dependency to the Internet similar to individuals who are addicted to drugs and as the latter, the former were found to have some aspects of their lives becoming negatively affected because of heavy Internet usage. Some of those affected aspects, included academic performance, relationships maintenance, physical and mental health among others. Young's [1996] study was at the basis of further research in this field and as such, future studies either supported or contested these findings due to the different methodologies the later studies used sometimes or the unreliability of the findings which made the results difficult to be generalized. However, most studies have confirmed the existence of Internet dependency symptoms among the general population, particularly students. This prompts a need to further investigate the extent of the problems associated with extensive Internet usage.

As the third section reviewed studies which confirmed the existence of Internet dependency among university students, it was important then to review studies which investigated whether students were

using the Internet for the main purpose it was intended for on campus, as a tool to support their education or whether they were misusing it. On these aspects, the reviewed studies are not unanimous. Some early studies supported findings by Scherer [1997] and Lubans [1999] that students mostly used the Internet for academic purposes while others found that the Internet was not being used by students as an educational tool but mostly as an entertainment tool [Rumbough 2001; Hazelhurst *et al.* 2011]. The fact that studies differ in their findings regarding what students use the Internet for reveals an urgent need for researchers to agree on standard instruments to measure Internet usage by students [Rumbough 2001; Gross 2004; Fortson *et al.* 2007].

After finding that students were subjected to Internet dependency and later on reviewing what they use the Internet for, there was a need to focus on the effects of their dependency to the Internet on their academic life. Since the Internet was mainly brought to campus to help students in their learning, it was necessary to review studies that investigated whether the Internet was fulfilling its intended purposes by asking students to report if they felt their usage of the Internet was influencing their academic performance anyhow. On this aspect, studies diverged again in their findings as Lubans [1999] and Chou [2001] among others suggested that students reported academic performance increment while other studies suggested otherwise [Young 1996; Anderson 2001; Kubey *et al.* 2001]. The difference in results among these studies may have been affected by the unreliability of self-reported data collected from students because what students report might be different from what they do as reported in Johnson's [2009] study, or because heavy Internet users may suffer from a great amount of denial as stated by Young [1996] and may thus report themselves as light Internet users. By using quantitative data collection methods, Hazelhurst *et al.* [2011] exposed the unreliability of results from previous studies conducted in this field because most of them over-relied on self-reported data whose validity was never tested. Therefore, we believe a combination of quantitative and qualitative data analyses could allow for triangulation of results and for identification of inconsistencies generated by both methodologies in order to get more reliable findings.

Chapter 3

RESEARCH HYPOTHESIS

3.1 Introduction

Following the belief that any healthy consumable or service becomes noxious when it is misused or overused, we believe that Internet usage may become harmful to students if they extensively use it. Since the Internet was brought to campus as an educational tool to support students in their learning, it is expected that an effective usage of it should just serve this purpose. The Internet being identified as a supporting tool needs therefore to be assessed against the purpose it was introduced for. How do people use it? For what purposes do people use it? What differences has it made since being introduced? Has its introduction come at some costs? If so, what are they and what are the extents of the problems identified? These are just a few questions that one could seek answers to when looking at whether the Internet is fulfilling its role on campus. As we have seen in our literature review, the Internet has for over fifteen years now been identified as a potential cause of concern for students. Although its importance is incontestable for people's daily living, researchers are not unanimous on the influence it has on its users, especially on students.

3.2 Research Hypothesis

The particular diversity of findings on the influence of the Internet on students' academic performance reviewed in the literature review chapter of this document shows an urgent need to study in enough detail the following hypothesis:

There is a positive correlation between excessive Internet usage and poor academic performance among students.

Excessive Internet users will be those students who will be identified as heavy Internet users by both the qualitative and the quantitative study.

To study whether there are enough evidence to support or refute the previously mentioned hypothesis, one needs to be mindful of the bias observed in the instruments previous studies have used as mentioned in the literature review chapter. This bias was mainly caused by the fact that previous studies' results have not taken into account students' denial of their real Internet surfing behaviours by relying only on what they self-reported. We therefore deemed important to pose the following research questions which answers should provide more reliable evidence:

1. Do students who use the Internet excessively perform badly?
2. Do students who perform badly use the Internet excessively?

In the literature review chapter of this document, we saw how findings from previous studies were prone to the unreliability of students' self-reporting of their Internet usage habits. The first research question will be using the same research instrument as those studies and therefore its findings will undoubtedly suffer from the same unreliability. This is why in our opinion by coupling findings from the

second and the first research questions, we will actually address the issue of students denial of their Internet usage habits by checking whether what students have reported for question 1 is what is being observed in the analysis of answers to question 2.

3.3 Conclusion

The motivation to this study is that previous studies have made use of self-reported data and its unreliability weakens the conclusions that such studies have drawn. We made use of quantitative data to investigate the potential existence of an association between high Internet usage and academic performance decrease among university students. The data collected for the quantitative study was triangulated with the participating students' self-reported data so as to show evidence of students being in denial about their Internet usage and its effects on their academic performance.

After formulating above the two research questions which answers helped us refute the hypothesis of a positive association between extensive Internet usage and poor academic performance, the next chapter gives an overview of the methodologies we used to collect the data that we used to answer our two research questions. This chapter highlights the two studies we conducted, the procedures we employed to select the participants to these studies, the variables we used to answer our research questions and how these variables were measured.

Chapter 4

RESEARCH METHODOLOGY

4.1 Introduction

In the previous chapter of this document, we posed two research questions that helped us find evidence of a potential mutual association between Internet usage and academic performance among university students. As further explained in this chapter, we adopted a mixed research methods to prevent the unreliability of the intended research outcomes due to students' denial of their Internet surfing behaviours. The first study we conducted is a qualitative study that used an 11 item questionnaire that we distributed to 389 3rd year students that helped us measure how much time students spend online while on campus, what are the reasons they use the Internet for and how do they perceive the Internet has influenced their academic performance. The subsequent quantitative study made use of 359 of the initial pool we surveyed and it used Squid Proxy logs data to measure the same concepts as the qualitative study although we also had to collect the courses final grade of these participants from the university as well. Each study is further explained below.

4.2 Qualitative Design

The first study we conducted was a qualitative study that made use of a questionnaire (see Appendix C) we developed and handed out to 389 3rd year students to measure the concepts highlighted in the table below in order for us to answer the research questions we posed in the Research Hypothesis chapter of this document.

Concept	Variable	Measurement Method
Time students spend online	Internet Usage	Ask students how much time they spend online in hours per day
Purposes students use the Internet for	Educational vs. Non-educational Internet usage	Ask students to indicate the reasons they use the Internet for i.e.: academic work, relationship maintenance, and professional work, others ...
Academic Performance self-evaluation	Academic Performance	Ask students to report whether they think the Internet has influenced (negatively/positively) their semester grades over the past 2 years

Anderson [2001] identified seven criteria that are used to determine substance dependence based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM IV)*. They are:

- Tolerance

- Withdrawal
- Using larger amounts or over a longer period than was intended
- A desire for or unsuccessful efforts to cut down or control the substance use
- A great deal of time spent in obtaining, using, or recovering from the substance
- Social, occupational, or recreational activities are reduced because of substance use
- Substance use continues in spite of negative effects

As we mentioned earlier in the literature review chapter of this document, previous studies have investigated and confirmed the existence of Internet dependency among students. Although no actual substances are involved in Internet use as Anderson [2001] mentioned in his studies, excessive Internet use is similar in behaviour to the concept of dependence. Similar to the above-mentioned study, a diagnosis of dependence in ours will be based on the presence of three or more symptoms. We therefore formulated statements in our survey that are related to the dependence criteria we have cited earlier. These statements are included in our survey and range from item 5 to item 11. The respondents who will agree with more than three of these statements will be classified as 'heavy' Internet users. We say that we will classify such students as 'heavy' Internet users instead of Internet 'dependent' users as would be expected because most studies we have reviewed in our literature review have been consistent in supporting the hypothesis that Internet 'dependent' users were 'heavy' Internet users. This is why we will just label 'dependent' users as 'heavy' Internet users for the purpose of our study.

This instrument was administered as a paper-and-pencil survey to 389 3rd year students registered for different university courses. We presumed that it would be safer for us to administer this survey during a class due to the high probability of having the surveys returned immediately once completed as opposed to conducting the surveys online, via emails, or interviews. Prior arrangements were made with the lecturers of the selected courses before we administered the questionnaire. We chose 3rd year students from different academic disciplines because we also investigated the probability of Internet usage habits being dependent on the discipline of study. Moreover, 3rd year students would already have spent at least two years at the university where we conducted this study and therefore their last four semesters proxy records would be available for the quantitative section of our study. Based on their answers, we classified the participants as either 'heavy' or 'light' Internet users.

Since we did not want to identify students who are willing to participate due to ethical requirements that ask for anonymity upon return of completed questionnaires, the following steps illustrate how the overall survey answering process was conducted:

- Distribute questionnaire to the whole class and ask students to turn the questionnaire over whether completed or not so that on collection none of them is visually identified as a participant.
- A random number was included on the questionnaire students had to fill along with their student number on a separate sheet so that students' responses could not be recorded with their student number on the same document as required for participants' anonymity.

4.3 Quantitative design

Concept	Variable	Measurement Method
Time students spend online	Internet Usage	Compute the Internet bandwidth usage of students from proxy logs data in Megabytes for a period of 2 years
Purposes students use the Internet for	Educational vs. Non-educational Internet usage	Look at websites students go to from proxy logs collected for the past 2 years
Academic Performance	Academic Performance	Get students' weighted average mark for the course he/she is enrolled in for the last 2 years

This study involved analysis of squid proxy logs which fields such as data size, URL requested, helped us identify students who are heavy Internet users. The identified websites these students go to were classified as either educational or non-educational so that we could actually be able to determine how much of students' Internet usage is educational and how is this affecting their academic performance. Heavy Internet users were those students whose Internet bandwidth consumed was bigger than the average user Internet bandwidth consumption. We then requested the performance data (course weighted average mark) of all respondents and compared it with their bandwidth usage for a time period of 2 years so that we could answer whether students who perform badly excessively use the Internet. The performance data collected allowed us to split the students under either the category of 'bad', 'average' or 'good' students and compare the Internet usage of the three groups. We define as 'good' student any student whose average in a course is of at least 65%, 'average' any student with an average grade equal to 50% and less than 65% and 'bad', any student with less than 50%. The comparison of the groups with regards to their Internet usage allowed us to answer whether students who perform badly excessively use the Internet. We then compared the three groups with regards to the purposes they use the Internet for. This comparison helped us determine if students' academic performance is influenced by Internet overuse or simply by the use of Internet being mainly non-educational or both.

We finally also investigated students who have stayed on campus residences for the last 2 years because as mentioned by Hazelhurst *et al.* [2011], their Internet usage can be reliably collected since the university's network and security department makes use of proxy logs to record students' Internet surfing behaviours. Moreover, their 24/7 accessibility to the Internet from their residences make them potential high Internet users compared to the rest of the student population as proven in the above mentioned study.

4.4 Conclusion

In this chapter, we reviewed the mixed methodology we used to find evidence of an association between Internet usage and academic performance among university students. We conducted a qualitative study and a quantitative study that respectively made use of a questionnaire distributed to 389 3rd year students and Squid proxy logs data of 359 of those 389 students. In each study, we measured the time students spend online while on campus, the purposes they use the Internet for as well as the influence the Internet exerts on their academic performance. In the next chapter, we detail the steps and calculations involved in each of the two studies that led to the results they each reveal. This chapter also includes a cross-triangulation of the findings from the two studies to address the issue of unreliability of self-reported data as well as the value we think our mixed methodologies research has added to this discipline.

Chapter 5

TRIANGULATION RESEARCH DESIGN: CONVERGENCE MODEL

We highlighted in the literature review chapter of this document that previous findings on the topic of Internet usage and academic performance suffered from the unreliability of students' self-reports about their Internet usage due to their possible state of denial when it came to reporting their Internet usage habits and the impact they have on their academic grades. We then argued that it was therefore important to address this unreliability by comparing what students self-reported with hard data collected on the same issue by the academic institution where students are enrolled, in our case, Squid Proxy logs data kept by Wits University.

We decided to use the Triangulation Convergence Model Research Design (see Appendix D) in our study to best highlight students' denial about their Internet usage and subsequently the unreliability of self-reported data because this model allows for the cross-triangulation of results gathered from different methodologies. This was achieved by comparing and contrasting the results gathered in both the qualitative and quantitative studies since they used different methodologies to answer the same research questions, notably:

1. Do students who use the Internet excessively perform badly?
2. Do students who perform badly use the Internet excessively?

The studies that followed tried each to answer both questions and the results they found were cross-triangulated in the final section of this chapter. Please go to Appendix D to view a diagram that illustrate the Triangulation Convergence Model.

5.1 Qualitative study

5.1.1 Introduction

In this section, we cover the first fold of our mixed methods research that involves the conduct of a qualitative study whose aim was to identify evidence of a potential correlation between extensive Internet usage on campus and degrading academic performance among 3rd year students at Wits university. This is based on students' self reported-data about their Internet usage habits on campus. We therefore start this section with a review of the methodology we used to conduct this study, followed by the data analysis and results interpretation section of the data we collected and we finish with a discussion of this study's findings in comparison with findings from the literatures we reviewed in this field. Since this study is based on participants' self-reports, we respectively rephrased the research questions we asked earlier:

1. Were students who reported a negative influence of the Internet on their academic grades identified as 'heavy' Internet users?

2. Did students who were found to be ‘heavy’ Internet users on campus report a negative influence of the Internet on their grades?

5.1.2 The Methodology

The Sample

Our sample population consists of 389 full-time 3rd year students at Wits University. Those students were coming from the following fields: Public International Law, Engineering Economics, Architecture and Networks, Igneous Petrology, French Studies, Remote Sensing, Physics, Microbiology, Formal Languages (Computer Science), Political Studies, and Management and Cost Accounting. We decided to use 3rd year students because our study requires students to report about their Internet usage habits on campus for the last 2 years, therefore 3rd year students unlike other year levels’ students were more likely to have been studying at this institution during the last 2 years. We also deemed necessary to survey students from different academic disciplines because we would like to investigate the probability of Internet usage patterns varying across academic disciplines. We also requested students to indicate whether they were staying in university residences or not during the relevant time frame because since they had more access to the Internet than their counterparts on campus, the effects on their academic performance could be more reliable. Moreover, it is important to note that our sample consists of students from various demographics and socio-economic backgrounds. Our main participating criteria was that our participants were 3rd year students at the time the questionnaire was being administered because we did not think that the mentioned factors would influence a student’s Internet usage habits on campus. After ethical clearance was granted by the University Research Ethics Committee (Non-Medical), we contacted randomly selected 3rd year lecturers upon being granted permission by their respective Head of school to whom a copy of the obtained ethical clearance certificate was emailed. The mentioned courses are the ones whose lecturers accepted to collaborate, the distribution of students per course appears in the table below:

Course	Number of students
Architecture and Networks	20
Engineering Economics	37
Formal Languages	29
Igneous Petrology	29
Management and Cost Accounting	84
Microbiology	29
Physics	14
Political Studies	42
Public International Law	42
Remote Sensing	59
French Studies 3	4

Table 5.1: Distribution of students per course

Total Number of students	Number of students in Residence	Number of students not in residence
389	108	281

Table 5.2: Distribution of students per living arrangements

The Research Questionnaire

Internet addiction as reviewed in the literature review chapter of this document is a construct for which researchers’ opinions are divergent mainly because, as most of them have acknowledged, self-reported

data are unreliable. The questionnaire used in this study was a nonstandardized tool we developed based on research related to Internet addiction by students. Although no substances are involved in Internet use as Anderson [2001] mentioned in his study, excessive Internet use is similar in behaviour to the concept of dependence. We therefore developed our questionnaire items from the seven criteria identified in Anderson's [2001] study that are based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM IV)* used to determine substance dependence. They range from item 5 to item 11 of our questionnaire and are:

- Tolerance
- Withdrawal
- Using larger amounts or over a longer period than was intended
- A desire for or unsuccessful efforts to cut down or control the substance use
- A great deal of time spent in obtaining, using, or recovering from the substance
- Social, occupational, or recreational activities are reduced because of substance use
- Substance use continues in spite of negative effects

We developed a paper-and-pencil questionnaire (Appendix C) consisting of 11 items that mainly required participants to report about their daily Internet usage, to rank the reasons for which they used the Internet by descending order of daily usage, and their perceptions of social and academic changes resulting from their Internet usage. The main reasons we asked students to report about ranged from: academic work, recreational activities, relationship development and maintenance and others. Their responses to item 5 to item 11 of the questionnaire by either 'Yes' or 'No' allowed us to measure the effects of their Internet usage on the aspects of their lives we mentioned earlier. Students had to report about their Internet usage on campus because the university records it into Squid proxy log files (which we used in the quantitative part of our research) for each student on a daily basis and we would later compare their reports and the university recordings in the cross-triangulation findings section of our research.

Variables measured

The following variables were measured by different items on the research questionnaire we mentioned above:

Internet Usage. To measure this variable, the questionnaire asked students to report on how much time they spend online on campus in hours per day.

Educational vs. Non-Educational Internet usage. This variable helped us determine the purpose students use the Internet for on campus. From their responses to the relevant item on the questionnaire, we were able to identify whether this usage was for an educational or for a non-educational purpose. The pie chart appearing in Figure 1.5 depicts this difference.

Academic Performance. One item of the questionnaire helped us measure students' perception of the influence the Internet has had on their academic performance over the past 2 years by asking them to report whether they think the Internet has influenced their grades either positively or negatively for the mentioned period.

5.1.3 Data Analysis and Results Interpretation

In this section of the document, we first report about the procedure followed to collect the data and how it was treated. Following this phase, we performed statistical analyses to answer our two research questions that we mentioned in the research hypothesis section of this document. The statistical analyses were divided into two parts: an exploratory statistics section that includes descriptive statistics that will help us understand our data appropriately and an inferential statistics section in which we explain the statistical calculations we performed to determine if there is any association between Internet usage and academic performance among 3rd year students at Wits university or between any variables measured in this study as mentioned earlier. Please note that all statistical calculations appearing in our study were performed using SAS Enterprise Guide version 4.2.

Data Collection Procedure and Treatment

All questionnaires were distributed, completed and returned in class due to the high probability of having them returned immediately once completed as opposed to distributing them online, via emails or interviews. A random number was allocated to all questionnaires as a requirement for anonymity of the questionnaires as requested in the ethical clearance application form. Along with the questionnaire were attached: a participant information sheet and a consent form participating students had to sign and write their student number on. The entire bundle of the 3 documents were sent to the Academic Information System Unit (AISU) of the university so that this entity would send participating students' course mark for the 2 years period of our study by replacing the student number appearing on the consent form with the random number allocated to the matching questionnaire for the purpose of the quantitative study that followed this study. Scheduling difficulties coupled with class blocks approaching their ends forced us to distribute this questionnaire over a period of approximately 4 months: from October to November 2010 then from January to February 2011. Therefore while students who participated in 2010 had to report their Internet usage habits on campus between 2009 and 2010, those who participated in 2011 had to similarly report for the years 2009 and 2010 because for obvious reasons they could not report on 2011. The questionnaires were collected in class and those that were correctly filled had their answers entered into a spreadsheet document classifying them by academic field and random number allocated to each questionnaire for data confidentiality purposes. Therefore, we considered that a correctly filled questionnaire, would be a questionnaire that was returned with all of its items correctly responded to, and also, the attached consent form would have been signed by the respondent who would have indicated his/her student number on it.

Exploratory Phase

In this section, we are going to describe our data with statistical tests that would help us better understand our sample population. Such calculations are meant to reveal evidence of a potential correlation between Internet usage and academic performance so as to strengthen the validity of the results we will gather from the subsequent inferential tests that follow.

Measures of central tendency and dispersion:

Basic Statistical Measures			
Location		Variability	
Mean	2.453136	Std Deviation	1.82611
Median	2.00	Variance	3.33467
Mode	2.00	Range	13.9200
		Interquartile Range	2.00

Table 5.3: Measures of location and spread for the total population sample

According to Table 5.3, our sample has an arithmetic mean Internet usage of about 2.45 hours/day, which is relatively low considering that Wits university provides its students with 24/7 campus wide Internet coverage. However, this is understandable when we consider that across all year levels, classes start at 8 AM until 4PM from Monday to Friday and in between students will have breaks accumulating to a rough average of 2 hours, which is why a mean of about 2.45 hours is justifiable. Table 5.3 also reveals that our sample population is roughly normally distributed because the mean, the median and the mode are almost equal. If we were to round them off, we would see that all three statistics are equal to 2. Moreover, the small value of the standard deviation allows us to say that most values of Internet usage for our sample are clustered around the mean which will give our distribution a bell shape.

Distribution of our sample:

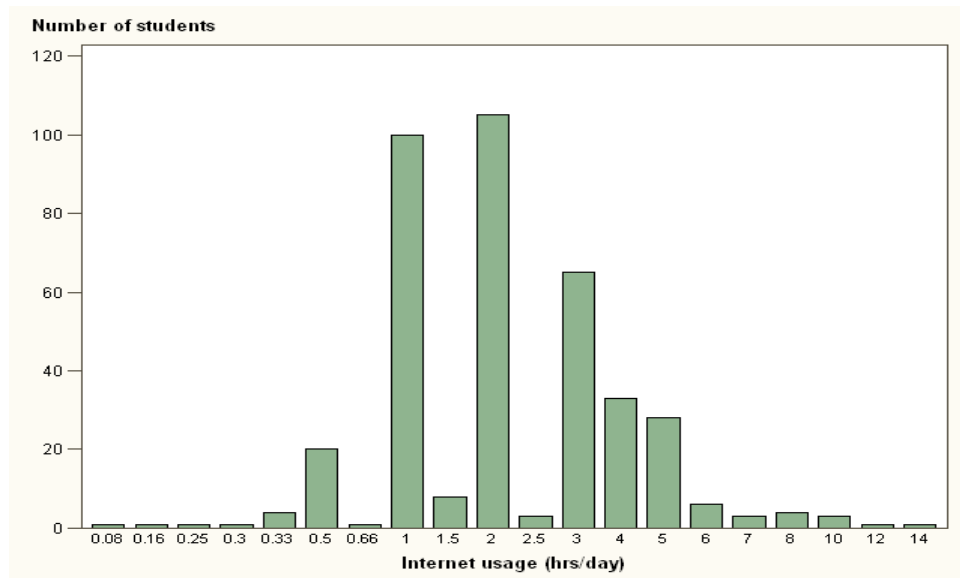


Figure 5.1: Histogram representing Internet usage for the entire sample population

Figure 5.1 confirms as cited in Table 5.3 that students are light Internet users on campus. Indeed, Figure 5.1 confirms that students use the Internet for an average of 2 hours daily on campus as the graph depicts this value as the most frequent reported value for students' daily Internet usage. This graph also confirms that the population is roughly normally distributed as we can see the values for Internet usage are following a bell-shape figure. Please note that one bar represents each unique value for the Internet usage variable and therefore, the gap in between bars does not hide reported values unaccounted for by the diagram.

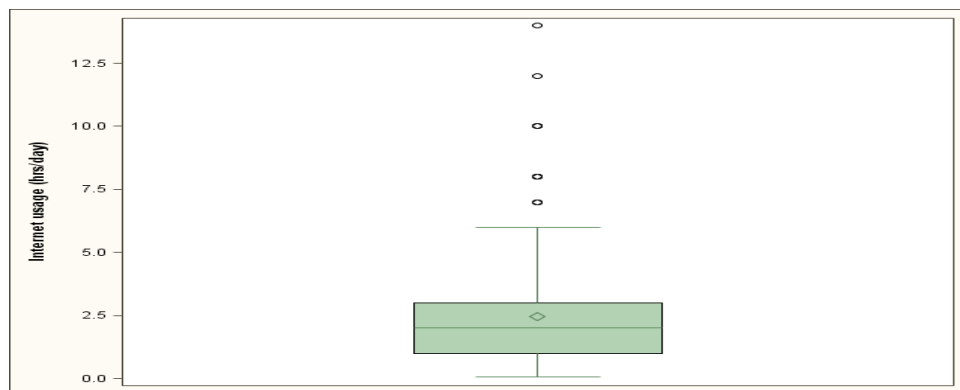


Figure 5.2: Box and Whiskers plot of our sample population

Figure 5.2 reveals that our top whisker is longer than the bottom one, in other words half of the data fall in the range between the median (here 2hrs/day is depicted as the line in the middle of the green box) and roughly 0, whereas the remaining half are spread over a wider range of scores which explains the light skewedness to the right in the Figure 5.1. Moreover, this box plot reveals that there are outliers in our sample depicted by the circles above the green box with darker boxes meaning that more than one case for the matching Internet value have been observed while the lighter ones represent single cases observed. This box plots shows us that there are multiple cases of students who are heavier Internet users on campus than their fellow students. Such cases are important to detect in our study because they may indicate cases of students who miss classes to stay on the Internet or simply that such students stay on university residences (where the Internet is also accessible 24/7) and therefore such students would obviously have longer on campus Internet usage than their fellow students.

Distribution of students based on daily Internet usage:

In the research methodology chapter of this document, we mentioned that students would be classified as either 'Heavy' or 'Light' Internet users depending on whether their daily Internet usage was greater or smaller than the sample mean Internet usage. Prior research such as that conducted by Anderson [2001] made use of a questionnaire developed from the Internet dependency symptoms we mentioned in the Research questionnaire section of this chapter. This instrument having proved solid in comparison to using the sample mean Internet usage (since previous studies never used this method), we thought a good way to assess how reliable it was to use the sample mean to classify students as either 'Heavy' or 'Light' Internet users was then to compare the classification using the sample mean against the classification using the 7 criteria to identify Internet dependency among individuals (an Internet dependent person in this case would have answered 'Yes' to 3 or more questions developed based on these criteria). We made use of the 'compare data' function provided by SAS Enterprise Guide 4.2 to compare the classifications results of both methods and the result reveals that only 122 observations out of our sample of 389 students were not equal. In terms of percentage, it means that 68.64% of our participants were equally classified as either 'Heavy' or 'Light' Internet users by both the sample mean classification method and the Internet dependency symptoms classification. We think it is therefore safe to use the sample mean to classify students in our study as either 'heavy' or 'light' Internet users on campus.

Table of Heavy/Light(Mean) by Heavy/Light(7 criteria)				
		Heavy/Light(7 criteria)		Total
		Heavy	Light	
Heavy/Light(Mean)				
Heavy	Frequency	0	63	63
Light	Frequency	59	0	59
Total	Frequency	59	63	122

Figure 5.3: Distribution of uncorrectly classified students by criterion

Figure 5.3 shows that out of 122 unequally classified students by both the sample mean for Internet usage and the 7 dependency criteria:

- The classification using the sample mean reveals 63 ‘heavy’ against 59 ‘light’ Internet users.
- The classification using the 7 dependency criteria reveals 59 ‘heavy’ against 63 ‘light’ Internet users.

These results show that even though the two criteria differed in the classification of students as either ‘heavy’ or ‘light’ Internet users, the number found in each category when grouped by criterion were almost equal. In other words, the number of ‘heavy’ Internet users according to the mean is almost equal to the number of ‘heavy’ Internet users according to the 7 criteria for Internet dependency, they are respectively 63 and 59. Moreover, each criterion is closed to a perfect symmetric distribution of participants as either ‘heavy’ or ‘light’ Internet users, which in our case would be 61 since there are 122 students in this group. The Chi-Square tests we conducted for both this group and the total sample reveals a probability of both variables to be associated is $p < 5\%$ and therefore there is a potential association between them. Simply put, whether one is a ‘heavy’ or ‘light’ Internet user based on the sample mean Internet usage depends on whether one is classified as ‘heavy’ or ‘light’ Internet user based on the 7 criteria for Internet dependency. One could argue then that a more reliable classification of students as either ‘heavy’ or ‘light’ Internet users would use the intersection of the classifications by both criteria, in other words where the outcomes of the classification by both criteria are equal, but this would not tell us whether or not students honestly reported about their daily Internet usage on campus or correctly responded to items measuring the level of their dependency to the Internet. We believe that only hard data can help us identify whether the two classification methods are reliable. We will investigate this as part of Chapter 6.

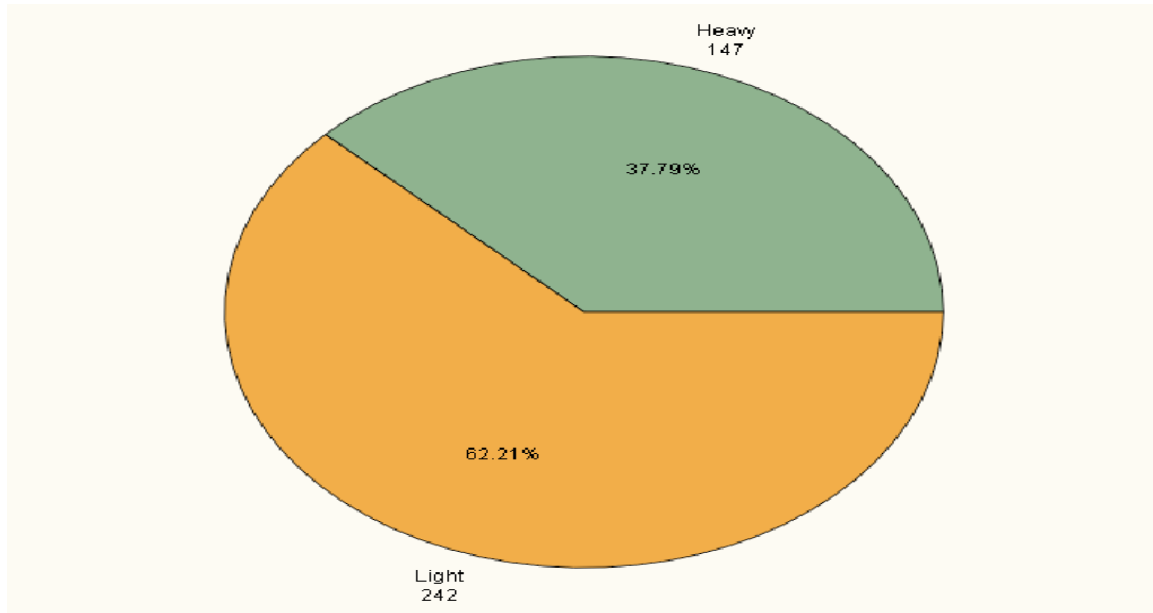


Figure 5.4: Proportions of Internet users by category

Figure 5.4 reveals that about 38% of the total sample population consists of ‘heavy’ Internet users whereas about 62% of them are ‘light’ Internet users on campus based on the sample mean Internet usage. This was to be expected because like we mentioned earlier in between classes starting at 8 AM until 4 PM, students have breaks that can add up to 2 hours during which they can go onto the Internet. If we look back at Figure 5.2, we notice that our outliers represent students who have a daily Internet usage of roughly 6 hours or more. Our sample data confirms that out of these 18 students, 10 are actually living on university residences and therefore their more extensive Internet usage can be explained by the extra hours they spend on the Internet after classes. This supports the argument we elaborated earlier about the importance of giving a particular attention to students staying on residences since due to their more extensive Internet usage on campus, a potential association between Internet usage and academic performance might be more visible with them.

Reasons students use the Internet for:

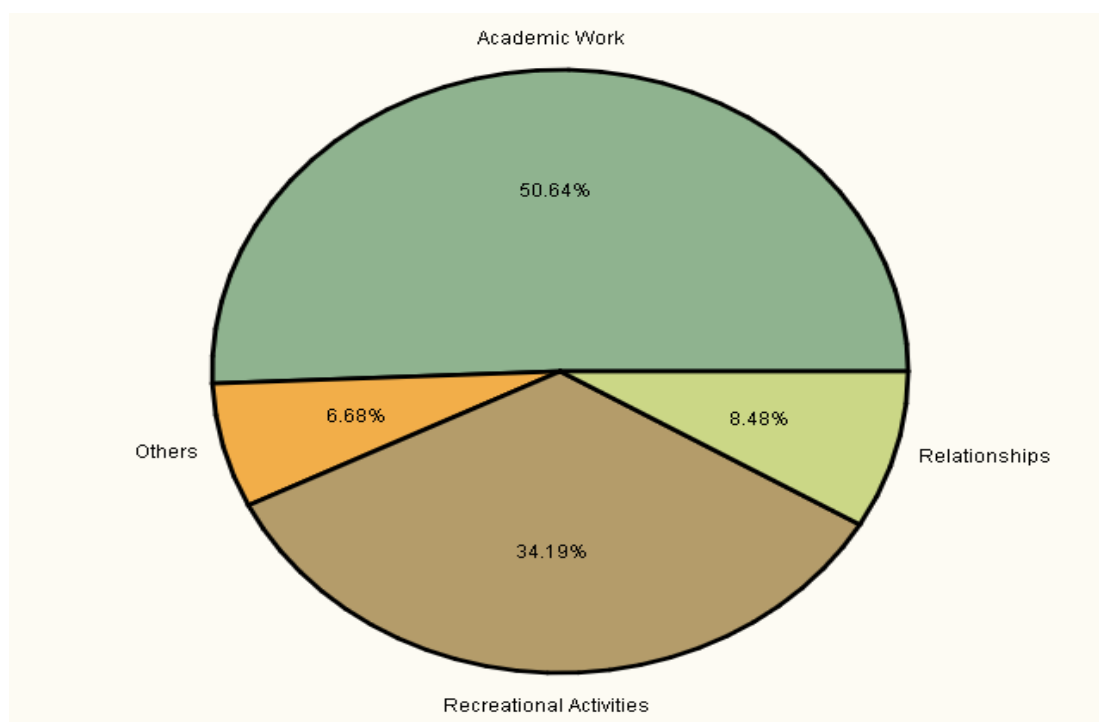


Figure 5.5: Purposes for which students use the Internet

The graph in Figure 5.5 reveals the purposes for which students use the Internet on campus as reported by them. It shows that almost 51% of them use it for Academic purposes, followed by 34% for recreational activities, 8% use it for relationships development and maintenance such as keeping in touch with friends and family over tools such as Skype, and 7% of them use it for other purposes such as job seeking etc. . .

Inferential Phase

In this section of the study, we are going to perform statistical tests that will allow us to determine whether there is any association between the variables measuring: Internet usage, purposes students use the Internet for and reported influence of the Internet on Academic performance.

As previously discussed in this chapter, the sample mean was a strong determinant in classifying students as either 'heavy' or 'light' Internet users. In the tests that follow, we have decided to use Chi-Square tests because they are best at showing whether there is a relationship between categorical variables. The measurement of daily Internet usage allowed us to have a type of user category with 'heavy' and 'light' as sub-categories, the purpose for which students use the Internet was divided into four (4) different categories: Academic work, Relationships development and maintenance, recreational activities and others. All four categories were explained earlier in this document. Finally, the variable measuring reported influence of the Internet on academic performance was divided into three (3) categories: positive, negative and neutral. The results appear in Figure 5.6:

Table of Academic influence by Heavy/Light(Mean)				
		Heavy/Light(Mean)		
		Heavy	Light	Total
Academic influence				
Negative	Frequency	20	18	38
	Deviation	5.6401	-5.64	
	Cell Chi-Square	2.2152	1.3456	
	Percent	5.14	4.63	9.77
	Row Pct	52.63	47.37	
	Col Pct	13.61	7.44	
Neutral	Frequency	15	25	40
	Deviation	-0.116	0.1157	
	Cell Chi-Square	0.0009	0.0005	
	Percent	3.86	6.43	10.28
	Row Pct	37.50	62.50	
	Col Pct	10.20	10.33	
Positive	Frequency	112	199	311
	Deviation	-5.524	5.5244	
	Cell Chi-Square	0.2597	0.1577	
	Percent	28.79	51.16	79.95
	Row Pct	36.01	63.99	
	Col Pct	76.19	82.23	
Total	Frequency	147	242	389
	Percent	37.79	62.21	100.00

Statistic	DF	Value	Prob
Chi-Square	2	3.9797	0.1367
Likelihood Ratio Chi-Square	2	3.8606	0.1451
Mantel-Haenszel Chi-Square	1	3.3597	0.0668
Phi Coefficient		0.1011	
Contingency Coefficient		0.1006	
Cramer's V		0.1011	

Figure 5.6: Chi-Square test results for association between type of Internet user and Academic Influence

Figure 5.6 reveals (in the top table) that out of 147 'heavy' Internet users: 20 reported a negative influence of the Internet on their academic grades, 15 had a neutral opinion on the matter and 112 reported a positive influence of the Internet on their grades. On the other hand, out of 242 'light' Internet users: 18 reported a negative influence of the Internet on their academic grades, 25 had a neutral opinion and 199 reported a positive influence of the Internet on their grades. Overall, 'light' Internet users reported a more positive influence of the Internet compared to 'heavy' Internet users, their proportions were respectively 82.23% and 76.19%. The table in Figure 5.6 also reveals that 13.61% of 'heavy' Internet users compared to only 7.44% of the 'light' Internet users reported a negative influence of the Internet on their academic grades. Furthermore, of those who reported a negative influence of the Internet on their grades, 52.63% were found to be 'heavy' Internet users while 47.47% were found to be 'light' Internet users.

Although one would be quick to conclude based on our early cited results that heavier Internet

usage can be associated with a negative perception of the Internet influence on a student's academic grades, the bottom table of Figure 5.6 actually reveals statistics that will make such a conclusion wrong. This figure shows that there is no statistically significant relationship between the type of Internet user and the reported influence the Internet has on students' academic grades: with a degree of freedom $DF=2$, the computed Chi-Square value is 3.9797 with a probability of both variables being associated $p = 0.1367(p > 0.05)$.

Table of 1st reason by Heavy/Light(Mean)				
		Heavy/Light(Mean)		
		Heavy	Light	Total
1st reason				
Academic Work	Frequency	58	139	197
	Col Pct	39.46	57.44	
Others	Frequency	10	16	26
	Col Pct	6.80	6.61	
Recreational Activities	Frequency	64	69	133
	Col Pct	43.54	28.51	
Relationships	Frequency	15	18	33
	Col Pct	10.20	7.44	
Total	Frequency	147	242	389

Statistic	DF	Value	Prob
Chi-Square	3	12.7072	0.0053
Likelihood Ratio Chi-Square	3	12.7343	0.0052
Mantel-Haenszel Chi-Square	1	11.4075	0.0007
Phi Coefficient		0.1807	
Contingency Coefficient		0.1779	
Cramer's V		0.1807	

Figure 5.7: Chi-Square test results for association between type of Internet use and purpose for which the Internet is used

The top table of Figure 5.7 reveals that academic work is the most reported reason for which students use the Internet on campus, 197 out of 389 participants reported using the Internet for academic purposes. This reason is then followed by recreational activities with 133 out of 389 participants, relationships development and maintenance with 33 out of 389 students, then other purposes with 26 out of 389 students. As the main focus of our research is to show whether there is an association between Internet usage and academic performance, we notice when looking at the same table that 'light' Internet users reportedly use the Internet for academic purposes more than 'heavy' Internet users as respectively reported by 139 vs 58 out of the 197 students whose main reason to use the Internet was for academic work.

Among 'light' Internet users, 57.44% of them reported academic work to be the main reason they use the Internet whereas for 'heavy' Internet users, engaging in recreational activities was the most common reported reason for using the Internet as was reported by 43.54% of them.

The bottom table of Figure 5.7 reveals that there is a statistical relationship between the type of Internet user and the reported reasons for using the Internet: the calculated Chi-Square value is 12.7072 with a probability of an association between the two variables being $p = 0.0053(p < 0.05)$, the degree of freedom $DF=3$.

Table of 1st reason by Academic influence					
1st reason		Academic influence			Total
		Negative	Neutral	Positive	
Academic Work	Frequency	8	8	181	197
	Col Pct	21.05	20.00	58.20	
Others	Frequency	3	3	20	26
	Col Pct	7.89	7.50	6.43	
Recreational Activities	Frequency	22	24	87	133
	Col Pct	57.89	60.00	27.97	
Relationships	Frequency	5	5	23	33
	Col Pct	13.16	12.50	7.40	
Total	Frequency	38	40	311	389

Statistic	DF	Value	Prob
Chi-Square	6	37.3726	<.0001
Likelihood Ratio Chi-Square	6	38.7936	<.0001
Mantel-Haenszel Chi-Square	1	28.7478	<.0001
Phi Coefficient		0.3100	
Contingency Coefficient		0.2961	
Cramer's V		0.2192	
WARNING: 33% of the cells have expected counts less than 5. (Asymptotic) Chi-Square may not be a valid test.			

Fisher's Exact Test	
Table Probability (P)	3.016E-13
Pr <= P	2.436E-07

Figure 5.8: Chi-Square and Fisher's Exact tests results for association between purpose Internet is used for and Academic Influence

The top table in Figure 5.8 reveals that of the 311 participants that reported a positive influence of the Internet on their grades for the past 2 years, 58.20% reportedly used it for academic purposes. The table further reveals that participants who reported a greater negative influence of the Internet on their academic grades, mostly use the Internet for recreational activities, they accounted for 57.89% of the sample population. This table confirms the finding that we mentioned earlier notably that students use the Internet for academic purposes and that the Internet has positively influenced their academic grades over the past 2 years as reported by almost 80% of our participants. The above findings are confirmed by the bottom table which shows that there is a small relationship between the purpose students use the Internet for and their perception of how it has influenced their academic grades. We decided to confirm this with the results of the Fisher's Exact Test because the Chi Square test may not be valid since some cells had expected counts of less than 5. The Fisher's Exact Test reveals that the probability of both variables being associated is $p = 2.436E - 07 (p < 0.05)$, therefore there is a relatively small relationship between what students use the Internet for and how they perceive the Internet has influenced their grades.

Table of Internet for improving grades? by Academic influence					
		Academic influence			Total
		Negative	Neutral	Positive	
Internet for improving grades?					
Neutral	Frequency	2	2	6	10
	Col Pct	5.26	5.00	1.93	
No	Frequency	20	14	63	97
	Col Pct	52.63	35.00	20.26	
Yes	Frequency	16	24	242	282
	Col Pct	42.11	60.00	77.81	
Total	Frequency	38	40	311	389

Figure 5.9: Chi-Square and Fisher's Exact tests results for association between Internet for improving grades and Academic Influence

Figure 5.9 reveals that 52.63% of the participants who reported a negative influence of the Internet on their grades do not actually use it to improve them. However, 77.81% of those who reported a positive influence of the Internet on their academic grades actually use the Internet for improving them. It will be of interest to then report on the kind of activities students who use the Internet to improve their academic grades actually use the Internet for. Before getting to that, the bottom table of this figure reveals that there is a small statistical relationship between whether students use the Internet for improving their grades and how they perceive it has influenced their academic performance over the past 2 years. The Fisher's Exact test confirms the existence of this relationship by revealing the probability of both concepts to be associated being $p = 3.316E - 05 (p < 5\%)$.

Table of Internet for improving grades? by 1st reason						
		1st reason				Total
		Academic Work	Others	Recreational Activities	Relationships	
Internet for improving grades?						
Neutral	Frequency	1	1	8	0	10
	Row Pct	10.00	10.00	80.00	0.00	
	Col Pct	0.51	3.85	6.02	0.00	
No	Frequency	43	8	34	12	97
	Row Pct	44.33	8.25	35.05	12.37	
	Col Pct	21.83	30.77	25.56	36.36	
Yes	Frequency	153	17	91	21	282
	Row Pct	54.26	6.03	32.27	7.45	
	Col Pct	77.66	65.38	68.42	63.64	
Total	Frequency	197	26	133	33	389

Figure 5.10: Chi-Square and Fisher's Exact tests results for association between Internet for improving grades and main online activities

The table in Figure 5.10 reveals that 54.26% of the students who reported using the Internet for improving their grades use it for academic work mainly but also of those who reported not using the Internet for improving their academic grades, most of them; 44.33% also used it mainly for academic work. Only 80% of our participants who remained neutral about whether they use the Internet for improving their grades reported using it mostly for recreational activities. Although the Fisher's Exact test probability of 0.0196 ($p < 0.05$) reveals that there is an association between whether students use the Internet for improving their grades and the activities they are involved in online, the fact that those who reported not using the Internet for improving their grades mainly use the Internet for academic purposes too. We thought it would then be interesting to know what such students reported about how they perceive the Internet has influenced their academic grades over the last 2 years. The results appear in Figure 5.11:

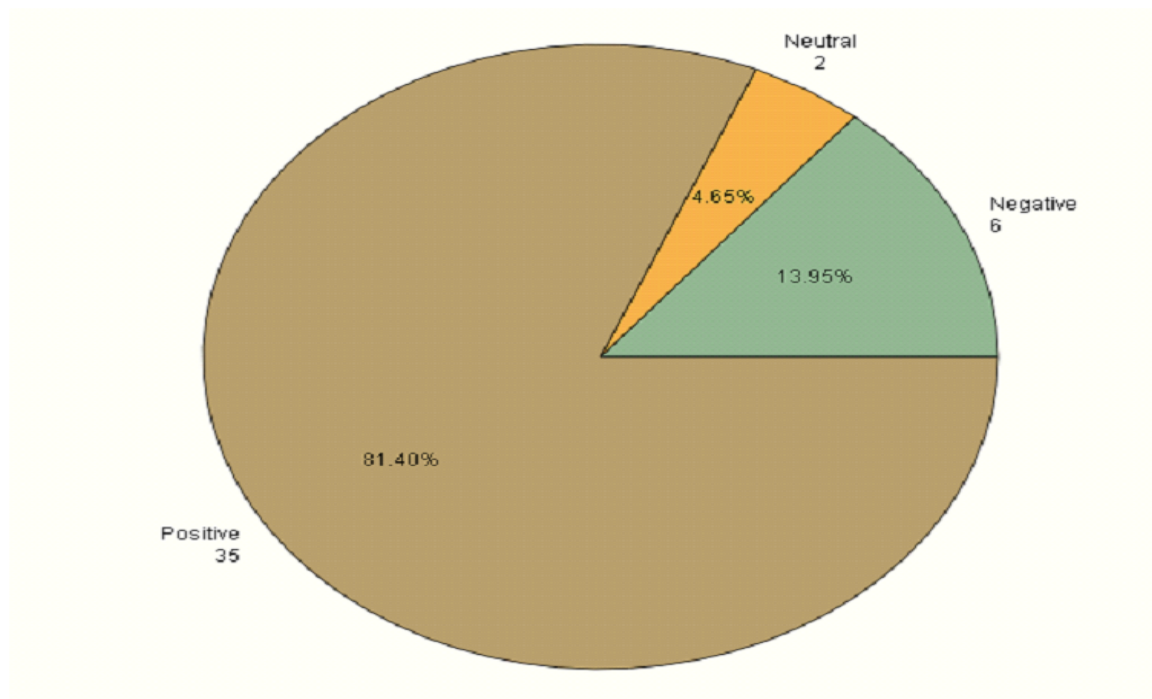


Figure 5.11: Internet for improving grades by its perceived influence on academic grades

The diagram appearing in Figure 5.11 reveals that of the students who reported not using the Internet for improving their grades and using it mostly for academic purposes, 81.40% of them reported that the Internet has had a positive influence on their academic grades against only 13.95% who responded negatively and 4.65% were neutral. This result, which we find a bit ironic, suggests that there is a possibility that students may not have been completely honest with regards to either their online activities or the influence the Internet has had on their academic performance. We think this might be the case because one would not expect students to report that although they use the Internet mostly for academic work and it turned out to be academically productive, they were not using it to improve their grades. This highlights the need for a reliable research instrument when collecting data regarding students' Internet usage and the influence it has on their academic performance.

5.1.4 Discussion

Although we have used the sample mean throughout this study to classify students as either 'heavy' or 'light' Internet users, when we used the 7 criteria for Internet dependency as used by Anderson [2001], we found that almost 37% of our participants showed symptoms of Internet dependency compared to 63% who did not. This result concurs with findings by Scherer [1997], Morahan-Martin and Schumacher [2000], Anderson [2001], Kubey *et al.* [2001], Metzger *et al.* [2003], and Fortson *et al.* [2007] that there is an existence of Internet dependency among university students. This study also reveals that almost 38% of our sample population use the Internet daily for more than 2.45 hours compared to about 62% of the total sample, therefore 38% of them were classified as 'heavy' Internet users and the remaining 62% as 'light' Internet users. The two above mentioned findings confirm that the sample mean Internet usage that was never used before as a way of grouping students under 'heavy' or 'light' Internet users groups is as reliable as the 7 criteria for Internet dependency symptoms used in previous studies. As we mentioned in the interpretation of Figure 5.2, 10 out of 18 students (about 56%) whose Internet usage were identified as outliers, were living in university residences. Even though we asked students to report only about their Internet usage on campus when handing out the questionnaires, we believe that if we were to ask students to report about their overall daily Internet usage both on and off campus, the distribution of 'heavy' vs

'light' Internet users could have been different. Since we had no way to measure students' Internet usage off campus for the quantitative study that follows, for the sake of consistency of sampling procedures between the two studies, we verbally asked students to only report about their Internet usage on campus. Therefore, we acknowledge that the probable finding of a different distribution in the types of on-campus Internet users in the study that will follow may highlight the unreliability of students self-reports.

Our study reveals in contrast to Scherer [1997], Jones [2002], Fortson *et al.* [2007], Young [1996], Rumbough [2001], and Metzger *et al.* [2003] who respectively found relationship maintenance and recreational activities to be the most predominant reasons students use the Internet that students mostly use the Internet for academic work, then for recreational activities, then for relationships maintenance, they respectively accounted for 50.54%, 34.19% and 8.48% of the total sample. Furthermore, we discovered that 'heavy' Internet users used the Internet mainly for recreational activities as opposed to 'light' Internet users who reported using the Internet mostly for academic purposes. They respectively were in the following proportions: for recreational activities, 43.54% vs 28.51% and for academic work 39.46% vs 57.44%. This finding corroborates Morahan-Martin and Schumacher's [2000] finding as far as 'heavy' Internet users are concerned, even though in their study the authors failed to show what was the major reason for which 'light' Internet users used the Internet.

We have revealed in Figure 5.6 that overall, no matter the category of Internet users they belong to, students perceive the Internet as a positive contributor towards their academic performance as reported by Ogedebe's [2010] study which also just like our qualitative study reveals that academic work is the main reason for which students use the Internet as reported by 45% of its participants. This was reported by 79.95% of our sample whereas only 9.77% and 10.27% respectively reported that the Internet had a negative and a neutral influence on their academic performance. This finding is in concordance with Lubans [1999], Scherer [1997], and Jones [2002] who also reported in their studies that most students believed the Internet had a positive impact on their academic performance. However, in agreement with Kubey *et al.*; Hazelhurst *et al.*'s [2001; 2011]'s findings we found that of those who reported a negative influence of the Internet on their academic grades, 52.63% were 'heavy' Internet users and 47.37% were 'light' Internet users. Moreover, of the identified 'heavy' Internet users, only 13.61% reported the Internet has negatively influenced their grades, while 10.20% had a neutral opinion and 76.19% of them reported a positive influence. The finding that most students who reported a negative influence of the Internet on their academic grades were initially identified as 'heavy' Internet users positively answers our first research question. However we also found that the majority of students who were labelled as 'heavy' Internet users reported a positive influence of the Internet on their grades, thus providing a negative answer to our second research questions. For an excessive Internet usage to be associated with a decreasing academic performance, we believe that there needs to exist a mutual relationship between both concepts, in other words, if an excessive usage of the Internet is associated with a decreasing academic performance, similarly, a decreasing academic performance needs to be associated with an abusive usage of the Internet. Unfortunately our findings could not find evidence of such an association as was confirmed by the results of the Chi-Square test in Figure 5.6, the probability found was greater than 5%, eliminating therefore any probability of extensive Internet usage being correlated to impaired academic performance.

This study has confirmed findings from some aforementioned authors that 'heavy' Internet users use the Internet more for recreational purposes than 'light' users as shown in Figure 5.7. Also, we found that the more the Internet was used for academic work, the more likely it was to be perceived as a positive contributor to students' academic performance increase as depicted in Figure 5.8. This finding when coupled with the ones we previously mentioned raises the hypothesis that the Internet in itself may not have any effects whether used excessively or not, but factors such as the reason it is being used for, whether it is used for improving grades or not may contribute to how it is being perceived with regards to the main reason it was brought to campus for: as an educational support tool. This is confirmed by the results appearing in Figure 5.9 which shows that students who reported using the Internet for improving their grades reported a more positive influence of the Internet on their grades and those who did not, reported otherwise. Figure 5.10 takes this further by showing that students who

used the Internet for academic reasons use it for improving their grades. Therefore future studies could look into this hypothesis to also determine if indeed using the Internet for academic purposes helps in a positive perception of its contribution to students' academic grades regardless of whether one is a 'heavy' or a 'light' Internet user.

This study also confirms the need for more reliable research instruments as suggested by Young [1996], Rumbough [2001], Gross [2004], and Fortson *et al.* [2007] because as depicted in Figure 5.8, students who use the Internet for recreational activities reported a more negative influence than positive of it on their academic grades but yet identified 'heavy' Internet users who reported using it mostly for the aforementioned reason reported a positive influence of the Internet on their grades. This finding which is somehow contradictory highlights the possibility of students not being completely honest when reporting about their Internet usage habits and the effects they have on their academic performance. Indeed, how can one not use the Internet for academic purpose but yet report it as having a positive influence on one's grades? The need for a further investigation into this question is confirmed by the results in Figure 5.9 which shows that students who reported not using the Internet for improving their grades reported nonetheless that the Internet has had a positive influence on their grades.

5.1.5 Conclusion

In summary, the different answers we gathered from the 389 correctly filled questionnaires we collected allowed us to confirm that there is indeed an existence of Internet dependency among students. Academic work was found to be the main reason students use the Internet on campus and the students we classified as 'heavy' Internet users were found to use the Internet more for recreational purposes than 'light' Internet users and also the more the Internet was used for academic work the more it was perceived to exert a positive influence on academic grades. In the next chapter of this document, we detail the quantitative study we conducted using Squid proxy logs recorded by the university for 359 out of the 389 participants we used for the qualitative study. This study will use the recorded logs to measure the time students spend online on campus, the kind of websites they go to which will be combined with their courses final grade so as to establish if there is an association between Internet usage and academic performance.

5.2 Quantitative study

5.2.1 Introduction

In this section, we cover the second part of our mixed methods research that involves the conduct of a quantitative study whose aim is to identify evidence of a correlation between extensive Internet usage on campus and degrading academic performance among university students. This study will make use of hard data and will (by the nature of the reliability of the kind of data we are going to use) either corroborate or refute the findings we discussed earlier in the qualitative study chapter of this document. We therefore start this chapter with a review of the methodology we used to conduct this study, then the data analysis and results interpretation section of the data we collected and we finish with a discussion of this study's findings in comparison to the findings from the literature we reviewed in this domain. At the end of this study, we expect to have answered the following research questions:

1. Are 'heavy' Internet users 'bad' students?
2. Are 'bad' students 'heavy' Internet users?

5.2.2 The Methodology

The Sample

Our sample population consists of the same student sample we used in the qualitative study chapter of this document. We decided to use the same sample population so that when we triangulate the findings of the two research methodologies we used, our findings of evidence of an association between extensive Internet usage and academic performance impairment will be more reliable. Also we would be able to identify potential inconsistencies between students' self-reports and the collected hard data. Upon our request and after ethical clearance was granted, the Academic Information Systems Unit (AISU) and the Computer Network Services (CNS) at Wits University respectively provided us with our participants' academic grades (course final grade for each year relevant to our study) and Squid proxy logs files for the years 2008 through 2010. After receiving the information we requested from CNS and AISU, our sample population consisted of only 359 students because of the 389 we surveyed in the qualitative study, 18 students provided us with wrong student numbers and CNS could not get any proxy logs for 12 other students. With such a small quantity of data compared to our total sample, we decided to proceed with the 359 students worth of data anyway because we concluded it would not have much of an influence on our conclusions.

The Research Instrument used

We mentioned in the literature review chapter of this document, that there was a strong need for more reliable instruments to be developed when measuring students' online usage after the shortcomings of self-reported data were exposed as expressed by Young [1996], Rumbough [2001], Gross [2004], and Fortson *et al.* [2007]. We therefore decided that since the university (and this should be the case in most academic institutions across the globe) records its network's users' activities online for its information security and resource usage policies, we could actually use such records in our study because they would truly be reflective of students' real habits when they are online. At Wits University, CNS keeps such records under a Squid proxy logs file format. Each network user therefore has his/her daily Internet activities recorded in a squid proxy log file under his/her university person number. Everytime a new web request is performed during a day, it is recorded as a new line. Each access.log entry consists of about ten fields organized in columns. The main fields we were interested in were: the date, the bandwidth used, and the URL visited. We then developed a Java application that helped us process these files in order to retrieve only the information we needed in the access.log file.

Variables measured

The following variables were measured in our study:

Internet Usage. We retrieved student's bandwidth usage (converted from bytes to MB) from the log files. Since for multiple network failure reasons we did not manage to get logs for each day of the 2 years requested, we decided to compute the yearly average over a 2 year period of all the distinct bandwidth values retrieved for each of our participants so that we could arrange students as either 'heavy' or 'light' Internet users based on the 2 year average bandwidth usage of the whole group.

Educational vs. Non-Educational Internet usage. This variable helped us determine the purpose students use the Internet for on campus. We retrieved the top 10 websites frequently visited by students to determine how much of their Internet browsing on campus is academically related. We then went onto each particular website so that we could determine whether they are academic-related, entertainment-related, relationships maintenance and development related types of websites amongst others.

Academic Performance. In most tertiary academic institutions in South-Africa an average of 65% qualifies a student as a 'good' student. We computed students' average mark from the weighted average marks we received from AISU for the years 2008 through 2010 to classify students as either 'good' (if average grade is greater than or equal to 65%), 'average' (if average grade is between 50% inclusive and 65%) and 'bad' (if average grade is below 50%).

We also stored the yearly average bandwidth usage as well as their matching weighted average mark to investigate a potential trend/pattern in academic grades variations according to varying Internet bandwidth used.

5.2.3 Data Analysis and Results Interpretation

In this section, we are going to report about the procedure we followed to treat the data and how much time was taken to actually collect the hard data we needed for this study, in this case they are students' weighted average mark for the years 2008 through 2010 and their Squid proxy logs files. Following this phase, we will report about the different statistical analyses we performed to answer the two research questions we mentioned earlier. Like in the qualitative study section of our research, the statistical analyses performed are divided into two parts: an exploratory statistics section that includes descriptive statistics that will help us appropriately understand our data then an inferential statistics section in which we explain the different calculations performed to determine if there is any association between Internet usage and academic performance among 3rd year university students at Wits or between any variables measured in this study as mentioned earlier. Just like for the qualitative study section reported prior to this study, all statistical computations to appear were performed using SAS Enterprise Guide version 4.2.

Data Collection Procedure and Treatment

As we mentioned earlier, Squid Proxy log files and weighted average marks for the years 2009 through 2010 were collected by respectively sending the student numbers of our participants to CNS and AISU. Upon reception of the requested data, for confidentiality purposes, all student numbers were replaced by their corresponding questionnaire random number. The created file in which student numbers were matched with the random numbers appearing on the questionnaires was given to the research supervisor of this study. Similarly, after this file was created, all the questionnaires, whether filled correctly or incorrectly were transmitted to AISU as per this department's request to have them included into each participants' student file kept by Wits. We would like to inform our readers that the number of students used in this study is lower than the one from the qualitative study because upon receiving feedback from AISU, we realised that 18 of our participants did not supply us with their correct student numbers. As we

did not think it will cause any prejudice to our overall study, we decided not to remove their contribution to the survey we initially conducted.

Once this process was completed, each file was processed by the Java application we developed that stored the information we needed from the proxy logs such as website visited, bandwidth consumed, date into a subsequently created MySQL database. The database stored each participants' Internet activities into a separate table. After all tables had been created, we performed queries on each table to retrieve information such as bandwidth consumed, websites visited. The results of these queries were stored into a Microsoft Excel document as a single sheet to which the weighted average marks of the participants were manually appended. This Excel file was later imported into a SAS project for subsequent statistical analyses.

This process took about 6 months to complete because the servers storing Squid proxy logs at CNS are not dedicated to either staff or students only but to both groups and as I was informed by this department, retrieving such logs was a time consuming task since 11*2=22 months (each academic calendar is nearly 11 months long) worth of logs were requested for each of our participants. However due to the fact that the servers conventionally keep logs for a period of 12 months only, we ended up having often less than 22 months worth of Squid proxy logs which in a way may affect our findings.

Exploratory Phase

The purpose of this phase of our study is to report about descriptive statistical computations we performed to better understand our sample population. Just like in the qualitative study section of this chapter, these calculations are meant to reveal evidence of a potential correlation between Internet usage and academic performance so as to confirm the validity of the results we will gather from the subsequent inferential tests we will conduct.

For this study, we have decided to use the mean bandwidth usage throughout the years 2009 to 2010 as well as the mean weighted average marks for the same years. The calculated variables are the ones we are going to be using for the statistical analyses we are going to conduct in the future.

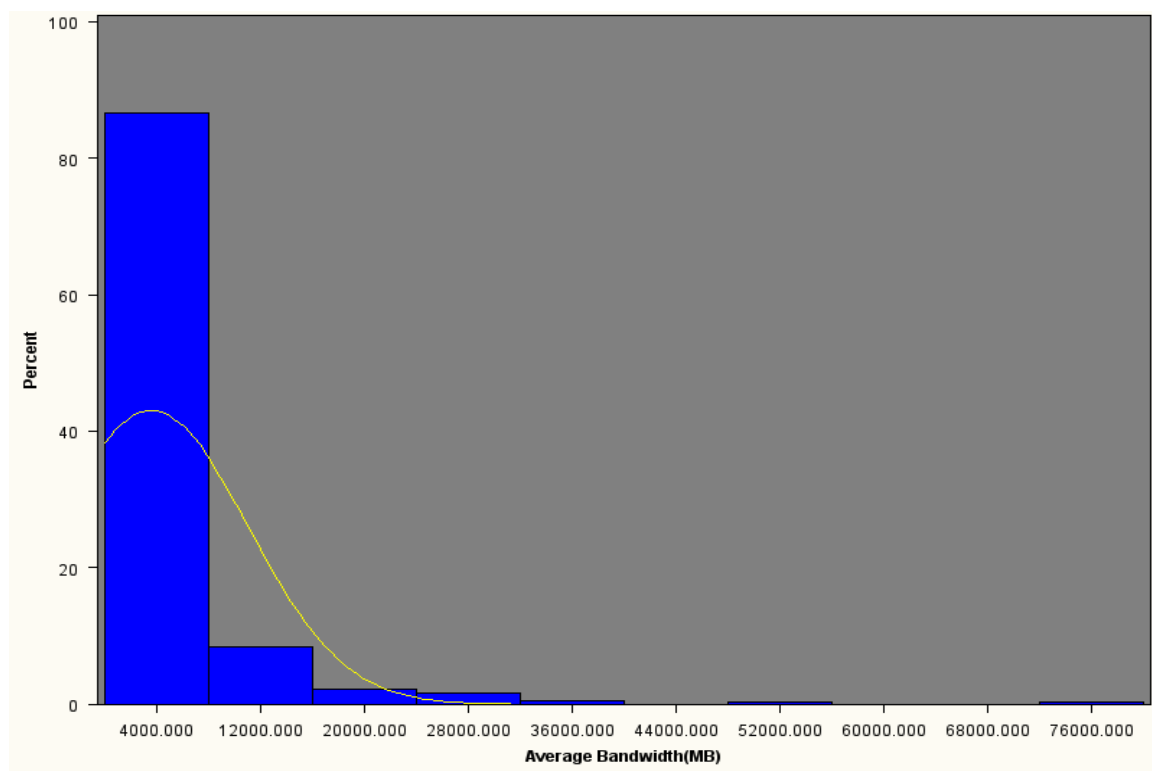


Figure 5.12: Histogram representing Internet usage for the entire sample population

The diagram appearing in Figure 5.12 reveals that in general, students are heavy Internet users because the averages observed for bandwidth consumed are in the range of thousands of megabytes of data downloaded per year. Also, our sample population is not normally distributed as we can see from the diagram, our data distribution is positively skewed. However, statistical inferences are based on the assumption that the data used is normally distributed. Therefore, using this data as it is will probably lead us to drawing mistaken inferences on the student population we are using in this research. We therefore decided to ‘change’ our data so that it does not violate the normality assumption usually made when conducting inferential statistics computations. The three possible approaches that are known when dealing with violations of the normality assumption as explained by Myers *et al.* [2010] are:

- *Transformations of data*
- *Trimming outliers*
- *Tests based on ranks*

We decided to go for the transformations of data because:

1. outliers may be cases that need special attention and thus trimming them might make us lose potential factors of evidence of an association between extensive Internet usage and academic performance impairments.
2. We only have one population distribution therefore there was no need for using tests based on ranks.
3. Our data distribution is positively skewed (here the tail on the right side is longer than the tail on the left side as depicted in the above diagram)

Transformation of the data and sample distribution:

We decided to use the logarithmic transformation over square-root and reciprocal transformations because of the three attempted transformations, it was the one that achieved better symmetry in the distribution of our sample data. Therefore all the statistical tests to appear in this quantitative study will be based on the log transformed data.

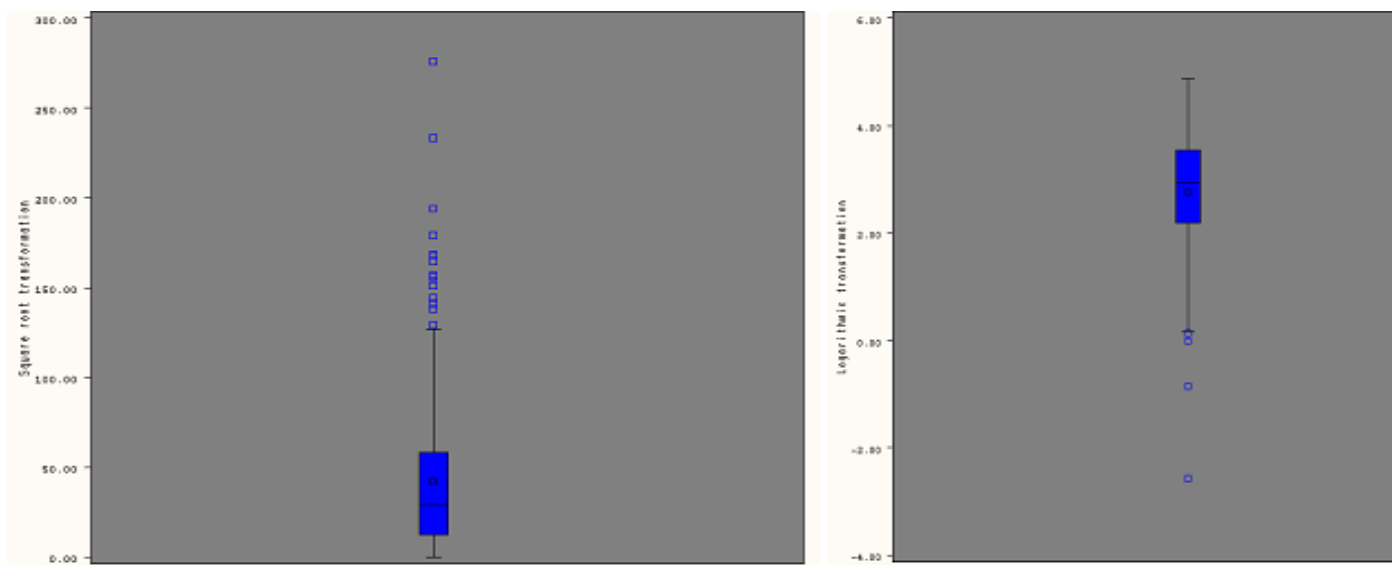


Figure 5.13: Boxes and whiskers plots for the transformed data

The diagram appearing in Figure 5.13 represents box and whiskers plots of the data after it has been square root transformed (left picture) and log transformed (right picture). Notice that after the data has been square root transformed, its distribution still shows a bit of skewness. As the picture on the left of the figure shows, the lower whisker and the lower half of the box are altogether much smaller than the upper half of the box and the upper whisker, which means that after this transformation, our distribution still displayed characteristics of a positive skewness of the distribution. However, as depicted on the right side of the above figure, the log transformed data shows a better symmetry between the lower whisker and lower half of the box, and the upper whisker and the upper half of the box. Moreover, as we mentioned above, trimming outliers which is known as an approach to deal with skewed data distribution has been accomplished by the logarithmic transformation. As Figure 5.13 shows, the log transformed data on the right has fewer outliers (depicted by the little squares below the lower whisker) than the square root transformed data on the left. Please note that the outliers observed in the log transformed data represent the log transformed Internet bandwidth usage of students who actually happen to be the students for whom we did not receive 22 months worth of logs as we indicated in the above ‘data collection procedure and treatment’ section of this study. This means that the classification of these students into either the ‘heavy’ or ‘light’ Internet users category could have been biased. However, we were lucky enough that the logs we received for these few students were nearly one year long and therefore what we did was just for these particular students for which we only received logs data worth one year only, we only used the course grade they received for the year that corresponds to the year for which we managed to get logs data. Therefore, by reducing the time period of our study from 2 years to 1 year for these students, their classification as either ‘heavy’ or ‘light’ Internet users was fair.

Measures of central tendency and dispersion:

Basic Statistical Measures			
Location		Variability	
Mean	2.768411	Std Deviation	1.04556
Median	2.929148	Variance	1.09320
Mode	.	Range	7.44708
		Interquartile Range	1.34790

Table 5.4: Measures of location and spread for the total population sample

The results of the basic statistical measures reported in Table 5.4 confirms our previously mentioned conclusions that the log transformed data is normally distributed because there is not much difference between the mean and the median, their values vary respectively between 2.8 and 2.9. In other words, students consume on average between 630MB and 800MB of bandwidth per year while online. This result shows that students are relatively light on campus Internet users. However, while this may be a misrepresentation of actual students’ Internet bandwidth consumption on campus due to the fact that we did not get 22 months worth of Squid proxy logs, a counter-argument to this may be that students often have 8AM to 4PM full timetables. It is important to note that only labs may involve the use of computers during which students have limited opportunities to browse non-educational related websites which usually have more bandwidth consuming materials than academic websites.

Distribution of students based on yearly average Internet bandwidth consumed and Academic Performance:

Table of heavy_light by good_bad					
		Good/Bad			Total
		Average	Bad	Good	
Heavy/Light					
Heavy	Frequency	66	8	12	86
	Col Pct	27.85	30.77	12.50	
Light	Frequency	171	18	84	273
	Col Pct	72.15	69.23	87.50	
Total	Frequency	237	26	96	359

Figure 5.14: Distribution of students by Internet usage and Academic Performance

The table in Figure 5.14 shows the distribution of our student population based on the sample mean Internet usage (which was found to be roughly equal to 3575 MB before our data being log transformed for normality then 589MB once log transformed) and their academic performance ('good' students would have an average academic performance of 65% over our target three year time period). This table shows that 273 out of 359 (roughly 76%) of our participants are 'light' Internet users on campus while only 24% are 'heavy' Internet users. Similarly 237 out of 359 (about 66%) of our participants were classified as 'average' students, 26 out of 359 (about 7%) as 'bad' students while the remaining 27% were classified as 'good' students. This table, however, does not tell us much about the impact the Internet has on students' academic performance because 'light' users are the most numerous in all three categories of students. This is mainly explainable by the difference in the sizes of the two categories of Internet users as reported in the beginning of this paragraph. It is therefore of importance to look at what the two groups use the Internet primarily for.

Reasons students use the Internet for:

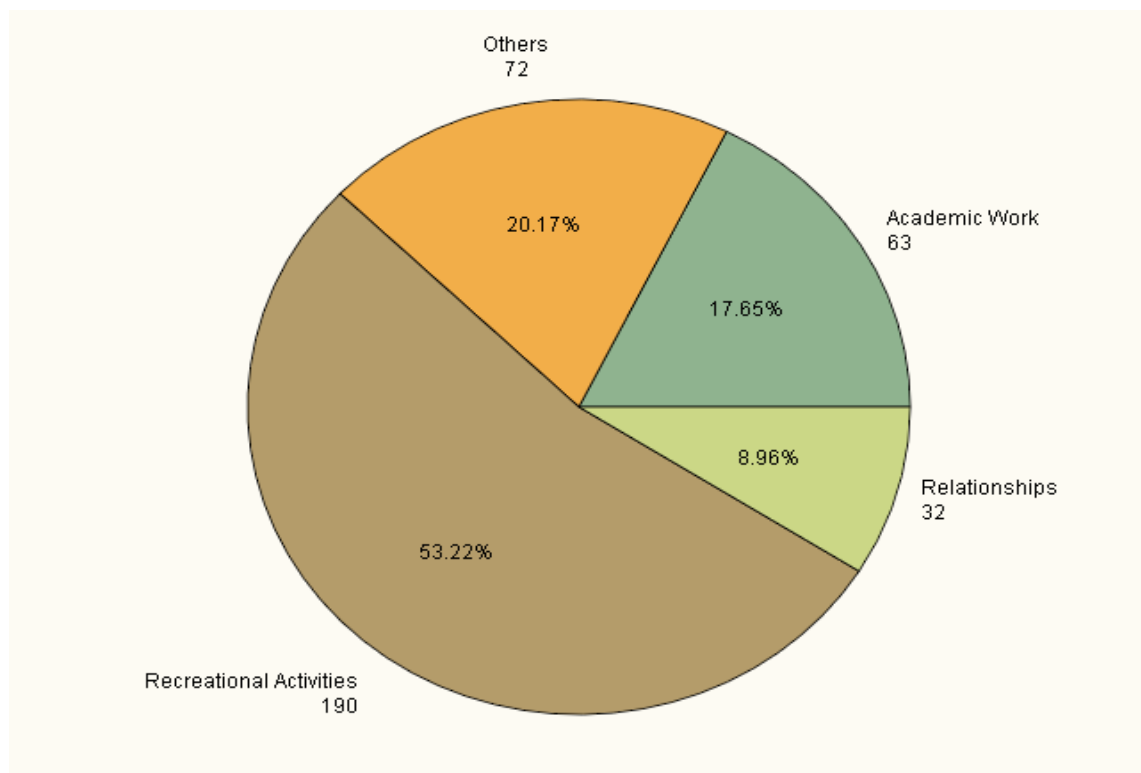


Figure 5.15: Purposes students use the Internet for

The pie chart in Figure 5.15 shows that the majority of our participants use the Internet mostly for recreational activities as discovered for 53.22% of them. Then 20.17% of them were reported using the Internet for other purposes such as job hunting or looking for accommodation, reading online news etc. . . . Academic work and relationships development and maintenance were the last two reasons students use the Internet for on campus, as discovered for 17.65% and 8.96% of our participants respectively. Appendix E lists the 10 websites that were visited the most over the years 2009 through 2010 which substantiate the figures given in the pie chart above. It is then important to have a look at the purposes for which our two categories of Internet users use the Internet because we found earlier that 'light' Internet users were the most numerous in all three categories of students. We expect this analysis to shed light into whether there is a difference in the purposes all groups use the Internet for.

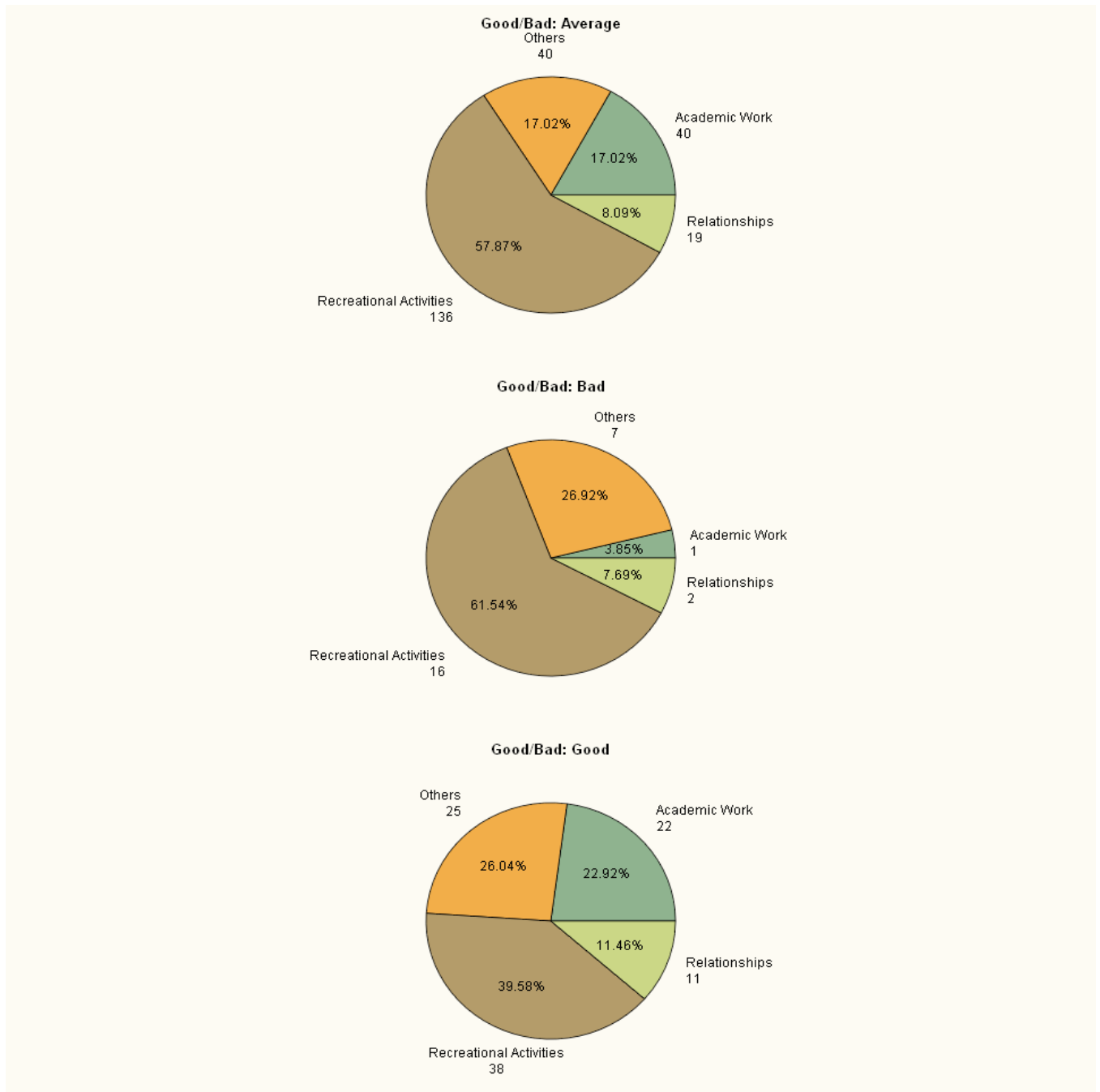


Figure 5.16: Purposes students use the Internet for by category of students

Although Figure 5.16 confirms the order of the purposes our participants use the Internet for, there is a considerable difference in the proportion each purpose is used among ‘good’, ‘average’ and ‘bad’ students. The diagram above reveals that ‘bad’ students use the Internet for recreational activities significantly more than ‘good’ and ‘average’ students, they are in the respective proportion of 61.54% against 39.58% and 57.87%. Moreover, ‘good’ students use the Internet for academic work considerably more than their ‘bad’ and ‘average’ counterparts, they are in the respective proportions of 22.92% against 3.85% and 17.02%.

Effects of Internet usage on students’ academic performance:

In this section of this chapter, we will be reporting on the different analyses we performed to determine whether students’ academic grades may be affected by how students use the Internet on campus.

We will therefore in this line of thought, compare the purposes for which ‘heavy’ and ‘light’ students use the Internet as well as plotting a scatter plot graph that would help us descriptively determine whether there is any association between Internet usage and students’ academic performance before we get to the inferential tests phase of our quantitative study.

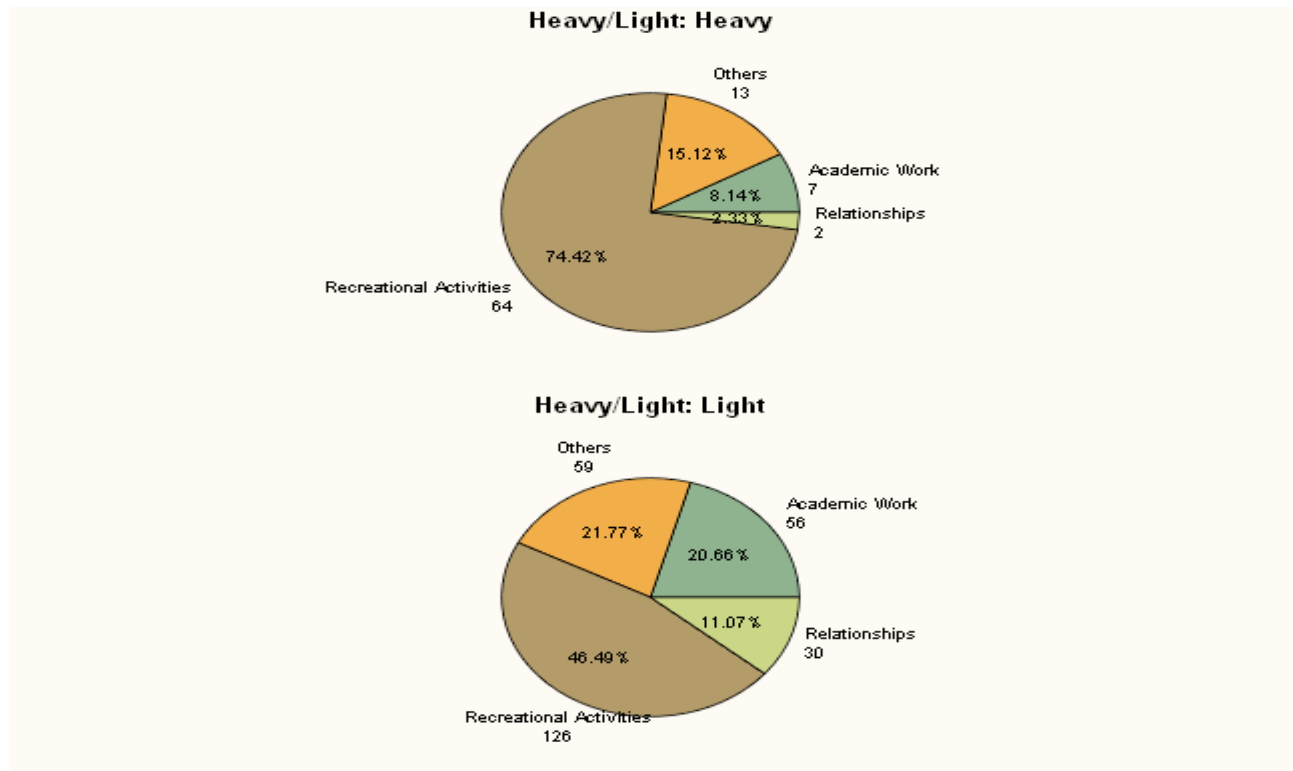


Figure 5.17: Purposes students use the Internet for by category of Internet users

Figure 5.17 reveals that even though recreational activities remain the main reason students use the Internet on campus, there is a considerable difference between what ‘heavy’ and what ‘light’ Internet users use the Internet for. As shown in the above diagram, 74.42% of ‘heavy’ users use the Internet mainly for recreational activities compared to only 40.49% of ‘light’ users for the same purpose. Also, 20.66% of ‘light’ students compared to only 8.14% of ‘heavy’ students use the Internet for academic work purposes. This finding supports the results of Figure 5.14 which shows that the proportion of ‘heavy’ Internet users is bigger in the ‘bad’ students category than in the ‘good’ category just like the proportion of ‘light’ Internet users is bigger in the ‘good’ students category than in the ‘bad’ one. The diagram in Appendix F gives us a clearer picture of the finding we have just mentioned in support of the table in Figure 5.14. It is also important to note that ‘light’ students use the Internet more for relationships and development purposes than ‘heavy’ students. In fact from the data we gathered, we noticed that applications serving this purpose, such as emails were more predominant in the ‘light’ Internet users category.

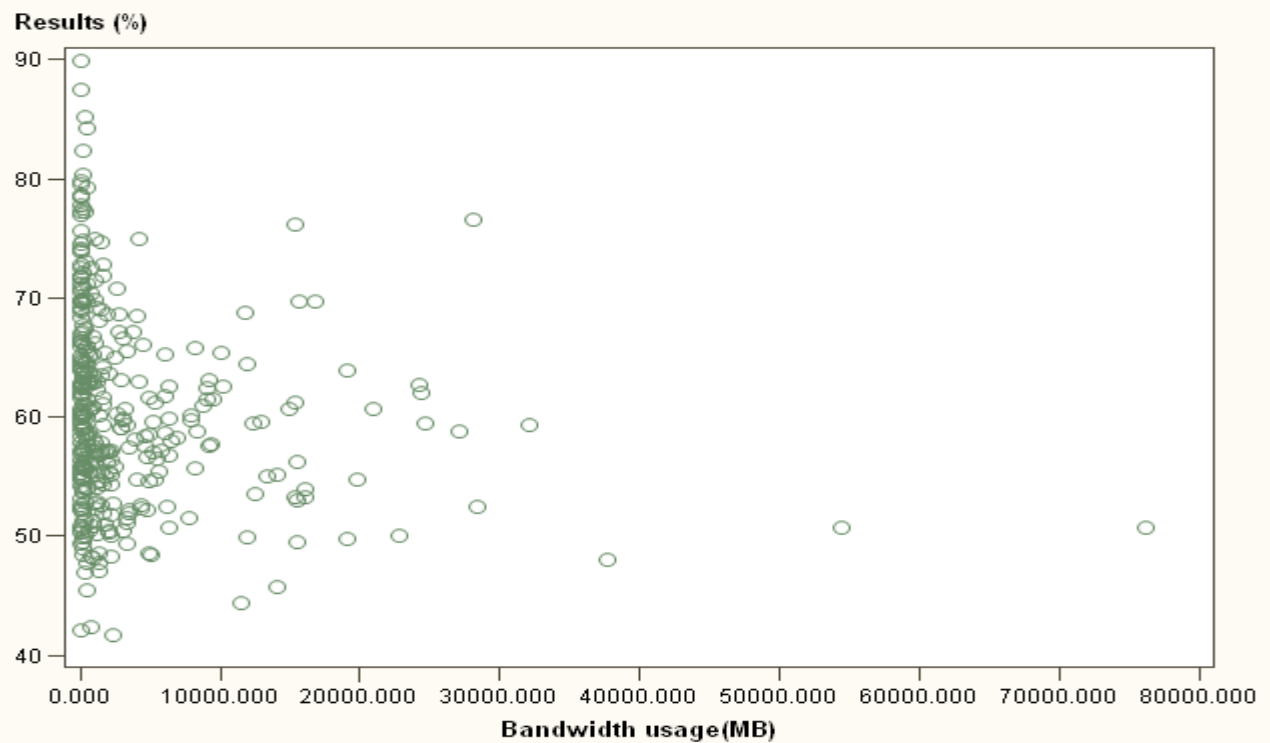


Figure 5.18: Scatterplot of Internet bandwidth and academic performance

When visualizing Figure 5.18, there is no way to tell whether there is an association between Internet usage and academic performance, let alone if there exists a correlation between ‘heavy’ Internet usage and ‘poor’ academic performance. By looking at the vertical axis, we notice that the points above 50% have Internet bandwidth values concentrated between almost 0MB and 30 GB. However, the points beyond 30GB (what we can consider as outliers) are all nearly situated around 50% for academic results. This means that ‘heavy’ Internet users are not necessarily ‘bad’ students just like ‘light’ Internet users are ‘good’ students but however very intensive Internet usage could be associated with poor academic performance as depicted by the points beyond 30GB of data usage. In other words, no association between Internet usage and academic performance is apparent when we look at this scatterplot. We therefore need to perform further analysis to determine whether any association exists between these two variables. Since this scatterplot was drawn using data from the entire sample, we believe that a similar analysis, performed for each separate category of Internet users and students could yield more significant results.

Inferential Phase

The first aspect of this section will be for us to conduct inferential tests used to determine if there is/are differences between the different groups of students and Internet users that we have. We have decided to perform a t-test for the Internet users categories because altogether they only involve two sub-categories ‘heavy’ and ‘light’ Internet users and ANOVA for the categories of students because altogether they involve more than two groups: ‘good’, ‘average’ and ‘bad’ students. The t-test requires the use of two variables: an independent variable that must be categorical, (in our case this would either one of the categories in which students are classified as ‘heavy’/‘light’ Internet users or ‘good’/‘bad’ students) and a dependent variable that must be quantitative. This means that in one situation our independent variable will be ‘heavy’/‘light’ Internet users and the dependent variable will be academic performance; in the other situation, the independent variable will be ‘good’/‘average’/‘bad’ students while the dependent variable will be the Internet usage.

Comparative Inferential Statistics:

heavy_light	N	Mean	Std Dev	Std Err	Minimum	Maximum
Heavy	86	58.3456	6.4593	0.6965	44.4595	76.5625
Light	273	61.2759	8.7647	0.5305	41.6713	89.8713
Diff (1-2)		-2.9303	8.2742	1.0232		

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	357	-2.86	0.0044
Satterthwaite	Unequal	192.01	-3.35	0.0010

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	272	85	1.84	0.0012

Figure 5.19: T-test for ‘heavy’ and ‘light’ Internet users based on academic performance

One assumption of the t-test is that the two group variances are homogeneous and in the case they are not, the statistical significance of the t-test may be misinterpreted and might lead to erroneous conclusions in our comparison. To ensure this, we look at the Folded F test conducted in the lower table of Figure 5.19. This table reveals that the Folded F test is significant because the obtained p value ($p = 0.0012$) is smaller than 0.05 and therefore we can assume equal variances between the ‘heavy’ and the ‘light’ Internet users group. Because the variances are equal, we read the top row of the middle table to interpret the results of the t-test (Pooled method row). The conducted t-test reveals a statistically significant difference between ‘heavy’ Internet users and ‘light’ Internet users with regards to their academic performance ($t = -2.86$, $df = 357$, $p = 0.0044$), therefore, we can conclude that ‘heavy’ Internet users (Mean = 58.35, SD = 6.46) perform significantly worse academically than ‘light’ Internet users (Mean = 61.28, SD = 8.76).

Below are the results of a one-way ANOVA test that allowed us to test for a difference between ‘good’, ‘average’ and ‘bad’ students based on Internet usage (please note that we are still using the log transformed data because it is the transformation that returned a better normally distributed data sample).

Source	DF	Anova SS	Mean Square	F Value	PF
Good or Bad	2	26.069887	13.034943	12.70	< .0001

Table 5.5: One-way ANOVA test for ‘good’, ‘average’ and ‘bad’ students based on Internet usage

Table 5.5 reveals that there is a significant difference between the mean Internet usage of our three categories of students, $F(2)=12.70$, $p < 5\%$. The diagram below allows us to see how significant that difference is.

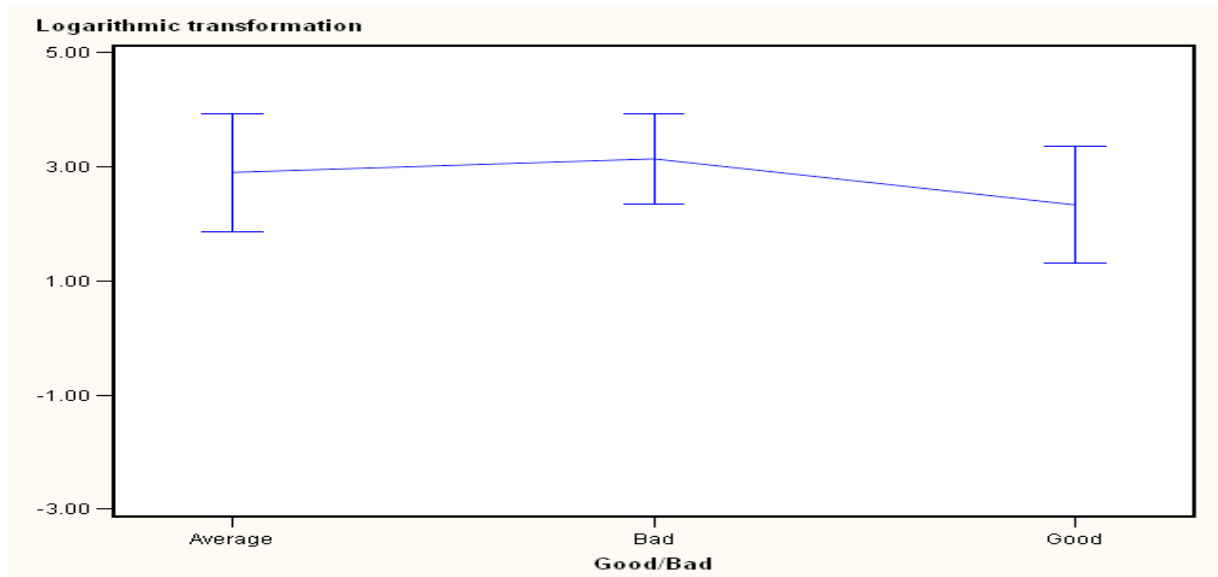


Figure 5.20: Internet usage means of the three categories of students

As we can see in Figure 5.20, ‘bad’ students use the Internet more than ‘average’ and ‘good’ students when comparing the log transformed values of their mean Internet usage.

Associational Inferential Statistics

In this section, we conducted inferential tests that would help us determine whether there is an association between Internet usage and academic performance. We decided to conduct a Pearson correlation test to determine if there is an association between Internet usage and academic performance for ‘heavy’ and ‘light’ Internet users, and if there is an association between Internet usage and academic performance for ‘good’, ‘average’ and ‘bad’ students.

Pearson Correlation Coefficients, N = 86	
Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.09962
Average WAM	0.3615

Pearson Correlation Coefficients, N = 273	
Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.25184
Average WAM	<.0001

Figure 5.21: Correlation test between ‘heavy’ and ‘light’ Internet users and academic performance

Figure 5.21 shows the results of a Pearson correlation analysis to examine whether there is a relationship between ‘heavy’ Internet users and academic performance (table on the left) and whether there is also a correlation between ‘light’ Internet users and academic performance (table on the right). The results reveal a nonsignificant and negative relationship ($r = -0.1$, $p = 0.36$) with a weak in strength correlation between ‘heavy’ Internet users and academic performance. In other words, higher values of Internet bandwidth usage are associated with lower academic grades for ‘heavy’ Internet users. The table on the right reveal a significant and negative relationship ($r = -0.25$, $p < 0.0001$) with a weak in strength correlation between ‘light’ Internet users and academic performance. In other words, higher values of Internet bandwidth are associated with lower academic grades for ‘light’ Internet users as well.

Pearson Correlation Coefficients, N = 237 Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.06110
Average WAM	0.3490

Correlation test for **Average** students

Pearson Correlation Coefficients, N = 26 Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	0.06212
Average WAM	0.7631

Correlation test for **Bad** students

Pearson Correlation Coefficients, N = 96 Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.22875
Average WAM	0.0250

Correlation test for **Good** students

Figure 5.22: Correlation test between ‘Average’, ‘Bad’ and ‘Good’ students and Internet usage

Figure 5.22 show the results of a Pearson correlation analysis to determine whether there is a relationship between academic performance and Internet usage for ‘average’ students (top table), whether there is a correlation between academic performance and Internet usage for ‘bad’ students (middle table) and whether there is a correlation between academic performance and Internet usage for ‘good’ students. The results reveal a nonsignificant and negative relationship ($r = -0.06$, $p = 0.35$) with a weak in strength correlation between academic performance and Internet usage for ‘average’ students. This means that higher values of Internet bandwidth usage are slightly associated with lower academic grades for ‘average’ students. This diagram also reveals when looking at the middle table, that there is a nonsignificant and positive relationship ($r = 0.06$, $p = 0.76$) with a weak in strength correlation between academic performance and Internet usage for ‘bad’ students. In other words, higher values of Internet bandwidth consumed for ‘bad’ students are slightly associated with higher academic grades for ‘bad’ students just like for ‘average’ students, higher values of Internet bandwidth usage are associated with slightly lower academic grades. Also, the bottom table of this diagram reveals a significant and negative relationship ($r = -0.23$, $p = 0.03$) with a weak in strength correlation between academic performance and Internet usage for ‘good’ students. This means that for increasing values of Internet usage we get slightly decreasing values of academic grades.

To sum up the results revealed in this inferential tests section of our study, we discovered that:

- ‘heavy’ Internet users performed academically worse than ‘light’ Internet users. However, only for ‘light’ Internet users, heavier usage of the Internet was found to be slightly associated with lower academic grades.
- there is a slight significant difference in Internet usage between ‘good’, ‘average’ and ‘bad’ students. However, heavier usage of the Internet resulted in academic grades being slightly poorer only for ‘average’ and ‘good’ students.

5.2.4 Discussion

The results of our study confirm findings by Young [1996], Scherer [1997], Morahan-Martin and Schumacher [2000], Anderson [2001], Kubey *et al.* [2001], Metzger *et al.* [2003], and Fortson *et al.* [2007] that there is an existence of Internet dependency among university students. Our study shows that of the 359 students we used in our quantitative study, 24% of them were categorized as 'heavy' Internet users. Although the Squid proxy logs files we received differed in terms of sizes which resulted in our data not being normally distributed initially because the total Internet bandwidth computed would obviously vary depending on the size of the Squid log file received, transforming it using the logarithmic based transformation gave us a better normally distributed sample which we used to conduct the statistical analyses we performed. Although the sizes of the log files we received varied, the reality is that Internet usage varies by its bandwidth consumed and purposes among 3rd year students at Wits.

Our study confirms findings by Young [1996], Rumbough [2001], and Metzger *et al.* [2003] who found that recreational activities are the most predominant reasons for which students use the Internet. In our study, this reason accounted for 53.22% of our sample population. The second reason for which students use the Internet was 'others' (20.17% of our sample) which consisted of reasons such as job hunting, information seeking because most sites visited in this category were predominantly search engines such as google as confirmed by Judd and Kennedy's [2010] study who found that information seeking is a key activity for most Internet users. Internet usage for academic work was in the proportion of 17.65% of our population and therefore this contradicts arguments by Lubans [1999], Scherer [1997], and Jones [2002] who found that academic work was a predominant reason for which students used the Internet. Our study furthermore reveals that there is a difference in activities 'heavy' Internet users and 'light' Internet users engage themselves in while online. We found that 'light' Internet users were less engaged in recreational activities online than 'heavy' users and that 'light' Internet users use the Internet for academic work more than double 'heavy' Internet users did, they were respectively for each purpose: 40.49% vs 74.42% and 20.66% vs 8.14%. This finding corroborates Morahan-Martin and Schumacher's [2000] finding that 'heavy' Internet users are more engaged in recreational activities while online than their 'light' user counterparts. Similarly, we have revealed that 'bad' students use the Internet more for recreational activities and less for academic work compared to 'good' and 'average' students. They were in the respective proportions of 61.54% vs 39.58% and 57.87% for recreational activities and 3.85% vs 22.92% and 17.02% for academic work.

After looking at the entire sample in Figure 5.18 we could see that there is no linear relationship between Internet usage and academic performance. We however decided to investigate whether this remained true if we separated our participants into the different categories we have used all along this study: 'heavy' vs 'light' Internet users and 'good' vs 'bad' vs 'average' students. After the t-test we conducted in Figure 5.19 revealed a statistically significant difference between 'heavy' Internet users and 'light' Internet users in terms of academic performance, although there was a positive and weak correlation between heavier Internet usage and increasing academic performance as shown in the middle table of Figure 5.21, 'heavy' Internet users were still found to perform worse academically than 'light' Internet users. In the same line of thoughts, the one-way ANOVA test we conducted in Figure 5.5 revealed that there is a statistically significant difference between 'good', 'average' and 'bad' students with regards to Internet usage. Also regarding our three categories of students, Figure 5.22 reveals that there is a weak negative correlation between Internet usage and academic performance whether a student is 'average' or 'good'. Since Appendix G reveals that of the students who use the Internet primarily for academic purposes these two groups are the most predominant, this finding leads us to think that as the Internet usage of these students gets heavier, they engage themselves less in academically related activities while online. Therefore looking at the variation in Internet usage values and academic grades within these categories could yield important information to substantiate the influence exerted by the Internet on students' academic performance.

Based on the results mentioned above, one could argue that poor academic performance is associated with increasing Internet usage because as depicted in Figure 5.16, 'good' students use the Internet more for academic purposes than 'bad' and 'average' students. This is strengthened by the calculated Pearson

correlation coefficients which revealed that heavier Internet usage for 'good' and 'average' students was found to be slightly associated with decreasing academic performance. We were able to find evidence of this correlation because as we found in the analysis section of this study, not only 'heavy' Internet users were found to perform academically worse than 'light' Internet users, but also a statistically significant difference was found between 'good', 'average' and 'bad' students with regards to Internet usage, in other words, 'bad' students used the Internet slightly more than 'average' and 'good' students. This finding coupled with the results appearing in Appendix F which reveals that among the three categories of students, there is a higher percentage of 'heavy' Internet users in the 'bad' students category confirms that indeed there is an association between heavy Internet usage and academic performance. Appendix G further strengthens this argument by showing that among the students who use the Internet primarily for academic work, there is only one who is a bad academic performer.

5.2.5 Conclusion

In conclusion, this study confirmed the existence of Internet dependency among university students as previous studies mentioned in the first paragraph of this discussion section discovered. Students were found to use the Internet mostly for entertainment purposes as found in 53.22% of our sample population. The categorization of our participants as either 'heavy' or 'light' Internet users and as either 'bad', 'average' or 'good' students allowed us to find that 'light' Internet users are less engaged in recreational activities while on campus compared to 'heavy' Internet users and the latter perform significantly worse academically than the former. 'Bad' students were also found to use the Internet more for recreational activities than other students. However, no relationship of causality was found between Internet usage and academic performance regardless of the category a student belonged to. In the next chapter of this document, we are going to triangulate the results of the qualitative and the quantitative studies in order to determine the proportion of students who are in denial about their Internet usage habits and why using hard and self-reported data proved to be valuable for our research.

5.3 Cross-triangulation of studies' findings

5.3.1 Introduction

In this section of this chapter, we will triangulate the findings of the quantitative and qualitative studies conducted above so as to generate information that neither of them alone would have been able to by comparing and contrasting their results. We will subsequently interpret these studies in terms of how relevant they were in addressing the issue of whether Internet usage can be associated with academic performance at Wits.

5.3.2 Comparison and contrast of the findings

In this section of the chapter, we will compare and contrast the findings of the two studies we conducted with regards to the three areas we focused our research on. These areas were notably:

- Is there an existence of Internet dependency among university students?
- What do students use the Internet for?
- What influence does the Internet have on students' academic performance?

Existence of Internet dependency among university students

The two conducted studies reveal that students are 'light' on campus Internet users. Of the 389 students we surveyed in the qualitative study chapter of our document, 232 of them (about 62%) were classified as 'light' Internet users for having a daily Internet usage less than 2.45 hours/day which was the mean Internet usage of the entire sample. The quantitative study revealed that of the 359 distinct Squid proxy logs we received, 273 students (76%) were classified as 'light' Internet users for having their mean Internet usage being below 3575MB/year or roughly 10MB/day. While we recognize that these findings may be an under-estimation of students Internet usage on campus firstly because of the unreliability of students' self-reports and secondly because as we mentioned in a previous section, we did not receive 3 years worth of Squid proxy logs from CNS for each of the 359 students, we would like to argue that at Wits, classes run from 8AM until run about 4PM and in between students may have breaks that only add up to 2 hours/day during which they are free to do whatever they want such as going onto the Internet. This is further supported by the fact that at Wits, the only classes that may involve Internet use are tutorials (usually if computers needed would be on average 4 to 6 hours per subject per week, plus Internet access is restricted to mostly search engines and academically related websites only) because lectures still follow the traditional approach whereby a lecturer would go through the teaching materials and students would write down notes.

The qualitative and quantitative studies also confirm the existence of Internet dependency among university students as found in 38% and in 24% of our sample population for the qualitative and quantitative study respectively. Among those students whom we classified as 'heavy' Internet users on campus, 18 out of the 147 identified 'heavy' Internet users from the qualitative study reported using the Internet for more than 6 hours/day while of the identified 86 'heavy' Internet users in the quantitative study, 38 were found to be using the Internet for over 10 Gigabytes/year or roughly 27MB/day. This is quite 'heavy' in both instances especially for the latter mentioned since students do not go to university everyday of the year and an academic year contains less than 365 days. These show that there is an existence of Internet dependency among 3rd year university students at Wits to confirm findings by Young [1996], Scherer [1997], Morahan-Martin and Schumacher [2000], Anderson [2001], Kubey *et al.* [2001], Metzger *et al.* [2003], and Fortson *et al.* [2007] that there is an existence of Internet dependency among university students in general.

Reasons for which students use the Internet

Regarding this aspect of our research, we found diverging results between the two studies we conducted with regards to the reasons for which students use the Internet on campus. The qualitative study we conducted revealed that academic work is the main reason for which students use the Internet, followed by recreational activities, relationships development and maintenance then other reasons as reported by 50.64%, 34.19%, 8.48% and 6.68% of our sample population respectively. The quantitative study however tells a different story. It revealed that recreational activities are the main reason for which students go online, followed by other reasons, academic work in third position then relationships development and maintenance last as found in 53.22%, 20.17%, 17.65% and 8.96% of our sample population respectively. The divergence of these findings raises a question of reliability as far as students' self-reports are concerned. Because we made use of hard-data in our quantitative study, we are compelled to argue that students are in denial about the reasons for which they use the Internet. Out of the 359 students whose Squid proxy logs were received, for only 107 of them, the reason for which they reported using the Internet actually matched what the Squid proxy logs were telling us, in other words 70% of our student population can be said to be in denial about the reason for which they mainly go online. Since the survey we conducted in the qualitative study was anonymous, we dare assuming that our participants had no reason to lie to us in their reports and therefore instead of implying that 70% of them lied to us, we prefer to say that 70% of our participants are in denial about their Internet usage habits.

Our studies also reveal diverging results in terms of the reasons for which our different groups of students and Internet users use the Internet. The qualitative study reveal for our 'heavy' Internet users that to engage in recreational activities is the most predominant reason for which students go online, followed by academic work, relationships development and maintenance the other reasons while the quantitative study reveals for the same group that, recreational activities is the first reason, then other reasons, followed by academic work and then relationships development and maintenance. Regarding the 'light' Internet users group, the qualitative study reveals that the main reason for which students go online are (in descending order of preference): academic work, recreational activities, relationships development and maintenance and other reasons while the quantitative study reveals following the same logic that it is in fact, recreational activities followed by other reasons, academic work and then relationships development and maintenance. We believe that the diverging findings between the two studies regarding these two groups of Internet users is explained by the elevated number of students we found earlier who are in denial, 70% of our sample population.

The influence of the Internet on academic grades

Regarding the influence exerted by the Internet on students' academic grades, both studies concurred on the negative effects of excessive Internet usage on academic grades. The qualitative study we conducted revealed that students who were classified as 'heavy' Internet users reported a negative perception of the Internet on their grades more than students who were classified as 'light' Internet users and that 'heavy' Internet users engaged more recreational activities and less academic work online than students who were classified as 'light' Internet users. The statistical calculations performed in the quantitative study corroborated these findings by revealing that 'heavy' Internet users used the Internet more for recreational activities and less for academic work compared to 'light' Internet users.

Another finding which we found to be interesting because the two studies seemed to concur on this aspect is that in the qualitative study, we found that students who reported a perceived positive influence of the Internet on their academic grades use it considerably more for academic work than for recreational purposes, they were in the respective proportions of 58.20% vs 27.97% and students who reported a perceived negative influence of the Internet on their grades use the Internet more for recreational activities than for academic work, they were in the respective proportion of 57.89% vs 21.05%. Similarly, in the quantitative study, 'good' students were found to use the Internet considerably more for academic purposes than 'bad' students, 22.92% vs 17.02% and less for recreational purposes than 'bad' students, 39.58% vs 57.87%.

The equality of the findings arising from the comparison we performed above, makes it arguable that extensive Internet usage for activities that are not academically related can have a negative influence on students' academic performance at university.

5.3.3 Interpretation of qualitative and quantitative studies

The two studies we conducted in this research allowed us to address two important questions beyond our main research focus which was to investigate evidence of a potential association between extensive Internet usage and poor academic performance among students at Wits. These questions are:

1. Are self-reported data reliable?
2. Do hard data tell us the full story?

With regards to question 1, the diverging results between the qualitative and the quantitative studies regarding aspects such as the purposes for which students go online show us that self-reported data is unreliable and that stronger instruments based on hard data need to be developed when dealing with people's behaviours as it is likely that they will not report them as they are in reality. This may be because they are not aware of them as we believe if data about such behaviours are collected in an anonymous manner they will be reported genuinely. In this sense, we think it has been beneficial for us to use a mixed methods research so that possibilities of denial can be easily identified and dealt with when we consider how critical is the role played by academic institutions in shaping individuals.

With regards to the second question, we believe that although hard data would have allowed us to draw reliable and generalizable inferences, the absence of self-reported data would have not made it possible to identify the possible existence of denial among university students which we believe would have been critical with regards to the value we expect any research should add.

Finally, we would like to add that even though the two studies differed in their findings of the reasons for which students go online, they concurred in revealing that there is an existence of Internet dependency among 3rd year students at Wits and that the Internet has an influence on their academic grades. The findings of the qualitative study have revealed that students, both 'heavy' and 'light' Internet users perceive the Internet as a positive contributor to their academic performance and that there was no mutual relationship found between extensive Internet usage and degrading academic performance. The results of the quantitative study have shown that 'heavy' Internet users performed academically worse than 'light' Internet users and that 'bad' students were found to use the Internet a bit more than the rest. However for 'bad' students, increasing usage of the Internet was found to be slightly associated with increasing academic grades which was not the case for other students. The latter finding reduces therefore the probability of extensive Internet usage being the cause of poor academic performance, they may be associated as suggested by previous findings mentioned earlier but other factors may be at the cause of extensive Internet usage causing degrading academic performance.

5.3.4 Conclusion

The different comparisons we performed in this chapter allowed us to realize that the qualitative and quantitative studies we conducted agree that there is an existence of Internet dependency among university students and that the Internet exerts negative effects on students' academic performance. However, we found a divergence of results when comparing the two studies around the reasons for which students use the Internet on campus. The qualitative study reveal that academic work is the main reason for which students go online on campus while the quantitative study reveals that students mostly use the Internet to engage in recreational activities when they are on campus. The reliability of the data we used in the quantitative study allowed us to deduce that students are in denial about their Internet usage habits on campus. We found that 70% of our participants were in denial about the reasons for which they use the Internet on campus. This finding supports the existing critics around the unreliability of self-reported data which was strengthened by a side analysis we performed that revealed to us that 53% of the students

we classified as 'light' Internet users in the qualitative study were found to be 'heavy' Internet users in the quantitative study. This chapter also allowed us to realize the importance of combining self-reported data with hard data when studying the effects of people's behaviours on their productivity for only such combination can reveal phenomenon that no type of data on its own could have. The following chapter investigates evidence of a relationship between Internet usage and academic performance if we consider factors such as academic discipline's Internet requirements and students' living arrangements.

Chapter 6

FURTHER ANALYSIS

6.1 Introduction

In this chapter of our research, we investigated if the Internet usage patterns were different among the distinct academic courses involved in our study and if it could explain probable divergence in the overall academic performance of an entire class. We also looked at whether students who live in university residences are more extensive Internet users than those who stay off campus because they have 24/7 access to the Internet and if effects resulting from their Internet usage could be different from the rest. The results of the following investigations appear below.

6.2 Comparison of courses Internet usage and academic performance

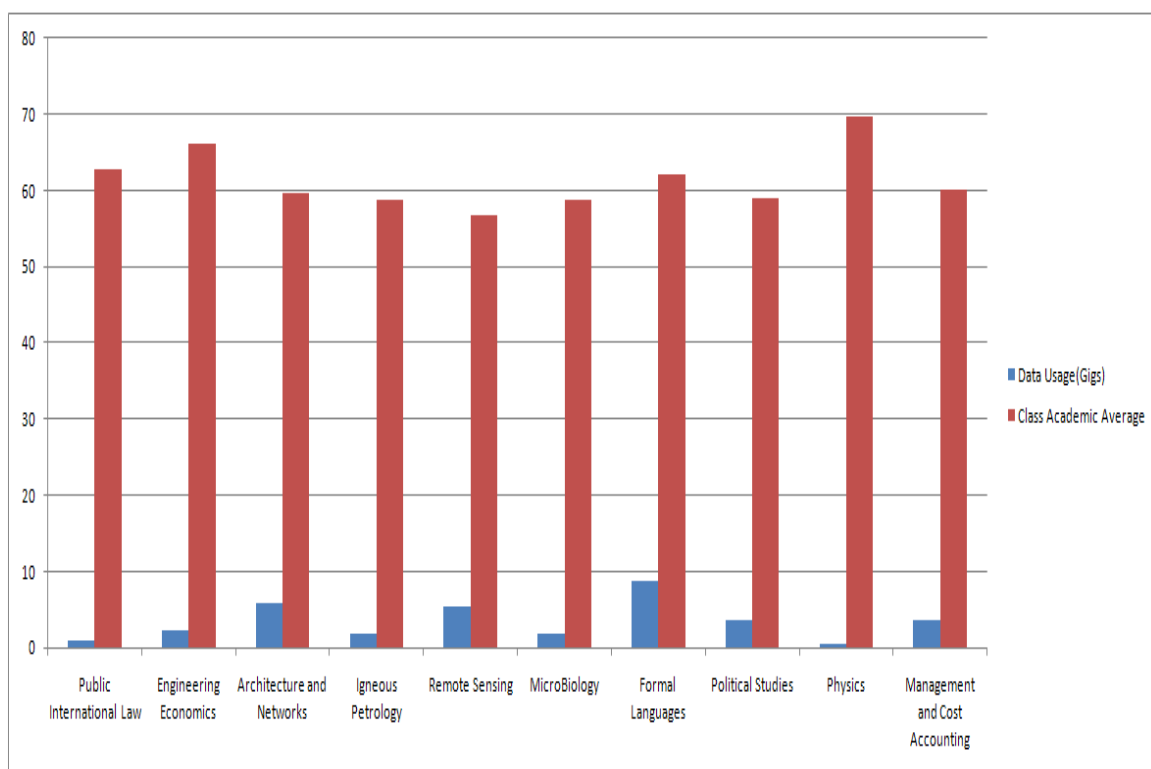


Figure 6.1: Class academic average vs student average Internet usage for each course

To cater for difference in sample sizes among all surveyed courses, we decided to plot the yearly average Internet usage of a student instead of the yearly average Internet usage of an entire class. As

depicted in Figure 6.1, we can see that Science students overall consume more Internet bandwidth than students from other disciplines as reported for Formal Languages, Architecture and Networks and Remote Sensing. However, this is not the case when we compare the classes' academic average, we can see from the graph that the classes identified as 'heavy' Internet users were not necessarily the best academically. Also, the graph shows us that patterns in Internet usage are not symmetric to patterns in academic performance because we can see from the diagram that 'heavy'/'light' Internet users are not necessarily 'strong'/'weak' academically and vice versa. In other words, from the graph, there is no way to associate any type/category of Internet users with any type/category of academic performance groups. Let's look at the table below to see if these findings are confirmed or refuted.

Source	DF	Anova SS	Mean Square	F Value	PF
Courses (10)	9	50.52756917	5.61417435	5.75	< .0001

Table 6.1: One-way ANOVA test for difference in Internet usage among the different courses

Source	DF	Anova SS	Mean Square	F Value	PF
Courses (10)	9	3357.276161	373.030685	6.01	< .0001

Table 6.2: One-way ANOVA test for difference in academic performance among the different courses

Table 6.1 and Table 6.2 reveal respectively that there is a significant statistical difference in Internet usage and academic performance among the 10 courses we surveyed as both tests results have probabilities $p < 0.05$. However, our main interest here is to see whether the Internet is the reason why a course has a better/worse academic performance than another. To answer this question, let's look at Figure 6.2 and Figure 6.3:

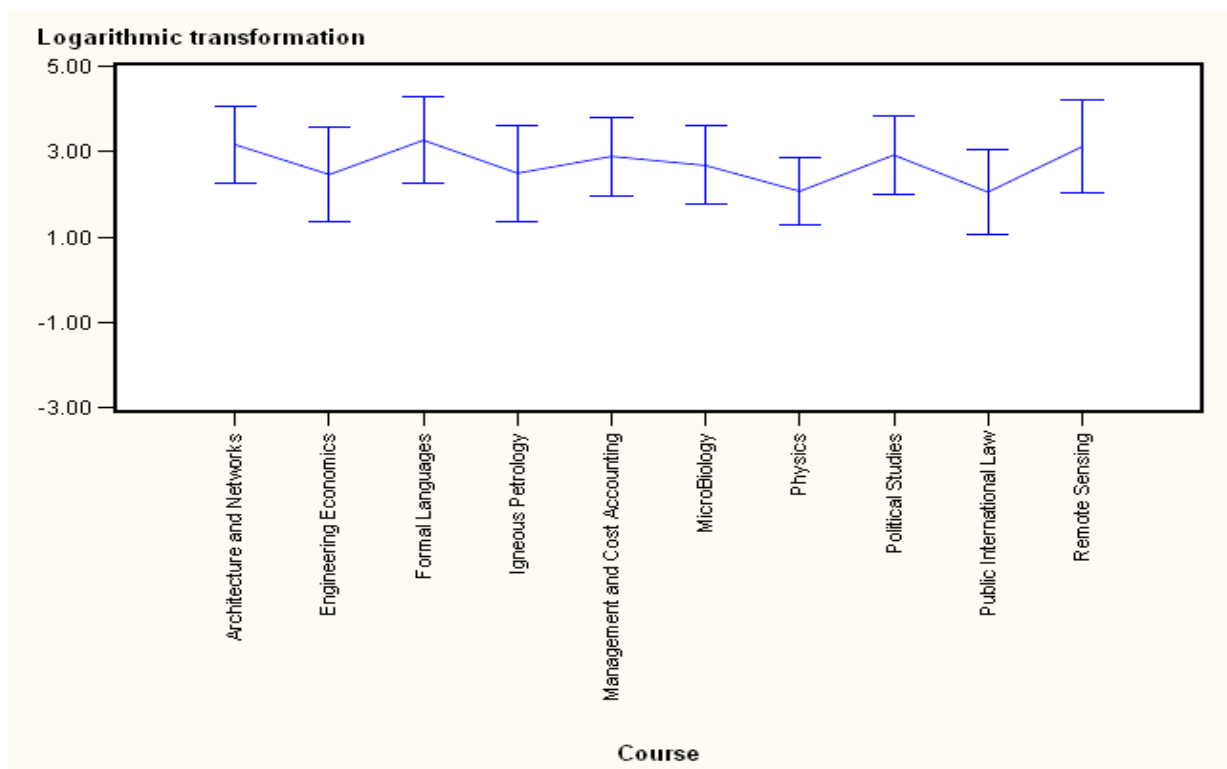


Figure 6.2: Internet usage Means of all courses

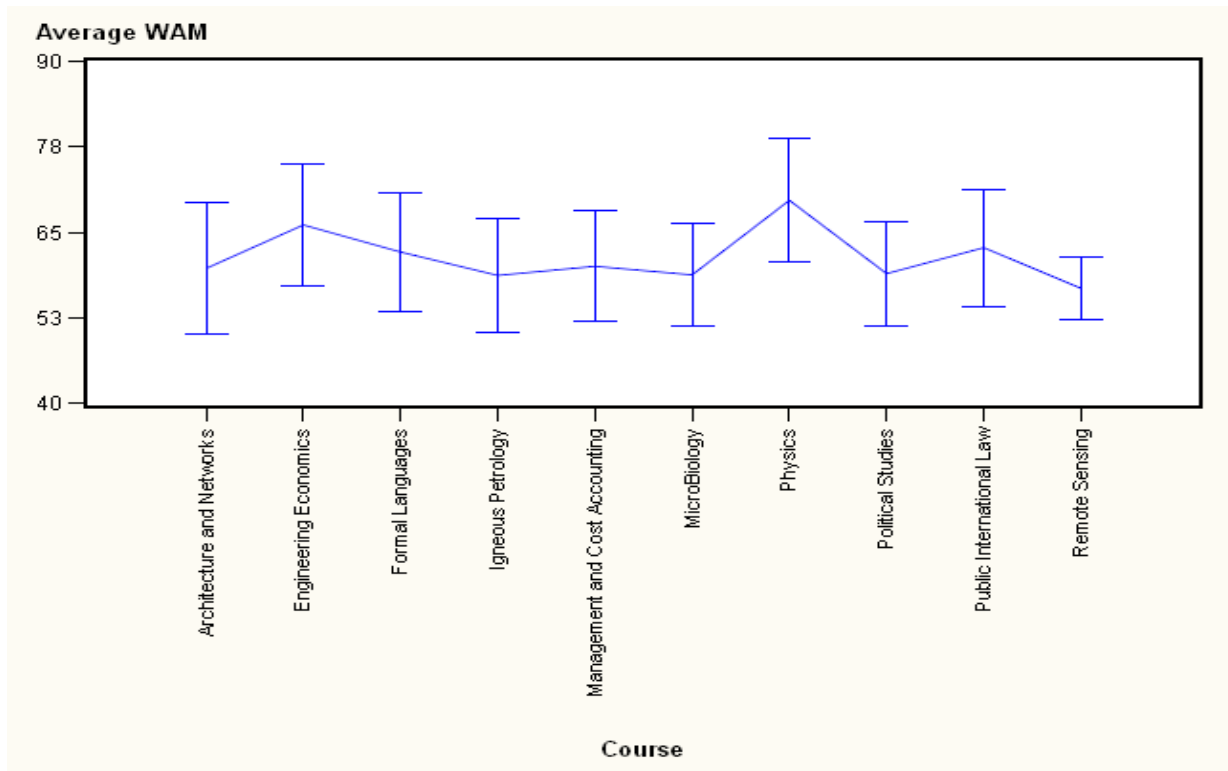


Figure 6.3: Class Academic Means of all courses

When looking at Figure 6.2 and Figure 6.3 simultaneously, we realise that the lines linking the means do not follow the same pattern (please notice that the courses appear in alphabetical order in both diagrams). Actually, we can go as far as to say that the lines do not follow any pattern at all when we compare the individual values we get for Internet usage and class academic average for each course. Therefore, since we were not able to identify any pattern linking Internet usage to class academic performance, we can say that there is no evidence to prove that Internet usage is the reason why a course performs better/worse academically than another. Appendix H shows for each course the main reason for which students go online.

6.3 Comparison of Internet usage and academic performance between students living on campus and the rest

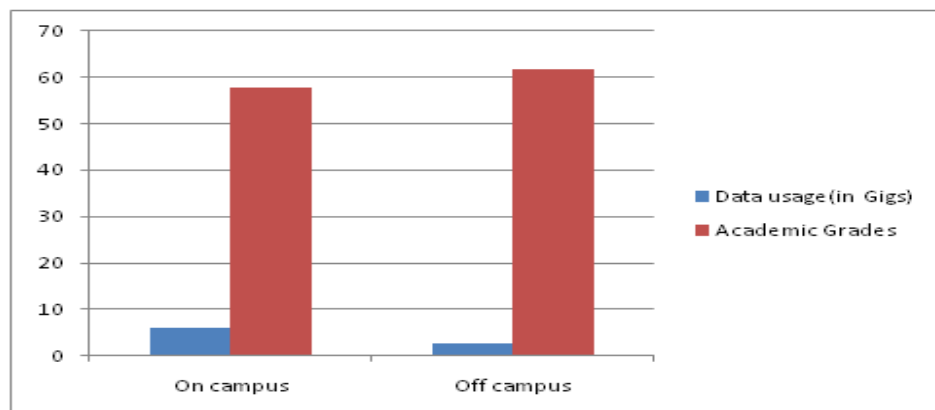


Figure 6.4: Class academic average vs student average Internet usage for each category of students

As we did in the previous section to cater for difference in sample sizes among participants living on campus and those living off campus, we decided to plot the yearly average Internet usage of a student instead of the yearly average Internet usage of the entire group (calculated as follow: average Internet bandwidth used= (sum of total Internet bandwidth consumed for all 2 years)/2). As shown in Figure 6.4, we can see that a student staying on campus uses the Internet more than a student living off campus. This is understandable because students living on campus have 24/7 access to the Internet, plus our study only measured students' Internet usage on campus. The graph also shows that off campus students perform slightly better academically than students living on campus. Although the graph is explicit enough in showing the difference in academic performance and Internet usage among the two groups, we decided to use statistical tests to determine whether a difference existed between them with respect to academic performance since we have already explained the difference for Internet use.

Residential Status	N	Mean	Std Dev	Std Err	Minimum	Maximum
Off campus	259	61.7014	8.7176	0.5417	42.1250	89.8713
On campus	100	57.6537	6.5240	0.6524	41.6713	76.2050
Diff (1-2)		4.0476	8.1685	0.9617		

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	357	4.21	<.0001
Satterthwaite	Unequal	238.97	4.77	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	258	99	1.79	0.0010

Figure 6.5: T-test for statistical difference in academic performance between 'on campus' and 'off campus' students

The T-test conducted in Figure 6.5 confirms what was pictured by the graph in Figure 6.4 regarding the difference in academic performance between students living on campus and those staying off-campus. As the bottom table of Figure 6.5 shows, we can assume equal variances between the two groups since the probability of the Folded F test $p < 0.05$. Therefore we read the Pooled method results in the middle table. The conducted t-test reveals a statistically significant difference in academic performance between 'on campus' and 'off-campus' students ($t=4.21$, $df=357$, $p < 0.0001$), therefore, we can conclude that 'on campus' students (Mean = 57.65, SD=6.52) perform significantly worse academically than 'off-campus' students (Mean=61.70, SD=8.71).

Pearson Correlation Coefficients, N = 259 Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.26128
Average WAM	<.0001

Correlation test for students living **off-campus**

Pearson Correlation Coefficients, N = 100 Prob > r under H0: Rho=0	
	logarithmic_transformation
average_wam	-0.05140
Average WAM	0.6116

Correlation test for students living **on campus**

Figure 6.6: Correlation between Internet usage and academic performance by residential status

Figure 6.6 reveals a weak but negative correlation between Internet usage and academic performance no matter a student's residential status, which means that higher values of Internet usage are slightly associated with lower academic grades. However this association was found to be significant only for students staying off campus as shown by the top table of Figure 6.6 because the probability that Internet is associated with academic performance for students staying off campus is $p < 0.05$. This can be explained by findings from the quantitative study which reveals that only for 'light' Internet users, the more they engage in non academically related activities, the worse they perform academically. Figure 6.4 and Appendix I respectively depict that students staying off campus are 'light' Internet users compared to those staying on campus, but however, they both use the Internet mostly for recreational activities as revealed in 47.10% and 68% of them respectively. Therefore, the findings from the quantitative study we stated above is also applicable to these two groups. Therefore, we can say that although students staying on campus were found to be 'heavier' Internet users and worse than off campus students with regards to academic performance, the association between their level of Internet usage and their academic grades was not found to be statistically significant. This leads us to conclude that there is no strong evidence of a correlation between Internet usage and academic performance whether a student lives on or off campus. Appendix I shows the main reason for which students use the Internet according to their residential status and strengthens findings of previous chapters that academic work is not the main reason for which student use the Internet and in our case whether they are living on or off campus is not a factor to the reasons for which they use the Internet. For both residential status, recreational activities is the main reason, followed by others, academic work and relationship development and maintenance.

6.4 Conclusion

In conclusion we can say that although on campus students were found to use the Internet more than off-campus students and perform significantly worse than the latter group, no strong evidence of a relationship between Internet usage and academic performance could be found among any of the two groups of students. For this reason, we believe that since the residential status of our participants did not help find any evidence of the association we are investigating, we believe that the roles of other resources contributing to academic work such as libraries need to be investigated since for every group we investigated we could not find much difference in the purposes for which each one of them use the Internet. In the following chapter, we reveal the limitations to our study and we make recommendations for future work around the influence of the Internet on students' academic performance.

Chapter 7

LIMITATIONS AND RECOMMENDATIONS FOR STUDY

In this chapter of our document, we present aspects of our research that present limitations of our study for various reasons and we mention areas which fell out of the scope of our research that could serve as ground for future work.

7.1 Limitations of the study

Firstly, we would like to mention that our sample size is relatively small when considering the number of 3rd year students at Wits. Our sample population consisted of 389 students for the qualitative study and 359 students for the quantitative study. This sample represents less than 10% of Wits university 3rd year students population. We initially intended to have over 1000 students to participate to our study but unfortunately due to a lack of collaboration from a number of academic staff contacted, we were forced to review our target down to the numbers mentioned above. We believe that a bigger sample could have allowed for a more reliable generalization of the various findings we presented in our document.

Secondly, we believe that our classification of students' Internet users as either 'heavy' or 'light' suffered from the bias that only on campus Internet usage was considered in our study. This can be considered as a major argument for contesting the results of this classification because it is arguable that 'light' on campus Internet users can be 'heavy' Internet users at home. While we acknowledge that this may be a major drawback for our study, we would like to argue that even if it was possible to include home Internet usage, the fact it would rely on self-reported data, therefore be unreliable advocates for the necessity to solely rely on Internet usage on campus because it is quantitatively measurable and thus reliable.

Thirdly, our data suffered from a lack of consistency among our participants. Our study involved Squid Proxy logs and yearly academic average for a 2 year time period (2009 to 2010). Unfortunately, we did not get 2 years worth of Squid Proxy logs for most of our participants (it is actually about 22 months worth of logs because classes at Wits university usually start in February and end in November with holidays that may add up to about 1 month) nor did we get for all students, their course average mark for every year, from 2009 to 2010. This respectively had an impact on our classification of students in the quantitative study as 'heavy' or 'light' Internet users and 'good', 'average' or 'bad' students. We believe that a better consistency in the data we received from AISU and CNS could have helped generate more reliable findings.

7.2 Recommendations for future work

Among our recommendations for future work in this field, we firstly would like to suggest that in investigating evidence of academic discipline influencing Internet usage, one could look at surveying students

enrolled in different courses and compare their Internet usage for each course. In our study, each one of our participants coincidentally happened to be registered for only one course among all the courses we surveyed. We believe that we were not able to find differences in Internet usage patterns among courses because we looked at the behaviour of the entire classes. It is probable that studying Internet usage behaviours for students enrolled in more than one course (each course belonging to a distinct academic discipline) could yield more significant results in investigating the difference in Internet needs and usage among distinct academic disciplines.

Secondly, we would like to recommend that other academic learning mediums be investigated beside the Internet. We found that the Internet is not mostly used for academic purposes rather for recreational activities. Moreover, the Internet was not found to be associated with any trend in academic performance, either 'improving' or 'impaired'. This means that if the Internet does not make much of a difference in students' academic performance, perhaps students rely on other academic mediums such as libraries or university online course material. We believe it would be beneficial to look at the role played by each academic learning medium in enhancing students' academic performance. Also, other factors such as students' socio-economic background could be investigated in looking at how the Internet influences students' academic performance. By investigating the socio-economic background factor, we believe that students who have access to a computer at home and the Internet are more likely to adopt this technology faster and perceive it as easy to use compared to students from less privileged backgrounds who would have lesser interactions opportunities with these technologies. Subsequently, if a student perceives the Internet as easy to use, this will definitely have an impact on how much he/she uses it and for what purposes. Therefore 'light' Internet users may be 'light' Internet users by using the Internet less than others because they do not perceive it as intuitive enough and this in return could be caused by how affordable it is for them to interact with it or even a computer outside university.

Thirdly, we believe as mentioned in the first paragraph of this section that conclusions drawn from group observations may distract us from what is experienced at an individual level. In our study, we could not conclude whether the Internet can be associated with academic performance as no evidence to support this argument was found for each group we studied. However, future studies could establish focus group consisting of individuals who initially belonged to the groups we studied. For each individual in the focus groups, we could look at the difference in Internet usage patterns and academic grades year after year and see if there is any causality that could be derived should a relationship be found between Internet usage and academic performance. This way, it would be possible to tell for example if Internet usage was found to be increasing year after year and academic grades decreasing that extensive Internet usage may cause academic performance impairment. This could yield significant results because there could be possibilities that for a 'light' Internet user observed, his/her Internet usage was increasing and his/her grades decreasing. In other words, we recommend this approach because we believe that what is true for a group may not be true for some individuals within this group.

In conclusion, we can say that despite the few limitations our study faces such as the relatively small sample size of fewer than 400 3rd year students in a university that contains over 10 times more, the inconsistency in the size of the Squid proxy logs we received, we made a substantial contribution to our discipline by our findings and also by using a mixed methodology approach that responds to the need for more reliable research instrument as expressed by the authors of the studies we reviewed in the literature review section of this document. Also, we believe that suggesting future work on this topic that would involve investigating the role played by other academic learning mediums such as libraries, university portals and also using focus groups with a few individuals from our research sample could prove to be fruitful in finding evidence of an association between Internet usage and academic performance among students.

Chapter 8

CONCLUSION

Although the Internet has become a daily commodity in most people's lives, its addictive-like features make any individual who excessively uses it a potential victim of its negative effects. The negative effects of excessive Internet usage which have been addressed by most research we reviewed in the second chapter of this document range from: impaired sleeping patterns to social relationships break ups, job losses, mental and physical health problems and academic performance decrements.

Students, who represent the majority of the population of Internet users worldwide, are more exposed to the dangers related to excessive Internet usage because of the availability and easy accessibility they have to the Internet. This is the reason why we believe there needs to be more research into the role of the Internet on campus and the negative effects associated to it because most of the problems we have cited earlier are found in the student population. Most researchers in this domain have focused on other negative effects of excessive Internet usage on students rather than on its consequences on their academic performance. As some articles have mentioned, the main reason the Internet was brought on campus was to enhance students' academic performance, then this very aspect of students' lives should be the main focus of studies that investigate the influence the Internet has on students. Has the Internet allowed students to perform better academically? Is excessive Internet usage the reason why students perform badly? These are two questions among many others which one needs to ask because after over fifteen years on campus, whether the Internet is fulfilling its role without negative effects on students' academic performance remains a grey area.

The literature we reviewed allowed us not only to identify gaps in the domain of our research in terms of diversity of findings and arguments' strengths but also in terms of validity of instruments. For instance, despite relying on students' self-reported data, many authors have admitted that the reliability of their findings is affected by the high probability of students being in denial about their Internet surfing habits. This acknowledgement from these authors made us realize that a mixed research methodologies study combining hard data and soft data analysis could yield more reliable results because of the possibility of shedding light on whether the sole use of self-reported data in this field suffice to derive reliable findings which could be generalized to a wider population. We therefore formulated two research questions in the research hypothesis section of this document that were both addressed by the two methodologies we used.

The conducted studies revealed that there is an existence of Internet dependency among university students as they both identified a good number of our research participants to be using the Internet far more than the average on campus Internet user. The results of the two studies led to the conclusion that the use of self-reported data or hard data is not enough to conclude whether there exists an association between Internet usage and academic performance among university students; no positive or negative association between these two variables could be established by any of the studies we conducted. Although 'heavy' Internet users were found to perform significantly worse academically than 'light' Internet users, no link of causality could be established between their intensive Internet usage and impaired academic performance even though both studies concurred on the negative effects an abusive use of the Internet has on academic performance. All groups of students and Internet users we investigated were found to

use the Internet for recreational purposes mainly in spite of the difference in the proportions of usage of each purpose among all the groups. For example, although 'heavy' and 'light' Internet users use the Internet mainly for recreational activities, 'light' Internet users would use it for recreational purposes significantly less than 'heavy' Internet users.

The further analysis we conducted in the sixth chapter of our study reveals that there is a possibility that other factors could influence students' academic performance besides the Internet. These analyses revealed that academic discipline was not a factor in how much students use the Internet nor was their residential status even though students staying on residences were found to use the Internet more than students staying off campus and perform significantly worse academically than those staying off campus. The point could be made that the inability to measure off campus students usage of the Internet outside university hours could lead to an erroneous conclusion that students staying on campus are 'heavier' Internet users and the subsequent inferences this could have on the influence their usage of the Internet has on their academic grades. Therefore other factors such as other resources available to students such as libraries, university portal, socio-economic background need to be investigated because they may dictate for the first two, what students rely on in terms of resources for their academic research and subsequently how much of the Internet is needed in this regard. For the latter, available opportunities to use a computer and the Internet outside university hours can have an influence on the perceived ease of use of the Internet (as this perception comes with frequency of interactions in our opinion) which subsequently can dictate how much of the Internet is used on campus.

Finally, the use of a mixed methodology in this research proved to be valuable because after triangulating the results of both studies, we were able to identify that 70% of our participants are in denial about their Internet usage habits and the effects the Internet has on their academic performance. Such a stunning finding would have never been possible if either methodology was used on its own. Our research reveals that self-reported data is unreliable because it differs completely from data recorded about the same studied behaviour but also the sole use of hard data does not add any value to research in the field our study belongs to. We believe that even though hard data on its own could have led us to more reliable and generalizable inferences, the triangulation of its inferences with results gathered from analyzing self-reported data allowed us to identify the existence of self-denial among university students. We believe that 70% is a big percentage and therefore, it should ring the alarm to university administration with regards to the responsibilities it has to its students. Addressing this issue of self-denial among students especially on an aspect that has a direct impact on their academic performance by providing support programmes to students who are willing to deal with this issue should be part of the mandate universities have to provide their students with quality education and a safe environment to learn and to become the best they ought to be.

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Appendix A

Participant Information Sheet

Please Note: This survey is only to be completed by students who studied at Wits between 2009 and 2010.

Good day,

My name is NGOUMANDJOKA Unnel-Teddy and I am a second year Masters student in the school of computer science at Wits University.

Following the belief that the Internet has an influence on students' academic performance, I decided to study evidence of this influence being positive or negative by investigating the potential existence of an association between extensive Internet usage and poor academic performance among varsity students.

I will be comparing what you have to say about your Internet usage with what the university records about it. Besides looking at your Internet usage records, I will also be looking at your academic performance in the years 2009 and 2010. I will be using both your academic performance data and Internet usage records for the period mentioned to determine whether extensive Internet usage can be associated with poor academic performance. In addition should we find a positive association between extensive Internet usage and poor academic performance, Wits University could develop some kind of support programs for students who want to deal with this issue.

Your participation is voluntary and should you wish to participate in this study may you please be advised that your information will be kept confidential. The random unique number that appears on your questionnaire ensures the confidentiality of the information you will provide us. However, you will have to indicate to us your student number along with your questionnaire random number so that we could retrieve your performance data along with your surfing records from the relevant university departments. Once we collect those, your student number will be replaced by the unique random number appearing on your questionnaire so that when we link your surfing records, to your survey answers and to your academic performance, your identity will remain unknown for the rest of the study. The university will keep the sheet on which you will have provided your student number and your unique random number.

My study involves participants from different academic courses and who are in their 3rd year of study because they would have spent the previous two academic years at Wits University, which is the time period I chose to test my research hypothesis. As you can therefore see, your class was randomly selected so were any of your classmates for that matter.

I will be more than happy to email my findings to you on your request once my study will be completed.

Thank you for your participation.

Appendix B

Participant Consent Form

I, _____ (student number) am consenting to involvement in this research which description was provided in the Information sheet I read.

I acknowledge my participation to be voluntary and I do not expect it to be remunerated whatsoever by the researcher.

I, NGOUMANDJOKA Unnel-Teddy, principal researcher for this study attest that the participant is free to withdraw from the study at anytime without any prejudices resulting from the participant's withdrawal.

Participant's signature

Researcher's signature

Appendix C

Research Questionnaire

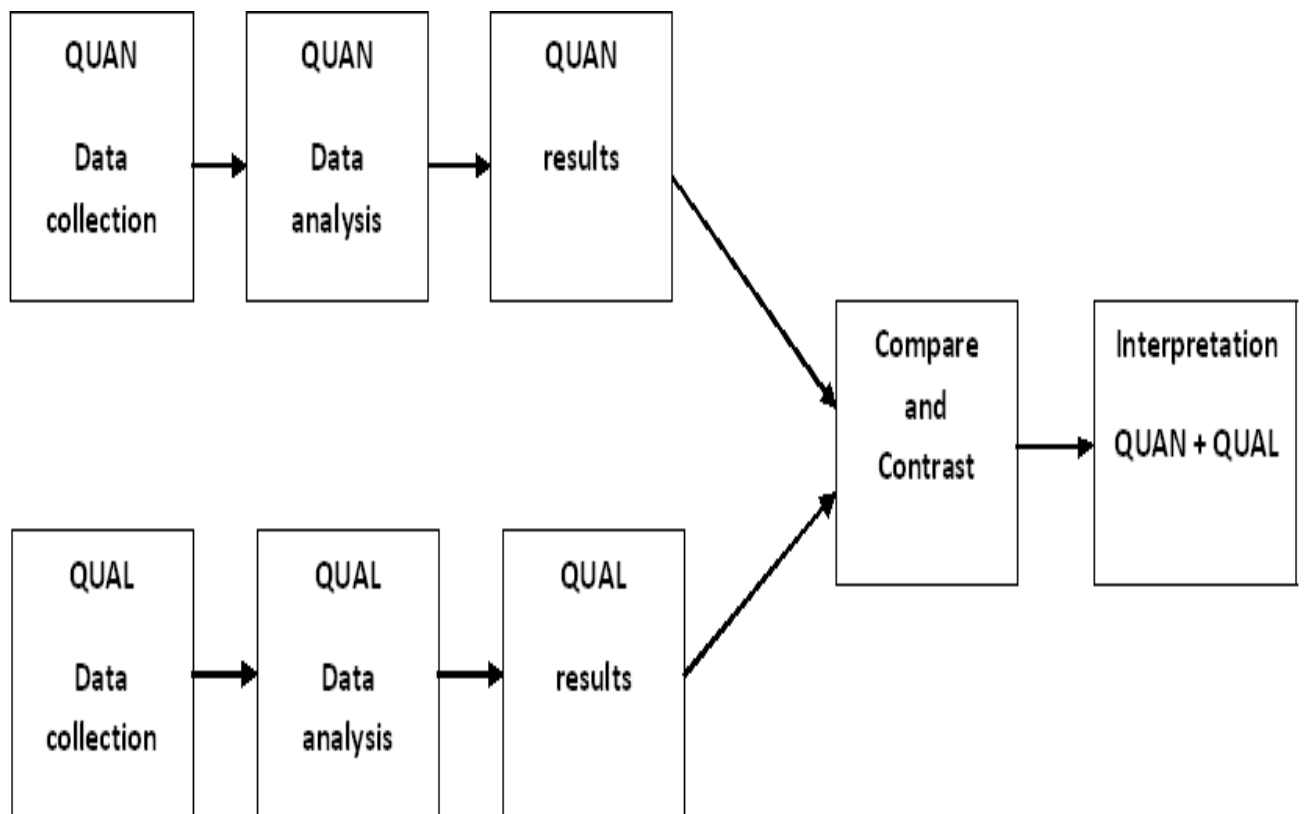
1. Survey Random Number: _____

2. Please answer YES or NO from item 5 to 11.

Item	Response
Have you been staying on university residences between 2009 and 2010? If yes please indicate the year(s)	
How many hours per day do you use the Internet?	
What are the reasons you access the Internet? Please rank in order of preference the following: academic work, recreational activities, relationship development and maintenance, others . . .	
How has the Internet influenced your academic performance over the past 2 years (positively or negatively?)	
Do you use the Internet to improve your grades?	
I usually stay online for longer periods than intended	
I have reduced the time I spend on other activities because of Internet use	
I have found it difficult to cut down on the time I spend on the Internet	
I feel more joy and comfort spending time online than being with friends or relatives	
I have been late for classes or appointments more than once because of using the Internet	
I go to sleep late at night because I need to be on the Internet	

Appendix D

Triangulation Design: Convergence Model



Appendix E

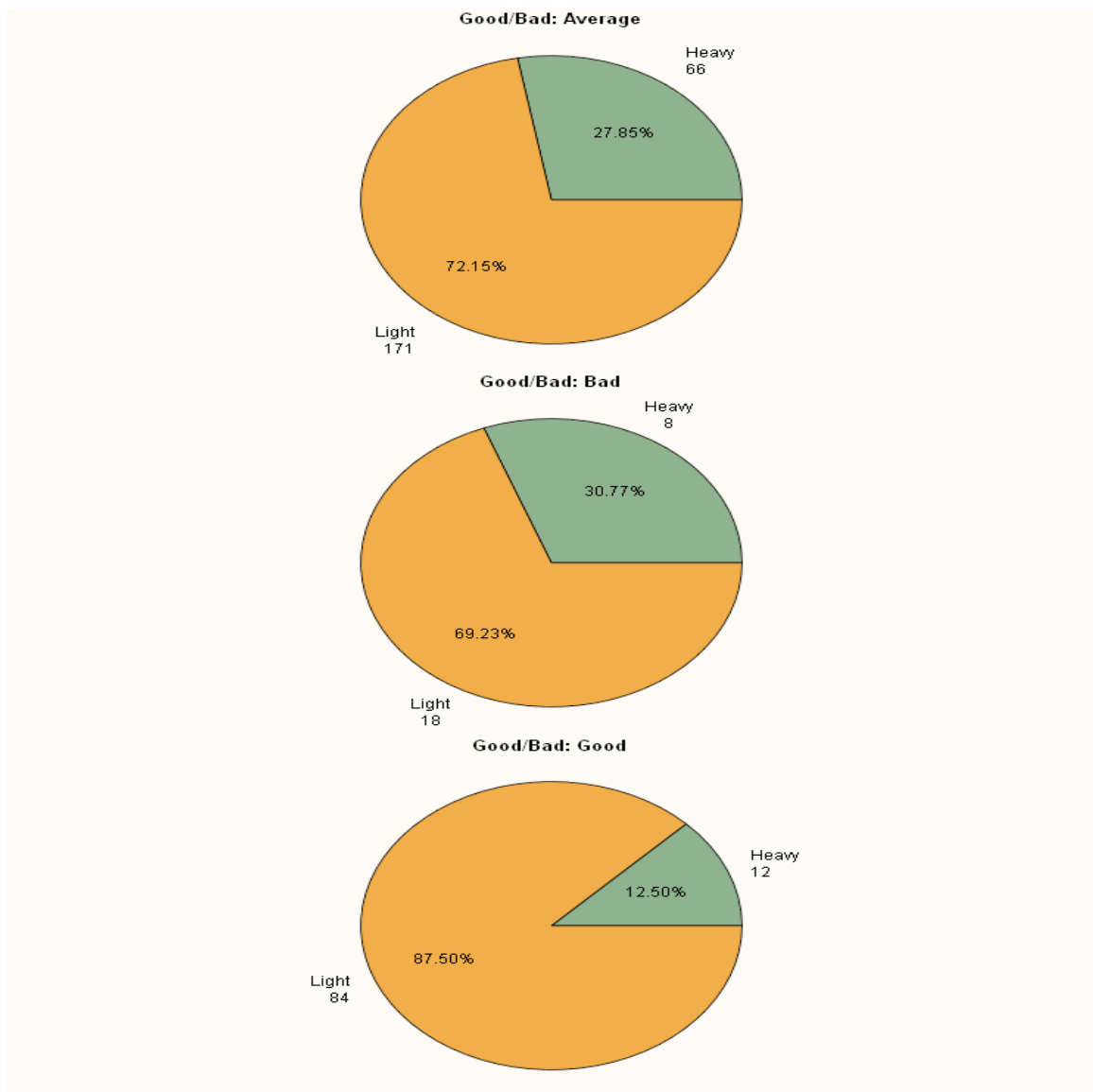
Websites Frequently Visited

Website	Frequency of visit
www.facebook.com	214
www.google.co.za	84
www.mathxl.com	58
mail.yahoo.com	56
runonce.msn.com	51
www.masteringchemistry.com	20
www.youtube.com	16
training.esri.com	16
www.syndetics.com	12
www.sciencedirect.com	12

The table above lists the most frequently visited websites between 2008 and 2010. Please note that this result was derived by compiling a list of the top 3 visited websites by each student between 2008 and 2010 and then counting the number of occurrences of these websites in that list.

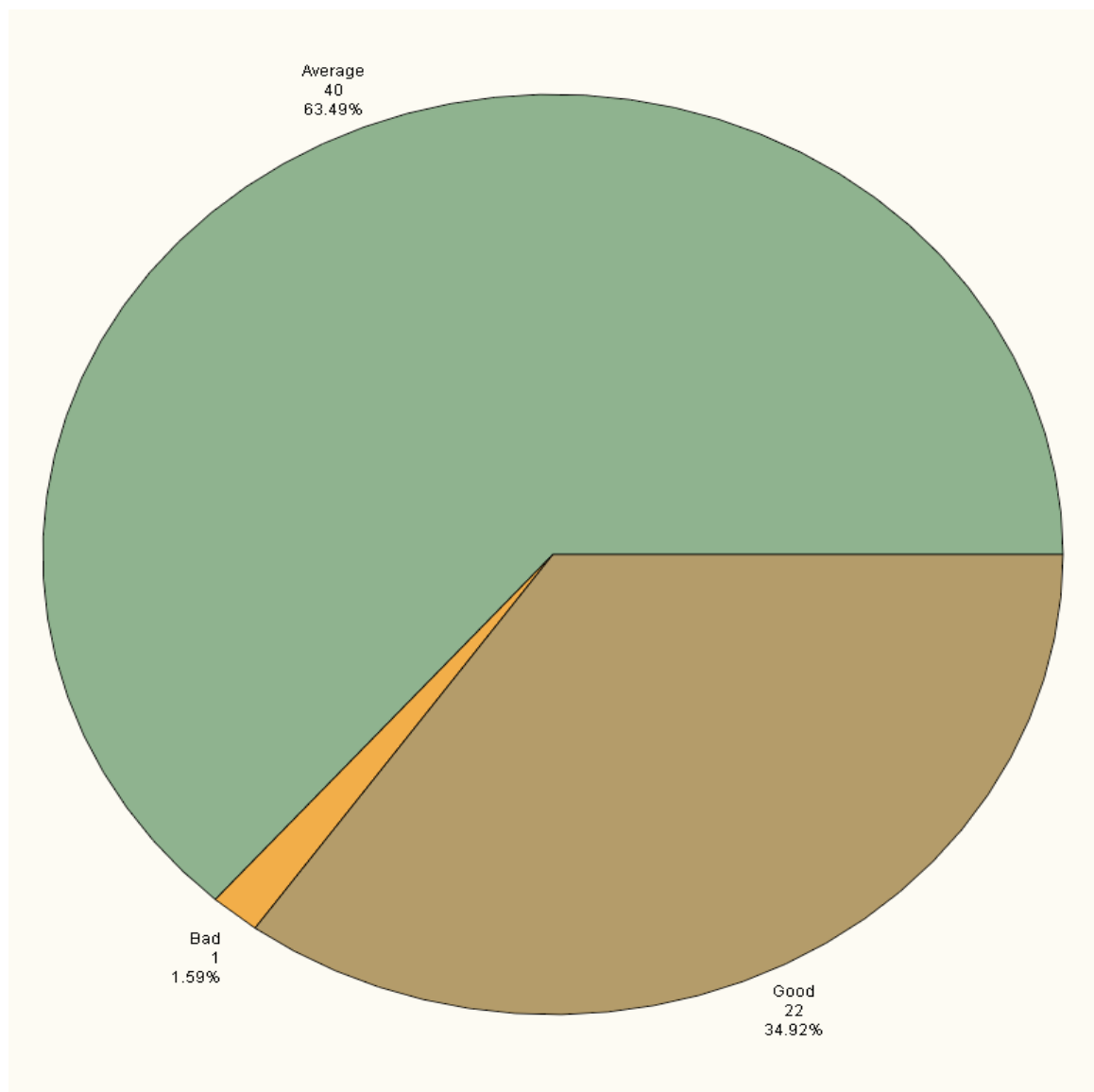
Appendix F

Proportion of ‘heavy’ and ‘light’ Internet users by categories of students



Appendix G

Proportion of ‘good’, ‘average’ and ‘bad’ students with academic work being first purpose



Appendix H

Main Reason students use the Internet per course

Table of _1st_reason by course												
		Course										Total
		1	2	3	4	5	6	7	8	9	10	
1st Reason												
Academic Work	Frequency	1	3	5	2	17	2	8	5	5	15	63
	Col Pct	5.00	9.68	17.86	7.69	20.99	7.41	61.54	12.82	12.50	27.78	
Others	Frequency	9	15	5	3	6	9	2	6	10	9	74
	Col Pct	45.00	48.39	17.86	11.54	7.41	33.33	15.38	15.38	25.00	16.67	
Recreational Activities	Frequency	10	9	18	18	52	14	3	25	13	28	190
	Col Pct	50.00	29.03	64.29	69.23	64.20	51.85	23.08	64.10	32.50	51.85	
Relationships	Frequency	0	4	0	3	6	2	0	3	12	2	32
	Col Pct	0.00	12.90	0.00	11.54	7.41	7.41	0.00	7.69	30.00	3.70	
Total	Frequency	20	31	28	26	81	27	13	39	40	54	359

1. Architecture and Networks
2. Engineering Economics
3. Formal Languages
4. Igneous Petrology
5. Management and Cost Accounting
6. Microbiology
7. Physics
8. Political Studies
9. Public International Law
10. Remote Sensing

Appendix I

Main reason students use the Internet per residential status

Table of _1st_reason by Residential Status				
		Residential Status		Total
		Off campus	On campus	
1st Reason				
Academic Work	Frequency	51	12	63
	Col Pct	19.69	12.00	
Others	Frequency	61	13	74
	Col Pct	23.55	13.00	
Recreational Activities	Frequency	122	68	190
	Col Pct	47.10	68.00	
Relationships	Frequency	25	7	32
	Col Pct	9.65	7.00	
Total	Frequency	259	100	359