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DO WEB-BASED PEDAGOGICAL TOOLS PROMOTE SELF-REGULATED LEARNING IN UNIVERSITY STUDENTS

A CASE STUDY OF THE LEARNING MANAGEMENT SYSTEM AT NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY IN ISLAMABAD, PAKISTAN

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Do Web-Based Pedagogical Tools promote self-regulated learning in university students - A case study of Learning Management System at National University of Sciences and Technology, Islamabad, Pakistan.

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Abstract

Education forms the core of all developmental activities. There exists a strong relationship between education and socio-economic development. However, only the education that prepares individuals which contribute to the society has the potential to unriddle dismal economic growth in the developing countries. The education system in most of the developing countries can be streamlined by employing technology to facilitate the learning processes. Hence an indirect yet a decisive role of technology for better education which paves the way to socio-economic development cannot be denied. Many universities even though they have employed technology into their education system continuously fail to establish effective learning process for the students. Therefore, this study has been conducted aiming to address a similar issue and to examine the use of the LMS at the National University of Sciences and Technology in Islamabad, Pakistan. The study essentially examines whether the use of the Learning Management System (LMS) assists the students to achieve better self-regulated learning and subsequently do the students report better satisfaction with their learning outcomes and productivity level. The study employs a quantitative approach based on descriptive and inferential statistics. The results from this study can help to improve the ways the LMS can be optimally utilized at NUST to effectively facilitate the learning process. Additionally, other universities based in Islamabad can take lessons concerning the use of Web-Based Pedagogical Tools (WBPT) to boost self-regulation and learning outcomes.

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Dedication

I dedicate this work to my parents.

Declaration

I, Ubaid ur Rehman, hereby declare that the study "*Do Web-Based Pedagogical tools promote self-regulated learning in university students - A case study of Learning Management System at National University of Sciences and Technology, Islamabad, Pakistan*" has not been submitted to any other universities than the University of Agder, Norway for whatsoever purpose.

Table of Contents

List of Figures

List of Tables

Appendices

Abbreviations and Acronyms

ANOVA: Analysis of Variance

DOCC: Distributed Open Collaborative Course

ICT: Information Communication Technology

LMS: Learning Management System

MOOC: Massive Open Online Course

NUST: National University of Sciences and Technology

SPSS: Statistical Package for the Social Sciences

UNESCO: United Nations Educational, Scientific and Cultural Organizations

UNICEF: United Nations International Children's Emergency Fund

WBPT: Web Based Pedagogical Tools

Chapter One: Introduction

 1. **Introduction**

Education forms the core of all developmental activities. The fundamental role that education plays in growth and development cannot be denied. Countries can achieve sustainable development only when the potential of the human brain is utilized optimally (United Nations, 2015). Education proves to be the best tool to unleash that potential. Despite the substantial role of traditional education in development, it is critical that the methods by which education is delivered must change in accordance with the needs of the present technological era (Bjørke, 2016). Therefore, employing technology in education is an imperative. Research has demonstrated how technology has reinforced the education systems and the process of learning. This also brings attention to how digitalization of education has changed the entire scenario of learning. Embedding technology into education has shifted the traditional methods of education towards a new learning paradigm where the learners take the responsibility of educating and self-regulating themselves (Attard, Loio, Geven, & Santa, 2010, p. 6). This can pave the way towards a better future of learning.

The human being is a key component in the complex process of development. Education lays down the foundation towards development by creating active participants that contribute to the nation's development. The United Nations Educational, Scientific and Cultural Organizations (UNESCO) therefore highly emphasizes the role of education and labels it crucial to acquire knowledge, achieve one's individual goals and contribute to the wider society.

According to UNICEF (2000, p. 4) the quality of education is a complex system and constitutes the learners who are healthy and participative, educational environment which is healthy and provides adequate resources and facilities, relevant curriculum which provides adequate skills and knowledge, and processes through which trained teachers disseminate information to achieve those outcomes that are based on creation of knowledge and skills. According to UNESCO (2015), good quality education is the right of every child, youth and adult and not the privilege of the few. It is not the technological advancements and solutions that can bring sustainable development but a good quality of education at all levels (UNESCO, 2014).

In the modern world, the use of information communication technologies (ICT) has increased to a tremendous amount in both public and private sectors. In the context of employing ICT in education, broadly it constitutes of numerous elements like compact discs with interactive assignments, videos, the internet, software, computer supported self-instructional courses, massive open online courses (MOOCs), distributive open collaborative courses (DOCCs), computer programs and the list goes on (Bjørke, 2016). An appropriate amalgamation of ICT with the education system can lead to a better quality of education. As Bjørke (2016) proposes, merely throwing technology in the classroom will not work. An emphasis upon customized and collaborative learning can reinforce the quality of education. In the modern era of technology, there exists a lot of untapped potential in employing technology into education and many universities make large investments in deploying ICT in the education systems. The question is whether these technologies are utilized effectively and what impact they bear on education and learning outcomes.

This research aims to find out whether the use of technology bears an impact on the quality of higher education at National University of Sciences and Technology (NUST) in terms of effective learning and better self-regulation of the students. The research will examine whether the students perceive if the Learning Management system (LMS) reinforces their self-regulation and learning outcomes. The research, therefore, undertakes the case study in NUST. NUST is ranked as one of the best higher education institutes in Pakistan. NUST also holds a good position in the world ranking and makes to the list of top 300 universities in the world.[1]

Embedding technology into education is a comparatively nascent concept in Pakistan and there has been limited research concerning the use of technology in education. Therefore, it is an imperative to examine if technology has proved to be a silver bullet to change the traditional methods of learning in Pakistan. The thesis is of significant importance because the results will provide a deep insight into the impact of technology on education at NUST and provide concrete solutions that may halt the effective use of the LMS. The research employs a quantitative methodology to address the research objectives. The results are based on primary data that predominantly uses a quantitative survey.

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[1] See QS world university rankings

1.1. Problem Statement

The use of ICT has been expanding in different areas of life during the last few decades. Undoubtedly, the use of ICT is a pre-requisite to living and working in the contemporary world. ICT keeps on transforming the various dimensions of societies from employment to leisure and bureaucracy to education (Selwyn, 2003, p.99).

LMS at NUST was first introduced in 2008 when NUST took an initiative to substitute the traditional paradigm of pedagogy with a contemporary paradigm, that is employing technology into the education system (NUST, 2016). Undeniably the purpose of employing technology in the education is to facilitate the learning process and improve the learning outcomes of the students.

Research in this area has demonstrated that the use of technology bears a potential impact on student self-regulation, their productivity level and learning outcomes (Zimmerman, 2008; Dabbagh & Kitsantas 2013). The study is aimed at understanding whether there exists a relationship between the use of the LMS and better self-regulation at NUST. Moreover, if the students using the LMS report a higher satisfaction with their learning outcomes and productivity level. Based on this the study will also investigate if the LMS is utilized to its optimum to achieve better learning at NUST.

The study performs an in-depth analysis of the matter using a quantitative method including descriptive (i.e., frequency tables, pie charts, histograms) and inferential statistics (i.e., Spearman's rho, multiple regression, ANOVA) respectively. The understanding of the subject can benefit NUST because the research will highlight those important themes which if taken into account can result in an optimum use of the LMS, and to the society in general in terms of effective ways to utilize technology in education in Pakistan.

1.2. Main Objective

The main objective of the study is to find out what potential impact LMS bears on student self-regulation, their learning outcomes, and productivity level. Based on the results the study examines if the LMS at NUST is utilized effectively at NUST.

1.2.1. Specific Objectives
- To determine the potential impact that the LMS bears on student's self-regulation at NUST.

- To determine whether the students using the LMS report a better satisfaction with their learning outcomes and productivity level.
- To examine whether the LMS has been effectively utilized at NUST to facilitate the learning process.

1.3. Hypotheses:

H$_1$: The students at NUST who find themselves familiar with the tools available on the LMS perceive better self-regulated learning.

H$_2$: The students who use the web-based pedagogical tools available on the LMS report better self-regulated learning.

H$_3$: A high percentage of students using the LMS report satisfaction with their learning outcomes and productivity level.

1.4. Study Area

The geographical location where the study has been conducted is Islamabad, Pakistan. Islamabad is the capital city of Pakistan. It is the hub of higher education with most of the well ranked higher education institutes situated there. After completing their high schools a large number of students move to Islamabad from various urban and rural areas for good higher education. The black squares on the map shown below represent the location of various higher education institutions situated in Islamabad while NUST lying at the very South of the map.
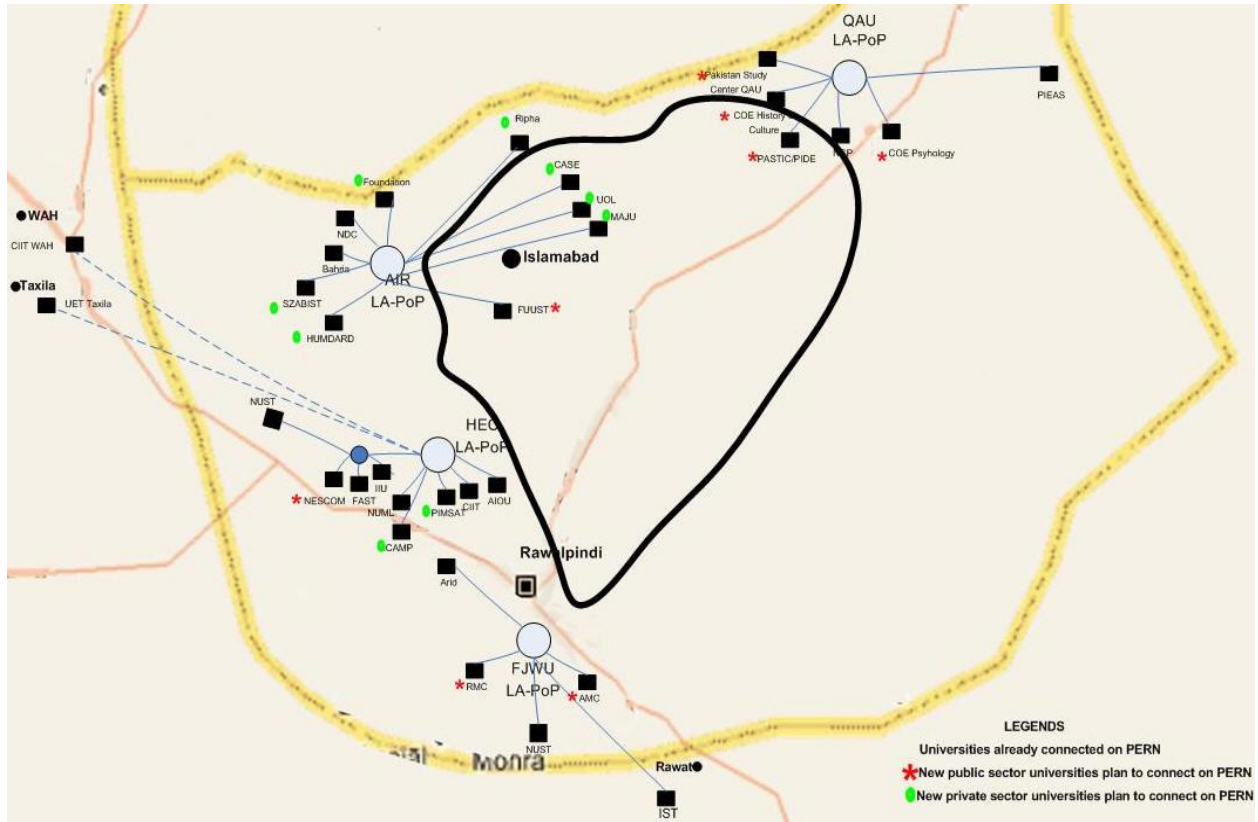
Figure 1: A map showing the geographical location of various higher education institutions located in Islamabad (Cortell, 2011)

NUST has been chosen as a case for this research due to its central location and good accessibility. It is a research-led University founded in 1991 and has over 20 departments. Currently, NUST enrolls over 10227 full-time students and 1280 faculty members. NUST has secured a good reputation and is listed among the next 50 leading young universities globally by Times (NUST, 2016a). NUST is also a member of United Nations Academic Impact, Commonwealth Universities and Tallories Network (Haq, 2016).

1.5. Key Statistics

Table 1. Student Key Statistics (NUST, 2016)

Number of students	Student to staff ratio	Percentage of international students	Student ratio of females to male
10,227	8.0	4%	33:67

According to Bughio, Abro, & Rashdi (2014, p.274) although Pakistan is putting efforts to adopt ICT at all levels of education, like the Global North, yet due to the lack of technological advancement these efforts are less productive. The use of LMS is a relatively new concept in higher education in Pakistan. Therefore, it is interesting to examine the impact of technology that is the LMS on higher education in Pakistan. NUST was using traditional methods of education when it first started using Moodle as an LMS in 2008 (NUST, 2016). Surprisingly, there have been few studies conducted on e-learning and its prospects in Pakistan. However, none of them particularly focuses on the use of LMS for effective learning and education. Therefore, the study examines the use of the LMS and its effect on the student self-regulation skills at NUST.

1.6. The Significance of the Study

The study is significant because the society can benefit from the findings of the study where the teachers and students can take lessons about the substantial role that the WBPT available on the LMS can play to boost self-regulation skills. The study will provoke the idea that the demand for a good quality education can be justified by making more investments in employing technology in education. Thus, the universities that are using the traditional models of education can derive a lesson from this study. Moreover, this study unveils some of the critical areas where the use of technology can be improved to facilitate the learning process, suggesting directions for further research in this area.

1.7. Methodology in Brief

The study employs a quantitative research strategy as a methodological approach to address the research objectives. The rationale to opt a quantitative approach is to achieve objectivity rather than an inclination towards the subjectivity of the researcher as we are aiming at examining the use of the LMS at NUST and its potential impact on student self-regulation. Moreover, the statistical findings can be generalized to the overall population of students at NUST. This approach will assist to restructure the broader issue of research into a specified number of variables which makes it easier to test various theories and hypothesis and determine a relationship between the variables. Both primary and secondary data are used in the research, however, the data analysis is predominantly based on the primary data obtained from NUST over a period of a month from December 2016 to January 2017. The data have been obtained from three departments including the department of engineering, department of business studies, and

department of social sciences. The quantitative survey is the predominant tool to collect the data.

1.8. Thesis Outline

This research study is divided over seven chapters. Chapter one incorporates an introduction to the research study explicitly stating the main objective and focus of the research. The chapter states the research hypothesis and introduces the issue and the research area that called for the need to conduct this research study. Chapter two presents the literature review and theoretical framework that forms the cornerstone of the research. Literature review, in detail, presents the data on the use of technology in education, LMS and its impact on learning which are of relevance to the study. The diagrammatical representation demonstrating the three stages of self-regulated learning serves as a framework around which the research revolves and guides the data collection and analysis. Chapter three gives a deep insight into the methodological approach and justifies the research strategy. Furthermore, this chapter sequentially explains the research design followed by an explanation of the data collection method, tools and techniques used, ethical issues and finally the challenges confronted by the researcher in the field. Chapter four in detail presents the data analysis and statistical model used to answer the research questions. Chapter five discusses the key findings obtained from data analysis in the light of theoretical framework and literature review. Chapter six concludes the research by explaining whether the research questions have been answered by the study and provide concrete solutions to the issues raised. Chapter seven provides an assessment of the entire research process and talks about the reliability and validity of the study. Furthermore, it indicates the possible direction for future research in this area.

Chapter Two: Literature Review and Theoretical Framework

2. Literature Review

This chapter reviews the literature from the earlier research that is relevant to the study. The chapter starts with the broader explanation on the use of technology and its potential impact on education and then explicitly elaborates on the concept of an LMS, its uses in education and discusses how it reinforces the pedagogical processes. The chapter discusses the significance of self-regulation and emphasizes that merely employing technology in the education system is not a silver bullet. To meet the needs of the present technological world an amalgamation of the technology with an optimal training on its use can lead to better self-regulation and learning outcomes.

2.1. Linkage Between Use of Technology in Education and Development

According to Chabbott and Ramirez (2000), there is a strong indirect relationship between education, economic growth, and social development. Education indirectly contributes to the economic growth by creating resources in the form of private and public income/taxations. This consequently helps towards the development of the society in the form of private and public spending.

Hanushek and Woessmann, (2007) found a relationship between the country's learning achievement and economic growth rates. For example, a big difference can be seen between Ghana and South Korea in terms of economic growth which in the early 1960's was at the same level. This is majorly because of the investments in the education sector that led to rapid economic growth in South Korea. However according to Wedgwood (2007) a common limitation to the studies that only consider the role of education towards the socio-economic development is that these studies ignore the effect of various decisive factors. Technology is one of the crucial elements that can reinforce the role of education towards development. For example, post-independence there had been a dramatic increase in the provision of education in Sub-Sharan Africa, however, the economic growth rates were dismal (Perkiö, 2011). This by and large is due to the ineffective use of technology in the education system because of which many of the developing countries find it difficult to thrive towards socio economic development. The framework presented in figure 2 shows the relationship where the technology lies at the core.
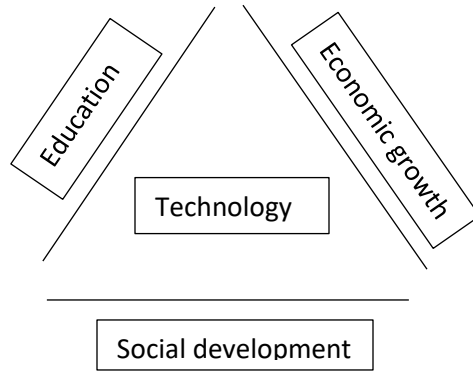
Figure 2: The relationship between education and socio-economic development where technology lies at the core (Source: Author, 2017).

Undoubtedly, technology, if put to an effective use, has the potential to boost the development in the respective sectors. Development be it social, economic, or political is a complex process. Various development indicators like international and domestic policies, economic policies and political situation strongly impact the development of any country. However, as mentioned earlier, education plays a significant role in the development of any society because it has the potential to promote the other goals of social development (Perkiö, 2011, p.119).

According to Hall and Midgley (2004, p. 153), education is a tool to curb poverty by opening new skills and knowledge for the people that break down the barriers which exclude the marginalized people from participating in the political and economic processes. An important consideration that arises is that what kind of education has the potential to bring the respective change? The answer to this question lies in the modernization of the education system. Like every other sector, education sector also needs to be modernized by incorporating technology in it (Bjørke, 2016). There is a need to build more smart universities which use technology to facilitate the learning processes.

The importance of education in development cannot be denied. Many developing countries have realized that education can prove to be a silver bullet to address the developmental issues and therefore try to adopt such policies which encourage an easier access to education. However, simply making the education accessible cannot solve the problem. The problem of quantity versus quality comes into play. How can a better-quality education be achieved? Can the technology prove as a guaranteed solution to streamline the education system in the developing

countries? Furthermore, do the people get an education to be entitled to get a certificate or diploma or do they adopt effective strategies to increase the efficacy of their learning. Unfortunately, most of the developing countries try to achieve higher enrollment statistics and do not take quality into account while formulating the educational policies (Grisay, & Mählck, 1991, p. 21). To effectively address this issue the policies and the methods through which the education is delivered must be changed. Technology can play a vital role by providing such tools that can assist the learning process and result in a better contribution towards development.

In Pakistan, over the last few decades, the use of ICT has resulted in a shift in the way how individuals, companies, and countries interact and perform various activities. However, currently, the coverage of higher education stands at a very low 5% when compared to other countries in the world (Bughio, Abro, and Rashdi, 2014, p.275). This is because the universities do not offer distance learning and accessing education for people becomes difficult. Although, employing ICT in education is a relatively new concept in Pakistan, yet it can unriddle the issue in the higher education to a considerable degree (Muhammad Nawaz Tunio, 2013). Presently, there is a massive gap between the number of students who graduate from higher secondary education and the students who get enrolled into the universities. There are few public universities and these universities do not employ ICT in their education system. On one hand the students do not have access to the very few public universities and on the other hand, they cannot afford to get into private universities. Only Allama Iqbal Open University has incorporated LMS for distant education but it does not suffice for the whole country. Bughio, Abro, and Rashdi (2014, p.278) propose that there is a dire need for investing in ICT in the education sector to solve the issue of low enrollment and effective learning in higher education in Pakistan.

The role of education is variable in the respective contexts and essentially depends on the quality of education and its significance in the context of socio-economic development. Therefore, this calls for a need to conduct a research on the ways education can be improved by effectively utilizing the technology that contributes towards the social development.

2.2. The Context of Technology and Education

A number of research studies conducted show that the use of technology in education bears a potential impact on education and can increase the efficacy of learning processes (Zimmerman, 2008; Dabbagh & Kitsantas, 2013). Since the last few decades, there has been a shift from the

traditional methods of learning to the modern era of pedagogy. For instance, since the 1980s when IBM created the first personal computer (PC), there has been a tremendous increase in the use of computers in classrooms. In that time, almost 20% of the classrooms integrated computers into the classrooms to facilitate the education and learning process (OurICT, 2015).

Over the last twenty years, the technology has brought in vast improvements in the education system and empowers the teachers and students to achieve a better learning environment. Almost twenty years ago it was impossible for the teachers to reach the students and vice versa. However, as of now, various sorts of technology like tablets, apps, PCs, the internet, and other web-based tools makes it easier for the learners and instructors to collaborate with each other regardless of their learning styles. Technology allows the instructors to actively engage the students that facilitate their learning process which could have been difficult to achieve otherwise (Taylor & Parsons, 2011). Not to mention, technology has completely changed the role of the teacher from being a traditional instructor to a facilitator and supporter of the student's learning. Technology also enables the instructors to be proactive and support the students exclusively if they need special guidance towards achieving a learning goal. Thus, the use of technology to facilitate and support the education system has created a solution where everyone benefits for both the instructors and the learners as it provides essential tools that can be used by the teachers to reach the students individually and simultaneously these tools help the students to choose the content they want to learn at their own will.

The use of computer technologies in education can be traced back to a few decades. Until the late 1980's, the use of ICT in education was a hot debate and in 1990's there was an explosion of the computer technologies and educational software for learning (Kats, 2010). After the 1990s, there has been a continuing transformation from the industrial regime to a technological epoch. Unlike the Global South, the Global North has adopted to the modern technologies in every facet of life including education. The countries that are not capable of shifting from industrial to technological societies cannot compete in the globalized world (Mac Keogh, 2001, p. 223). Modern technologies are being used to an enormous amount in our everyday lives. Likewise, ICT is used in education in the form of LMS, MOOC, DOCC and computer programs (Bjørke, 2016). International agencies, like UNESCO, are taking a central part in promoting ICT in education worldwide.

According to Mac Keogh (2001, p.224), the four rationales to include ICT in education are vocational, social, catalytic, and pedagogical. The vocational aspect describes vocational education given to the students that include technology. The social aspect defines the role which ICT play in the society and how the education manifests the concerns of the society. The catalytic aspect delineates that ICT in education can prove as a catalyst in changing the society in terms of education system, student-teacher relationship, and administration. The pedagogical aspect identifies that ICT in education can enhance the teaching processes and effective learning. ICT in education can contribute to amplifying educational opportunities, increase efficiency, augment the quality of learning, enhance the quality of instruction, facilitate skill formation, and support lifelong learning (Haddad, 2002).

Yadav and Mehta (2014) define ICT in the context of education as a set of technological tools used to create, store, manage and disseminate information. ICT assists teachers and students to add value to education for effective learning. Studies depict that the onset of ICT into the education system has brought a substantive increase in the quality and quantity of education. However, in contrast, Oliver (2002) claims that despite ICT have fetched an enormous change in several facets of society including businesses, architecture, and engineering yet the impact of ICT, particularly on education, has not proved to be much effective. This is because many developing countries are not capable of affording the costs associated with deploying ICT in the education system. Furthermore, even though universities make heavy investments on deploying ICT yet it has been identified that there is a lack of motivation in the teacher and students to utilize them (Starr, 2001). These two counterpointing views portray that the assumption of merely employing ICT in education can increase the quality of education without keeping other aspects like teacher-student motivation, training, technical support under consideration is not true in many cases. This denotes that the use of ICT does not assure a positive change in the education system if they are not used effectively.

2.3. Learning Management System (LMS)

The use of ICT is on the rise in the context of higher education (Allen & Seaman, 2016, p.4). In the present time, an inevitable necessity for using ICT in education has led the higher education institutions to recognize the significance of ICT to be critical to their competitiveness and growth (Dabbagh & Kitsantas, 2013, p.197). Numerous research studies have deemed substantive the

use of ICT in education to sustain meaningful and effective online learning. Given the growth rate in the use of ICT and web-based pedagogical tools over the last decade, the pervasive use of LMS to achieve effective learning in higher education to enhance teachers and learners' interaction has also increased to a considerable degree

An LMS is an internet based system that has the capacity to render, track and report on the learning and training processes that happen anywhere. In the context of education, LMS is a database that contains information about the teacher, students, course, and contents (Kats, 2010, p.1). An LMS contains various features such as discussion forum, calendar, chat, tools that support self-regulated learning and time management (Dabbagh & Kitsantas, 2013, p.198). According to them, an LMS is an "enterprise technology" or a course management system which contains web applications that integrate pedagogical and technological tools of the Internet and the Web together to facilitate Web-based courses and online learning environments. These technological and pedagogical tools can facilitate meaningful and effective learning.

Additionally, studies show that these tools can scaffold to acquire metacognitive skills that assist the students to self-regulate themselves and achieve effective learning (Kitsantas & Chow, 2007). For instance, Hollingworth and McLoughin (2001) demonstrated that while the students possessed problem-solving skills, they lacked metacognitive skills like planning and revising the solutions to the problems. To address this issue an online tutorial using LMS was developed to engage the students in monitoring and evaluating their own approach towards problem-solving. Results demonstrated that the tutorial provided using LMS allowed the students to comment on each other problems' solution which in addition to gauging motivation developed analytical and cognitive skills among the students which they lacked before (Hollingworth and McLoughin, 2005). In addition, Kitsantas and Chow (2007) demonstrated that the students who engage the use of LMS to support their studies demonstrate a higher level of confidence in seeking help via online discussion forums than in the traditional classrooms.

LMS contains synchronous and asynchronous learning management tools. LMS embedded synchronous tools include electronic white boards, chats and audio and video conferencing. Similarly, asynchronous tools include emails and discussion forums. Learning management tools enable the students to work collaboratively and learn as a team. Dabbagh and Kitsantas (2013, p.200) explain that LMS serves as a place for the students where they can collaborate and share

their ideas with other students, edit course documents and collectively work on group activities. This allows the learners to get assistance from peers and LMS community members by engaging in effective dialogues regarding course content when they are confronted with a difficulty. Moreover, the learners can also define and establish individual and group goals where the learners can hold themselves accountable whether they fulfill their responsibilities of being an active member of the group (Dabbagh, 2002).

Dabbagh and Kitsantas (2013) explain that in addition to student support, LMS contains various tools such as curriculum archives that assist the instructors where the instructors can upload the course contents. This enables the instructors to effectively provide the course resources to the students on time. Thus, LMS creates such a learning environment where the instructors and the students collaborate and effectively interact with each other creating a fruitful learning environment. Furthermore, these tools facilitate the instructors to elaborate, organize, structure, and transform the learning content in a way that supports effective learning (Dabbagh & Kitsantas, 2004). This allows the learners to choose from a variety of learning options and to clearly understand and interact with the course content consequently the learners developing a higher interest in the course content (Dabbagh, 2002).

Furthermore, LMS includes tools to manage information about the students such as providing user ids and passwords, administering tests and quizzes, posting scores and grades, managing and setting the duration and availability of course components and tools to generate areas where the students can communicate and collaborate among themselves and with the instructors (Dabbagh & Kitsantas, 2013). In addition to the mentioned administrative tools, LMS also contains hypermedia/learning tools. Using hypermedia tools students can explore the information available on the Web and create a personal learning experience where students can locate the web-based resources, bookmark them, take notes and compile the information available (Kitsantas & Dabbagh, 2004). Hypermedia tools also include community and network building tools which allow students to build networks based on their learning requirements (Kitsantas & Dabbagh, 2010). Such tools include glossaries, course index, search and bookmark feature and digital libraries and databases. Additionally, LMS includes various assessment tools to create online tests and develop performance-based portfolios. In addition to supporting the instructors,

the assessment tools enable the students to do a self-assessment, peer assessments and their performance assessment using various graphic charts, scales, and grading criteria.

2.4. LMS at NUST

LMS at NUST started in 2008 with the idea of gearing up classroom teaching. LMS at NUST provides the instructors and the student with a platform to collaborate and share ideas for better learning. Like any other LMS, the LMS at NUST contains file management, user management and communication tools, online quizzes, grading and assignment submission tools. In short LMS at NUST attempts to make a creative learning environment to improve the quality of academia. Figure 3 shows a screenshot of the LMS portal at NUST.
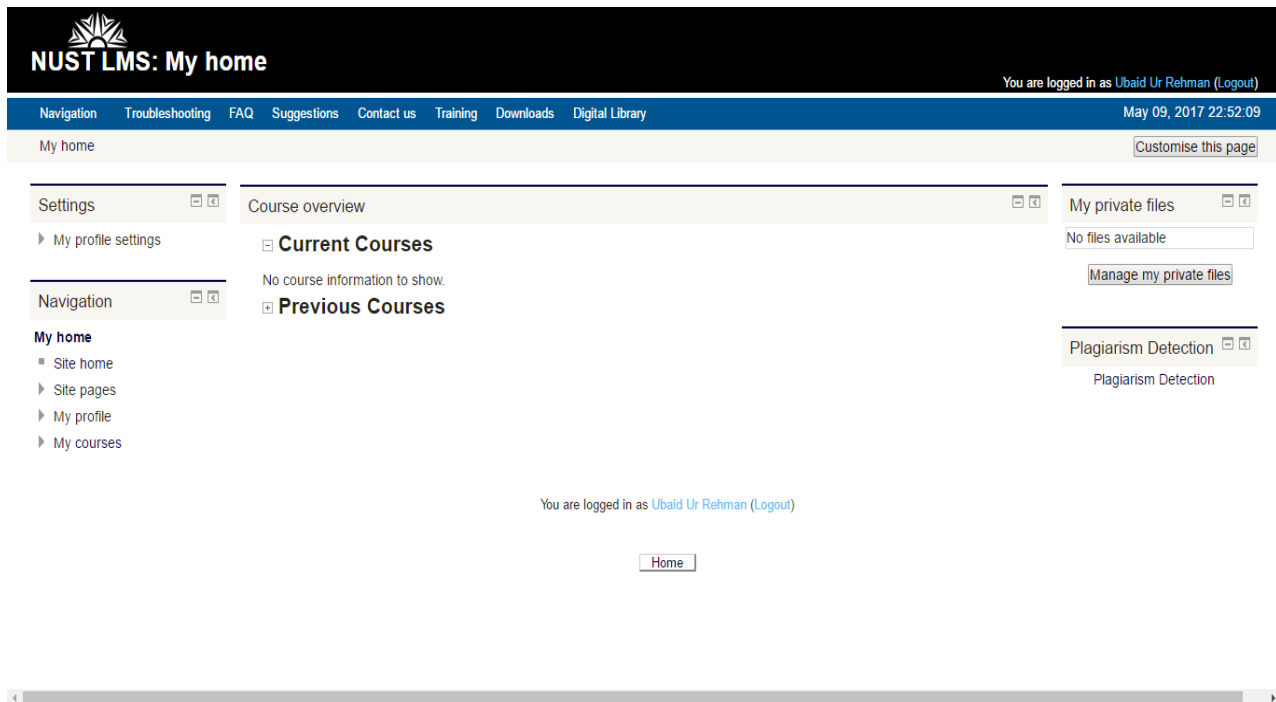
Figure 3: NUST LMS portal (NUST, 2017)

2.5. Theoretical Framework

Self-regulation is the extent to which the students can monitor, evaluate, and reflect on their learning progress. The figure below demonstrates the three fundamental stages of self-regulated learning.
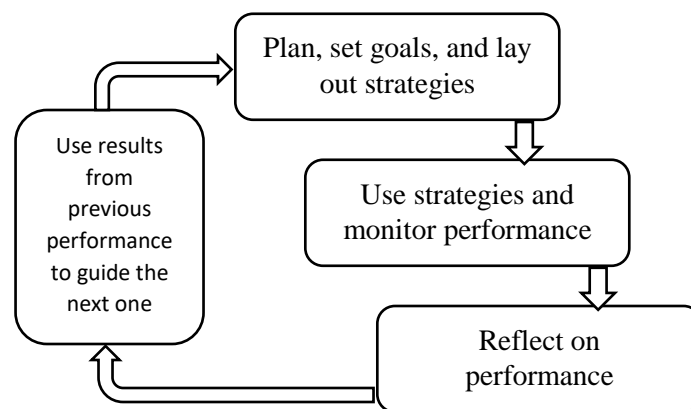
Figure 4: The cycle of self-regulated learning. From (SAGE n.d.)
Zimmerman (1989, p. 329) describes self-regulation as a process where the students metacognitively, motivationally and actively hold themselves responsible for their own learning process. These students take initiatives and channelize their energies towards acquiring knowledge on their own and do not altogether rely on the teachers and others for assistance. To accomplish effective lifelong learning students must adopt respective strategies.

Under the definition of self-regulation, there are three key concepts that must be understood. These are foremost self-regulated learning strategies which involve those activities, actions, and processes that are aimed at acquiring knowledge and skills. These actions and processes comprise seeking and organizing information and transforming it into knowledge (Zimmerman & Pons, 1986, p. 618). Secondly, self-efficacy encompasses the perceptions about one's capacities and capabilities that are requisite to coordinate and implement actions deemed to reach the certain performance of skill for specific tasks (Bandura, 1986). Finally, the commitment to academic goals such as grades, social admiration varies extensively in nature and the time to accomplish it (Zimmerman, 1989, p. 329).

Self-motivation and self-direction establish the foundations of self-regulation, which means that the students must possess necessary skills and know how to strategically engage these actions and activities that assist in the cognitive process of acquiring skill or knowledge (Dabbagh & Kitsantas, 2013, p.203). However, according to Zimmerman (2008), self-regulation is not something that just occurs, it is not an inherent ability of the student but something that is learned and developed by a sufficient training furnished by the instructor.

In the contemporary world of digitalization, availability of limitless information and employment of technology in the classrooms, it is of the essence for the students to discover how to self-regulate themselves to achieve an effective learning (Dabbagh & Kitsantas, 2004). The idea of self-regulation becomes more significant when it concerns online, distant, or blended learning because these types of learning demand students to stay self-motivated and self-direct their own learning process. Engaging self-regulatory processes like setting goals, strategically working towards those goals, and monitoring and evaluating permits the students to effectively self-regulate themselves (Zimmerman, 2008, p.176). Goal setting allows the students to explicitly identify their learning outcomes and then recognize those strategies that could facilitate towards reaching those goals (Zimmerman, 2000, p.87). Therefore, goal setting serves as an essential component of self-regulation. Research conducted by Zimmerman and Kitsantas (1999, p.243) demonstrates that students who set specific goals in comparison to general goals and deliberately focus on the processes and actions rather than merely the outcomes of the goals display better learning and skills and report higher motivation towards completing a task.

Under self-regulated learning, students can implement task strategies to attain their learning goals. Task strategies encompass deep processing and elaborative strategies such as rehearsing, revising notes, drafting the main ideas, and using mnemonics to remember important concepts of a theory (Dabbagh & Kitsantas, 2013, p. 203).

Time management likewise is one of the decisive elements that must be taken into account for improved learning. Under self-regulation, the basic theme of time management relates to efficacious utilization of time and is highly correlated to successfully accomplishing the goals. Research indicates that the students who keep track of the time they devote to a specific learning task develop patterns to efficiently budget their time and account an appreciation of the value of time spent towards achieving the learning outcomes (Zimmerman 2000; Kitsantas, Winsler, & Huie, 2008).

Self-monitoring, a personality trait pertaining to the ability of the students to regulate their learning behavior is also an essential metacognitive phase of self-regulation. It directs the student behavior and sets them aside to monitor the effectiveness of their efforts towards goal attainment (Dabbagh & Kitsantas, 2013). For instance, knowing the outcomes of the efforts students put in

permits them to make appropriate adjustments to reach the desired outcomes (Zimmerman & Kitsantas, 1999, p. 248).

Another key component of self-regulation is self-evaluation which pertains to comparing ones' performance outcomes with set goals (Zimmerman, 2000, p.87). While the students monitor their efforts that they invest into a task they subsequently can evaluate their performance towards larger goal acquisition (Zimmerman, 2008, p.170). Thus, self-evaluation proves to be an effective strategy for the students who desire better learning in future. A research study conducted by Zimmerman (2008) shows that the students who self-evaluate their performance demonstrate higher interest towards goal attainment and consequently display higher skills acquisition compared to those who do not self-evaluate.

Thus, the students who self-regulate themselves using various self-regulation strategies including goal setting, monitoring, and evaluating are aware and direct their efforts strategically to increase the efficacy of their learning process. This can be achieved through proper training by the instructors. If it is not addressed by the teachers, students may adopt maladaptive strategies of memorizing and rehearsing (Dabbagh, & Kitsantas, 2013, p. 204). Research shows that maladaptive learning behaviors can be eliminated by teaching self-regulatory processes to the students that enhance their skills and learning outcomes (Zimmerman & Kitsantas, 2005; Zimmerman, 2008). For instance, the instructors can guide the students on how to monitor and evaluate their learning process. Once the loopholes are identified the students can make the needed adjustments. Once the adjustments are made the next step is to execute them and monitor their effectiveness. Students can achieve an optimal level of self-regulation by engaging the sequential cycle, that is, first monitoring and evaluating their performance, making the desired adjustments, and then again monitoring the efficacy of the adjustment made (Dabbagh, & Kitsantas, 2013).

In blended learning, the physical presence of the instructor can prove a silver bullet for those learners who have lower self-regulatory skills. It is of significance importance to create awareness among the students having low self-regulatory about the WBPT present in an LMS to achieve better learning. This includes using electronic schedules for time management, following progress through portfolios, seeking help on discussion forums etc. Hence the goal of this research is to examine whether the LMS at NUST assists the student to achieve a better self-

regulated learning and whether the students who use the LMS report satisfaction with their learning outcomes and productivity level. Moreover, based on these results the study examines whether the LMS is being effectively utilized. The flowchart presented in figure 5 gives an understanding of the theoretical framework adopted from the literature review and a broader view of the study.
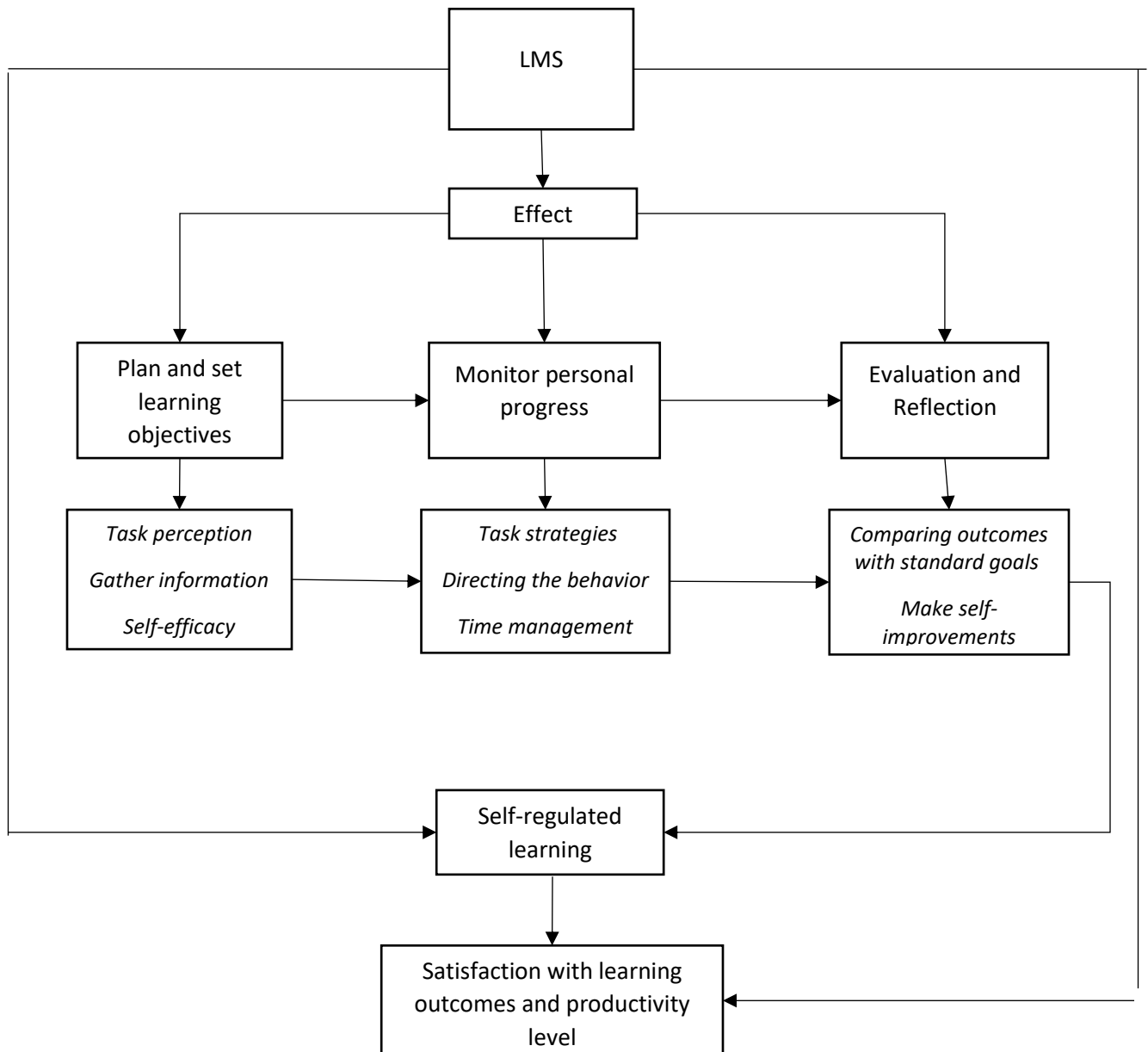
Figure 5: Flowchart demonstrating the effect of the LMS on the respective stages of self-regulated learning (Source: Author, 2017).

Chapter Three: Methodology

This chapter starts off with the ontological and epistemological perspective that organizes the knowledge domain of the study and explains all the relevant entities and their relations to conduct this research study. It also discusses in detail the type and design of the research and why it was chosen. Subsequently, the chapter explains various data sources, data collection methods and sampling techniques used in the research. The chapter concludes with stating the ethical concerns and the challenges faced by the researcher in the field.

3. Ontological and Epistemological Considerations

Epistemological and ontological paradigms lay down the foundation of knowledge in the social world. Epistemology describes the philosophy of knowledge and what it means to know something (Hannafin, Kim, & Kim, 2004, p.5). On the other hand, ontology refers to what does it mean to be a thing, the magnitude of the relation of the social things/entities with the social realities (Bryman, 2012). The ontological perspective gives an assertion that the knowledge obtained must be free from instrumentalism, prejudices, and biases of the researcher and other social influences. The key point to grasp here is that research method should focus on the objectivity rather than the subjectivity of the researcher, that is the outcomes of the research are not influenced by the researcher. That lays down the foundation of the quantitative research.

Positivism is an epistemological orientation which implies that there is only one objective truth while studying any social phenomenon (Bryman, 2012). The knowledge obtained in this study is independent of biases and prejudices based on interests, emotions, or personal beliefs. The key consideration is that there is a frequent emphasis on objectivity which means that the study lies external to any influences by the social actors. The data is obtained through self-completion questionnaires for the study. Based on the data collected generalizations are made for a larger population. The results obtained using this technique are quantitative, derived from statistical rules. Inferences are deduced based on the result findings.

Objectivism, on the other hand, is an ontological orientation which means that social phenomenon is independent of social actors or the researcher (Bryman, 2012, p .33). For example, the object of interest in this study is to examine the relationship between LMS and self-regulated learning. Therefore, objectivism is a suitable approach to understanding the relationship between the variables in this study. This study chooses objectivism as opposed to

constructionism to explain the phenomenon under study because of the objective nature of the research issue. The results obtained in this study are statistical data governed by the rule of mathematics, therefore, they are genuine and free from researcher's preoccupations.

A quantitative research comes in this paradigm. The results used in this study are from 213 respondents from the respective departments obtained through stratified probability sampling. Therefore, the findings presented are generalizable to a larger population at NUST. The data obtained helped me to get an insight into the phenomenon under study and based on the hard statistical findings deduce inferences about the problem under study. The next section presents the reasons as to why I have chosen a quantitative study.

3.1. Why Quantitative Approach

Over the last few decades, there has been a continuous contention among the academic scholars about the practice of quantitative versus qualitative research approach and whether one overrules the other. Different authors hold different standpoints about the constitution of the two approaches nevertheless there exist a substantive correspondence about the fundamental contradictions in terms of their practical implications for conducting a research (Bryman, 2012). According to Bryman (2012, p.15), the qualitative apprehension of the social processes serves to understand the cause and effect of a social phenomenon. This offers a better approach towards interpreting the human behavior and therefore can be an advantage over the quantitative approach. However, in contrast, as accounted earlier quantitative approach is more objective rather than based on the subjectivity and researcher's personal impressions and hence more likely to be free from researcher's preconceptions. In addition, Durkheim (1938, p. 31) while conducting an analysis of social factors like culture, family, economy etc. states because the qualitative studies are inclined towards personal preoccupation, biases, and prejudices, therefore, the researcher must devote attention to these issues and try to eliminate them. This means that a qualitative approach can be challenged based on these issues.

According to Silverman (2001), while discoursing the superiority of one method over the other it might be unwise to acknowledge one method overrules the other. According to him, the question here is not about the preeminence of the two methods but the adequacy of the technique which hinges upon the nature of research question under study. Subsequently, the superiority of the

method can be ascertained by probing which method can prove effective to conduct the research (Silverman 2001, p. 4).

The fundamental query for this research study is to identify the extent of the potential impact that LMS bears on student's self-regulation and their learning process. An authentic information to examine the extent of the impact of the independent variable that is the use of LMS at NUST on the dependent variable that is self-regulated learning can be obtained through statistical analysis rather than qualitative data. Therefore, an appropriate approach to test the hypotheses would be to espouse a quantitative approach.

It is however of the essence not to blank out the deficiencies of this method and its implications on the research findings. According to Saunders *et al.,* (2009) the primary intention of the quantitative research is to quantify the data and generalize for a larger population based on the response from the sample population. However, according to Simon (2011), while generalizing and deducting inferences there might occur respective limitations such as an improper representation of the target population. This issue is minimized through administering questionnaires based on the numbers of students in the respective departments to obtain a normal distribution of the sample population.

Another limitation while conducting a quantitative research is that it is difficult to control the research environment (Baxter, 2008). This implies that researchers on certain occasions may confront difficulties in receiving the responses under a certain time frame. This issue was also minimized by administering questionnaires to the students in the classrooms by visiting respective departments. Nevertheless, the rationale for employing a quantitative technique is to come across the facts assuming a fixed measurable reality that is the presumption if the employment of LMS at NUST has an impact on student self-regulation and their learning process. The data acquired from the three departments are genuine data which are analyzed through statistical inferences and numerical comparisons and ultimately accounted through statistical analyses. Furthermore, there are no personal and individual values regarded that could influence the statistical findings. Therefore, research can be viewed to be neutral since the answers obtained from the respondents are numeric data and are not limited to the subjectivity of the researcher.

3.2. Type of Research

The research employs quantitative method since it aims to examine the extent to which the LMS at NUST has been effectively utilized and the extent to which it serves the students in self-regulated learning. In accession to the reasons aforementioned why I preferred a quantitative method is because quantitative research has been less controversial since it exhibits codification of the numeric data during research process as compared to qualitative research (Bryman, 2012, p. 380). This denotes that the research finding acquired through the primary data are reliable and objective because they are obtained through the statistical inferences and therefore the subjectivity of the researcher is recognized less in a quantitative approach.

3.3. A Cross-Sectional Research Design

The research is a cross-sectional study. The reason for choosing cross-sectional design is because of the researcher's interest to examine the variation in the independent variable (i.e., the use of the LMS) and the dependent variable (i.e., self-regulated learning). The research will find out if there exists a correlation between the independent and dependent variable. As Bryman (2012, p. 59) proposes that a cross-sectional research design collects data on variables simultaneously. Therefore, a cross-sectional design has been chosen to collect the data on the use of the LMS and extent of self-regulated learning at a given point in time. Additionally, the cross-sectional design allows forming patterns of association between the independent and dependent variables (Bryman, 2012, p. 59). This research attempts to investigate this issue and determine whether the LMS at NUST enables the students to take control of their own learning, set their learning goals and subsequently monitor and evaluate their learning outcomes. Furthermore, based on these measures, if they report a better satisfaction with their learning outcomes and productivity level.

3.4. Data Sources

The data used in this research are gathered from both primary and secondary sources, however, the primary data predominates and influences the research findings, whereas the secondary data are used to complement the primary data. The primary source of data is the self-completion questionnaire administered to the students based at NUST, Islamabad, Pakistan. The secondary data is collected from the archives and literature available online.

3.5. Sampling Technique

The research study employs a stratified random sampling to gather the data from the students. The research intended to gather a representative sample of 300 students from three respective departments which include the department of engineering, department of social science and department of business studies. The reasons the sample obtained is a representative sample are explained subsequently.

According to Bryman (2012, p. 188), a biased sample is one that does not represent the population from which it was adopted. Nevertheless, it is exceedingly difficult to obtain an unbiased sample. However, to minimize the biases in the sample, the researcher has engaged few steps. Foremost, an attempt has been made to acquire a probability sample. A probability sample entails a random sampling method in which the human judgment is less recognized and causes random members of the population to be selected (Bryman, 2012). NUST has various departments including engineering faculties, business school and school of social sciences. All these departments employ LMS to facilitate the learning process. Therefore, these departments, as a rule, are representatives of the use of the LMS at the university altogether and hence a probability sample was obtained.

It is indispensable to realize that a probability sample does not and cannot eliminate the sampling error altogether (Bryman, 2012, p. 190). This signifies, irrespective of how considerably well the sample was crafted there may exist a degree of sampling error. Thus, this study likewise is exposed to a sampling error. As referred earlier, three hundred questionnaires were evenly administered based on the stratified sample population (see Table 2), 30 to 35 in each faculty, among the three main departments, that is department of engineering which has various engineering faculties including electrical, mechanical and civil engineering, department of social sciences which has faculty of public policy, faculty of mass communication and faculty of psychology and department of business studies which has specializations in business administration and human resource management. However, according to Bryman (2012, p. 199), it is very likely that some people who are in the sample do not respond to the sample and some who do might not take it seriously when responding to the survey. Therefore, the responses incurred back and those which were answered in an accurate way (crosschecked by the researcher) were 213 out of 300. Hence a non-response rate of 29 percent was accounted. At this

point, one might ask why 213 is a sufficient sample size. Bryman (2012, p.200) explicates that for a homogenous population, such as the students at NUST using the LMS, a smaller sample can suffice. The research aims to examine student self-regulation based on the use of the LMS and one might not find it difficult to understand that why the students at NUST is a homogenous population.

The sample in total comprises of 36.6% of the responses from the department of engineering, 35% from the department of social science and 28% from the department of business studies. The variation of percentage in the sample size among the three departments can be identified which is the sampling error of the research with the department of engineering having the highest representation. Moreover, to ensure that the sample is unbiased and representative of all the students at NUST an adequate sampling frame had to be chosen. The fundamental query that the research tackles is to analyze the potential impact of the LMS on self-regulated learning Therefore the sampling frame adopted by the research is adequate because it accommodates all those students who are using LMS at NUST to support their studies. Accumulating data from the respective departments provides the basis to assess the overall impact of LMS on self-regulated learning.

3.5.1. Type of Probability Sampling Used in the Study

As discussed earlier, during the discourse of the research study one of the critical elements was to exhibit a proportional representation of the different departments from which the sample was obtained. Therefore, I sought to acquire a stratified random sample which is by far the most desirable sampling technique for this study.

A stratified sample is one in which the researcher splits the population into groups (called strata) and draws a probability sample from each group (Bryman, 2012, p. 192). The purpose of choosing a stratified random sample is that it was easy to identify the departments as separate units and treat each of the respective departments as strata. Stratification sampling is ideal for the research studies like this one where the use of LMS at the respective departments and its impact on self-regulation was to be tested. In this research, a stratified random sample was obtained by accessing university's records in respective departments in which the students are based. This was done to validate that the students are accurately represented in terms of the departments to which they belong. Therefore, the sample population has been stratified based on the criterion of

the respective faculties at NUST to which the students belong. A random sample has been chosen from each of the resulting strata. The following table gives an overview of the stratified random sampling used in this research.

Table 2: Stratified Sampling Based on the Respective Departments

Departments	Population	Stratified Sample	Sample Obtained
Engineering	3743	110	78
Social Sciences	3599	105	75
Business Studies	2884	85	60
TOTAL	10226	300	213

(Source: Author, 2017, based on sampling technique used during the fieldwork)

The table represents three departments as three stratas representing the students' count in each stratum which is based directly on the population of the department. The research capitalizes on the advantage of the stratified random sample because the sample obtained from the respective departments is distributed in the same way as the student population at NUST in terms of stratification.

To add, a stratified sampling has been used because of the availability of the information and an easy identification of the population at NUST. As referred originally the research is primarily based on a primary data which is obtained through a questionnaire. According to Bryman (2012, p. 195), an added advantage of stratified probability sampling is that it is possible to deduce inferences from the information acquired through the sample about the general population. This offers me to make inferences about the potential impact that the LMS has on student's self-regulation at NUST. Thus, the findings from the respective departments can be generalized for NUST.

3.6. Data Collection Method

3.6.1. Supervised Self-Completion Questionnaire

As mentioned earlier, this research study is predominantly based on primary data Supervised self-completion questionnaire is the dominant data collection tool for this study. I have presented some information about the questionnaire in the sampling technique that the research employs. To add, in general, the questionnaires were administered to a total of 300 students under the

supervision of the faculty members and coordinators at the respective departments. Faculty members including lecturers and professors based at the departments of engineering, social sciences, and business studies administered the questionnaires to the students at the end of their lectures in the classrooms.

The questionnaire comprises of five subsections. Foremost there are questions about the general information and the respective departments where the students are based. This section is important because this section helps us to understand if the sample obtained is a representative sample by identifying our stratified random sample. For instance, a proportionate count of male and female students who are in their bachelor's and master's studies and the respective departments to which they belong. The second section of the questionnaire is about student familiarity and perception about the helpfulness of the LMS. In this section that students were required to choose on a scale from 1 to 5 if they think they are familiar with the use of the tools available on the LMS and its resulting helpfulness. This section is important because it gives the researcher a general insight if the students perceive the LMS to be helpful to achieve self-regulated learning. Moreover, the questions allow the researcher to identify if the questionnaire response is useable by crosschecking with the question in the latter section. The third section comprises of questions related to the students' perception about the LMS and the purposes they use the LMS for. This section is included in the questionnaire to get an insight into the general use of the LMS at NUST linking it to the subsequent sections while analyzing the data. This section is predominantly used for descriptive analysis. The fourth section of the questionnaire is based on the frequency of usage of the LMS to support the studies. This section is important because while analyzing the data it will help the researcher to identify the patterns why some students perceive that the LMS helps to achieve self-regulated learning while others do not based on how often they use the LMS to assist their studies. The fifth section is derived from the theories of self-regulation. This section is based on a Likert scale where the students were supposed to respond whether they think the use of the LMS bears a potential impact on self-regulated learning.

There are several reasons why a supervised self-completion questionnaire is an appropriate tool to gather data for this research study. Foremost, supervised questionnaires allowed the researcher to administer them quickly with the assistance of faculty members. It was not a challenging task

for me because approximately 30 to 35 questionnaires were administered at once with the assistance of the faculty members in a classroom. Usually, it took from 3 days to a week to collect the responses back from the faculty members.

3.7. Coding

This section explains the process of data coding for this research study. Statistical Package for the Social Sciences (SPSS) is used for the process of coding. Coding is a key stage in any quantitative research (Bryman, 2012, p. 247). The data collected through self-completion questionnaires for this research was partially unstructured meaning that some of the questions including questions regarding the gender and level of school needed to be quantified in order to put them in SPSS to generate results. The data obtained in section four (4) where the students had to rank themselves based on the frequency of use of the various tools available on the LMS contained intervals like 6-7 times a week, 4-5, times and so on, needed to be categorized under the respective categories where they were coded. Therefore, it was important to assign codes to the intervals in this section. The intervals are coded from 1 to 5 where 1 represent the highest and 5 represents the lowest frequency of the usage of the LMS respectively. The reason for coding them is to achieve a harmony among the codes and match it with the subsequent section. Because the study employs a quantitative technique, most part of the questionnaire designed in a way that it was pre-coded. For instance, the section five (5) is based on a Likert scale ranging between 1 to 5, 1 representing a strong agreement and 5 representing a strong disagreement. The section coding is in alignment to the previous section, where the intervals are coded. This process makes it easier for the researcher to deduce clear inferences from the results produced by the data.

According to Bryman (2012, p. 248) assigning numbers to the categories is an arbitrary process where the numbers serve as tags for the respective categories. Therefore, the remaining categories that have been created are named based on the nature of the question rather than being numbered. For example, the question where the students should agree or disagree if they think that the LMS improves the quality of their process, self-regulation has been categorized under the category "LMS_and_quality_of_learning" rather than being assigned a number. This makes it easier for the researcher to remember which category is being tested.

As mentioned earlier, a major part of the questionnaire was pre-coded. For instance, most of the questions asked the students to rank themselves just by ticking or encircling a number based on the use of the LMS or self-regulation. This makes it easier for the researcher to process the data by simply entering the pre-coded responses into SPSS.

3.7.1. Coding Manual

Coding manual explains the codes applied to the data and the rules of their application (see Appendix 1).

3.8. Sampling Frame

The sampling frame essentially comprises of the students who are based at the department of engineering, department of social sciences and the department of business studies at NUST. As mentioned earlier, the data for this research study has been gathered through stratified random sampling which is a probability sample. Therefore, a sampling frame of the students based on the respective departments represents the general population well. Moreover, the main objective of this research is to get an insight into the potential impact of the LMS on student's self-regulation at NUST. This is one of the main reasons to include the students as the only determinant unit of the sampling frame. A comprehensive sampling frame of the students is obtained by dividing the departments into strata as explained earlier.

3.9. Data Analysis in Brief

This section very precisely explains the data analysis. The results obtained using SPSS show that there exists a correlation between students' familiarity with the LMS and their perception of better self-regulated learning at NUST. Based on this we accept our first hypothesis. Furthermore, the results show that there exists no correlation between the actual use of the LMS and self-regulated learning. Consequently, the students do not report better satisfaction with their learning outcomes and productivity level. Therefore, we reject our second and third hypotheses. However, the results based on which our second and third hypotheses are rejected are not statistically significant because the p-value is greater than 0.5 which means that there are more than 5 in 100 chances that the results obtained have occurred by a chance.

3.10. Challenges

One of the biggest challenges that the researchers face is in a social survey like this one is nonresponse (Bryman, 2012, p. 200). Response rates can be boosted by incentivizing the

respondents. Often boosting the response rate might prove expensive for the researcher. Similarly, the research is non-funded and the researcher is a student who could not incentivize the respondents[2].

I, while conducting this research also confronted a situation where the students refused to participate. This challenge of the cost of incentivization and the access to the students in the field was minimized by approaching the faculty members in the respective departments where I had some connections and got access to more faculty members in other departments through referrals. Thus, I gained access to the various departments and the questionnaires were being administered through the assistance of the faculty members at the respective departments. Another challenge that I faced was that some students filled out the survey in a hasty manner. While sorting the questionnaires I have removed 77 questionnaires by cross checking the answers yet there might be some cases where the responses are not correct but still, they are used in the study. Thus, those responses can influence the results of the study.

In the beginning, the sampling frame of this research study also included the faculty members and their views on whether the use of the LMS at NUST bears any impact on students self-regulated learning. This data was primarily gathered through semi-structured interviews. Later on for the sake of narrowing down the research and to avoid the complexity of using mixed methods, the researcher shifted the focus only on the student's responses. Conducting interviews added an extra challenge for the researcher in terms of time management.

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[2] Thanks to the faculty members who helped overcome this challenge by administering the questionnaires to their students and hence a 71% response rate was achieved

Chapter Four: Presentation of Results and Analysis

The chapter presents and explicates the results from various tests that have been used in this research study to arrive at the conclusions based on which the hypotheses are accepted or rejected. The results are presented in the light of the literature review and theoretical framework upon which the study is based. The results are based on the data collected from 300 respondents[3] (i.e., the students based at NUST). The study employs descriptive and inferential statistics including pie charts, histograms, Spearman's rho, multiple regression to investigate the relationship between the use of the LMS and self-regulated learning at NUST.

4. Missing Data

The data gathered from 213 respondents that form the sample of the study is presented in the appendix (see Appendix 2). Each of the questions is represented by the variable number, for example, var01, var02 and so on. Statistical Package for the Social Sciences SPSS is used for running various tests on the data gathered from the students. The data has been entered vigilantly into the SPSS[4]. However, while entering the data there were circumstances where the respondents intentionally or unintentionally did not completely answer the questionnaires. The missing data has been coded with "555" in any case where the respondents did not answer the question. This is done to ensure that the SPSS treats the missing data properly so that the results of the study are not contrived.

4.1. Levels of Measurement

By now we know that the study employs a quantitative technique. The variables used in this research study are categorized under categorical and scale variables and are defined in SPSS respectively. Ordinal and nominal variables come under the umbrella of categorical variables. Ordinal variable includes all those variables in the research that could be assigned an order including those variables where the students had to rank themselves based on how much are they familiar with the LMS and find it helpful to assists their studies. Moreover, all those variables that come under self-regulation are ordinal and the students had to rank themselves between strongly agree and strongly disagree on these variables. These variables are ordinal because there is a level of agreement involved. On the other hand, gender, the level of school and departments where the students are based are nominal variables because they could not be assigned a

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[3] 213 responses were useable out of the 300 questionnaires incurred back
[4] Any error while entering the data remains the responsibility of the researcher

meaningful rank or order to them. Variables, where the students have to rank themselves based on the frequency of the use of the LMS, are scale/interval-ratio variables because the distances between the categories are equal such as 6-7 times, 4-5 times and so on.[5]

The reason for defining the level of measurement is that it is essential to classify the data correctly because incorrect classification of data will lead to incorrect results and analysis subsequently (Bryman, 2012, p. 335).

4.2. Frequency Tables

The frequency tables (see Tables 3-5) presented below provide the number of students who responded to each of the category and a percentage of student's sample population belonging to each category. The tables show for example that 95% of the students in the sample population use the LMS to check the attendance, 33% to collaborate with peers, and 11% responded that they get training on how to effectively use the LMS through the LMS workshop etc.[6] These frequency tables will assist later to grasp a better understanding of the inferential statistics in the light of reviewed literature and theoretical framework.

Table 3: Frequency Table Showing the Purposes the Students Use the LMS for[7]

Purpose	*"n"* Out of total 213 responses	%
Checking attendance	202	95
Downloading lectures	158	74
Uploading assignments	121	57
Checking plagiarism	82	38
Accessing results	100	47
Observing task deadlines	115	54
Online discussions through forums	58	27
Checking latest news and upcoming events	39	18
Use of hypermedia tools	11	5

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[5] I will use the term scale variable instead of interval ratio variable for the rest of the study as it is defined in SPSS
[6] Percentages are rounded off to the nearest whole number
[7] Students may use the LMS for more than one purpose

Table 4: Frequency Table Showing the Percentage of Student's Perceptions about the LMS

The LMS serves as a platform to	*"n"*	%
Collaborate with peers	70	33
Share ideas	60	28
Work on individual and group tasks	127	60
Get assistance from peers and professors	45	21
Establish individual goals	98	46
Explore and locate information on the web	75	35
Build networks with peers	38	18

Table 5: Frequency Table Showing the Percentage of the Students who get Training on the LMS through Respective Ways

The university trains the students through	*"n"*	%
LMS workshop	23	11
Presentation or Lecture	58	27
The institute does not train the students	132	62
TOTAL	213	100

4.3. Pie Charts Representing the Percentage of the Students Based on the Respective Variables

The basic purpose of using the pie charts is to give an overview of the respective variables and their relative size to the total sample of the students based at NUST. The pie charts will make it easier to understand and interpret the results. All the pie charts have been generated using SPSS. To begin with, a brief explanation is provided for each pie chart.
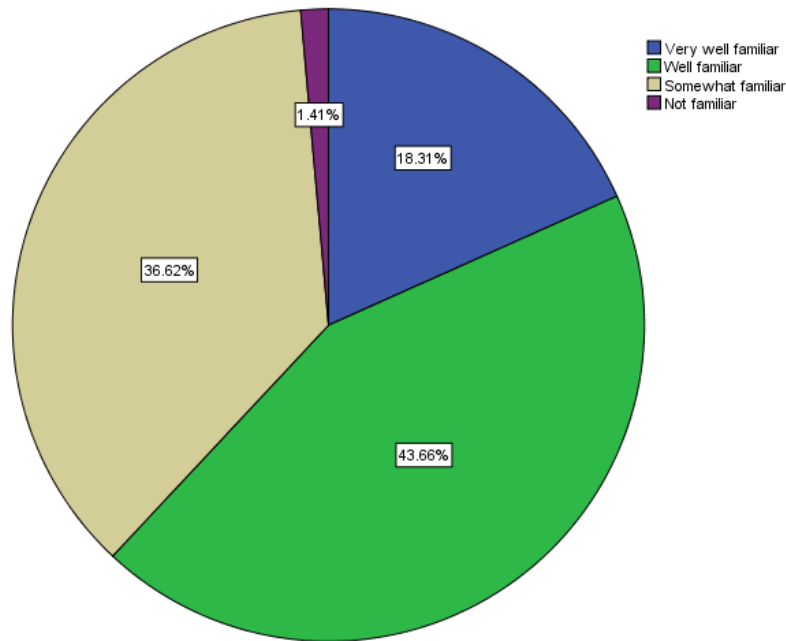
Figure 6. Pie Chart 1: The percentage of the students based on their familiarity with the LMS

Pie chart 1 presents an overview of the sample students based on their familiarity with the LMS. Familiarity with the LMS entails whether the students find themselves familiar with the use of the various web-based pedagogical tools available on the LMS to facilitate their learning process. These tools include collaborative and communication tools like online discussion forums, emails and chats, content creation and delivery tools including assignments and activities, administrative tools like posting students grades and taking quizzes on the LMS, learning tools like the link to digital library that allows an access to various web resources and finally the assessment tools available on the LMS like grading schemes etc. The response to this question demonstrates that approximately 62% of the sample students are familiar and 37% have a slight idea concerning the use of various tools aforementioned whereas only a very little percentage of approximately 2 percent are not familiar with what the LMS is all about. This can also be clearly seen in the frequency table 3 where a good percentage of the students demonstrate the use of the various tools available on the LMS. For instance more than 70% of the students who show some level of familiarity with the LMS responded that they use the LMS for delivering assignments and downloading lectures and course materials which are a content creation and delivery tool. Likewise, the frequency table 3 shows that 47% of the students reported that use the LMS to

access their results which are an assessment tool. Hence the empirical data illustrates that the students, in general, are familiar with the LMS at NUST.
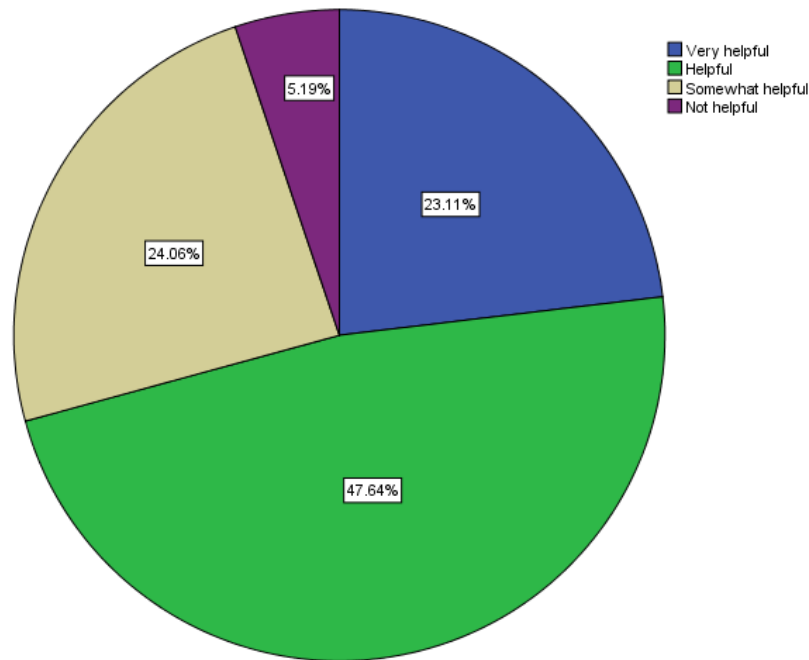
Figure 7. Pie Chart 2: The percentage of the students who find the LMS helpful in supporting their studies

Pie chart 2 presents an overview of the sample students based on whether they find the LMS helpful in supporting their studies or not. Helpfulness of the LMS, in general, entails student perception about whether the respective WBPT available on the LMS facilitate them in accomplishing their individual goals while monitoring them simultaneously. The relative size of the slices to the total sample size demonstrate that approximately 70% of the students find the LMS assists them in their studies, 24% have the opinion that the LMS does provide a fraction of facilitation whereas only a small percentage of approximately 5% demonstrate a disagreement with the helpfulness of the LMS in supporting the studies. This can be linked back to the frequency tables 3 and 4 respectively where more than 70% of the sample students use the LMS for various purposes like downloading course material, delivering assignments, sharing ideas etc. These patterns of association provide enough evidence about why the students at NUST perceive the LMS as a helpful medium.

The first two pie charts present an overview of the student understanding and their perceptions about the LMS in general. The pie charts presented afterwards are context specific, that is based

on the theoretical framework of self-regulation. Each pie chart represents the level of agreement of the students to the variables based on the respective stages of self-regulation.
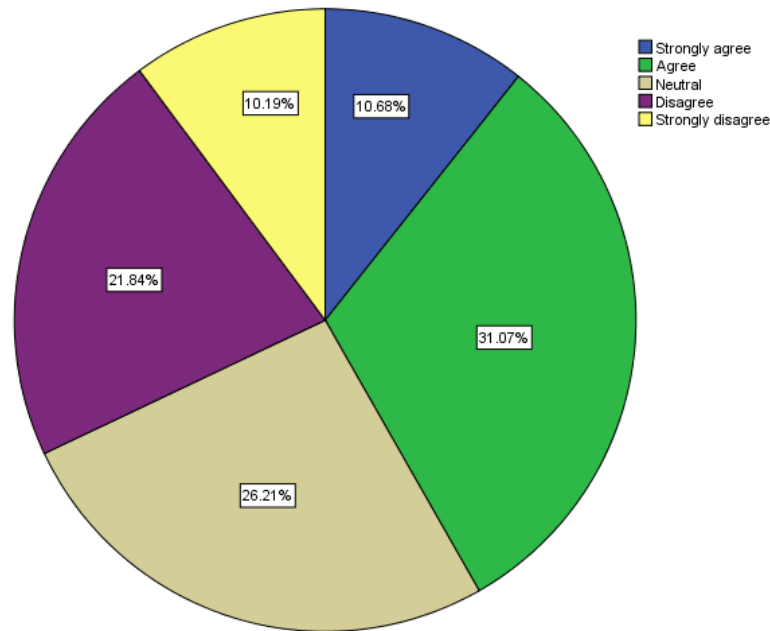
Figure 8: Pie Chart 3: The percentage of level of agreement of the students who find the LMS helpful in planning and setting the learning objectives

Pie chart 3 presents an overview of the level of agreement of the students based on whether the students find the LMS helpful in planning and setting their learning goals. Planning and setting the learning objectives can be understood as the first phase of the self-regulated learning where the students gather information on a perceived task and set specific objectives. These goals could be completing an assignment or scoring an A on the exam. The pie chart depicts that approximately 42% of the sample students at NUST show a high or moderate level of agreement whereas 32% show a certain level of disagreement. By looking at the frequency table 4 we can observe that 46% of the sample students responded that the LMS helps them to set their individual goals when they were asked directly. The 4% is not a staggeringly big difference and a correspondence can be seen in the respective responses. The pie chart illustrates that less than half of the sample population finds the LMS not helpful in setting their goals and learning objectives which signify the ineffective usage of the LMS.
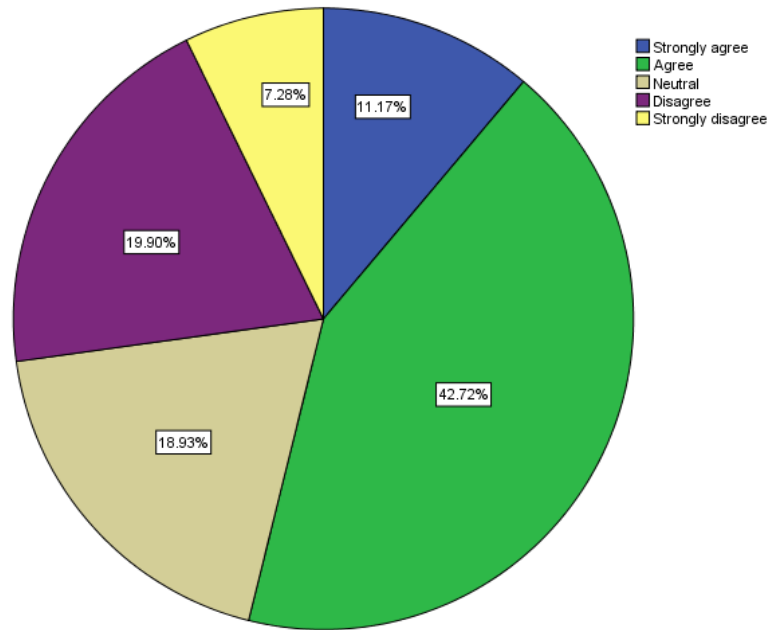
Figure 9. Pie Chart 4: The percentage of level of agreement of the students who find the LMS helps to monitor and evaluate personal progress

Pie Chart 4 presents the percentage of level of agreement of the students based on the second stage of self-regulation, that is self-monitoring. The concept of self-monitoring is based on those metacognitive processes where the students monitor their behavior and direct their attention towards achieving the goals that have been set in the first stage.

The pie chart depicts that contrary to 27% of the students who show a certain level of disagreement approximately 53% show a certain level of agreement to the idea that the LMS helps to monitor their personal progress. Frequency Table 3 also shows that approximately 47% of the sample students use the LMS for accessing results during the semester. This signifies that on average 50% of the sample students monitor their progress through the LMS.
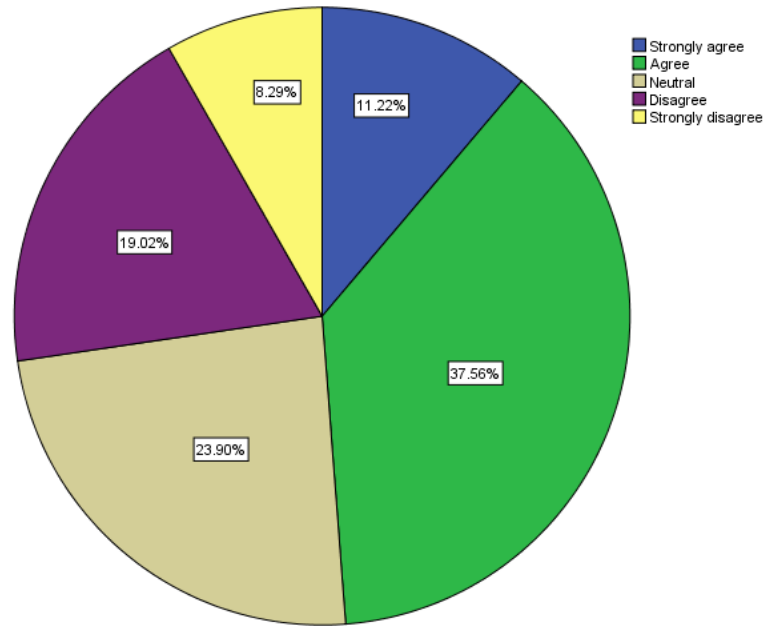
Figure 10. Pie Chart 5: The percentage of level of agreement of the students who find the LMS helps to effectively budget the time

Pie chart 5 presents an overview of the level of agreement of the students who find the LMS helpful in effectively budgeting their time. Time management is a key process in self-regulated learning which entails keeping records of the time spent on specific tasks. Time management is critical while performing self-monitoring and can be categorized under the second stage of self-regulated learning.

The pie chart illustrates that approximately 48% of the sample population is in agreement that the LMS assists them to effectively budget their time whereas approximately 27% show a certain level of disagreement. Frequency table 3 shows 55% of the sample students responded that one of the purposes to use the LMS is to observe the task deadlines which in other terms can be understood as time management for specific tasks. One of the reasons for a 7% difference on two occasions might be because some students who do not agree that the LMS helps them to effectively budget their time still use the LMS for observing specific deadlines.
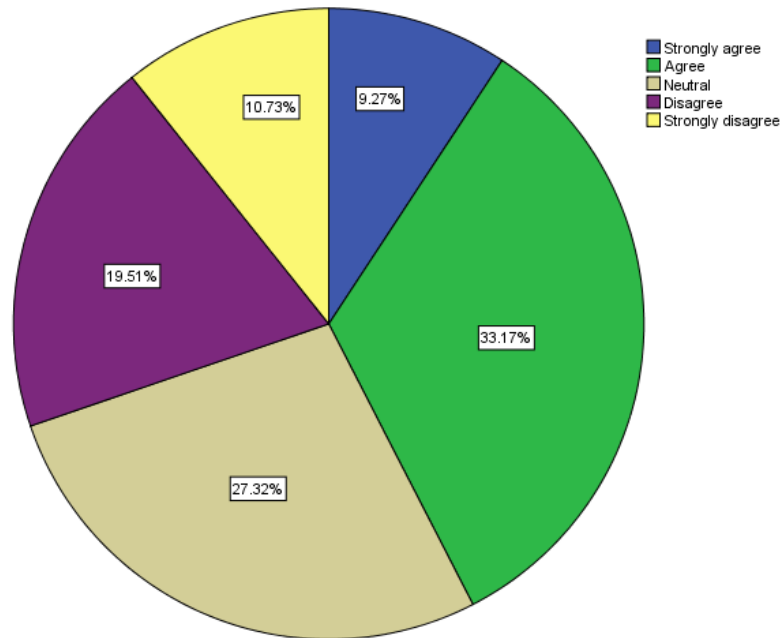
Figure 11. Pie Chart 6: The percentage of level of agreement of the students who the LMS assists in reflecting on personal progress and making self-improvements

Pie chart 6 gives an overview of the level of agreement of the sample students who find the LMS helpful to self-evaluate and reflect on their personal progress. This pie chart is based on the third stage of self-regulation, that is "reflection". Reflection entails that students perform self-evaluation of their own personal progress by comparing their performance outcomes with the standard set goals which subsequently allows them to make self-improvements.

The pie chart depicts that approximately 42% of the students show moderate to strong agreement whereas approximately 30% show a disagreement. Frequency table 4 also shows 47% of the students responded that accessing results is one of the main purposes that they use the LMS for which is actually the third stage of self-regulated learning, that is "evaluation". Based on the results students can reflect on their personal progress and try to make self-improvements.
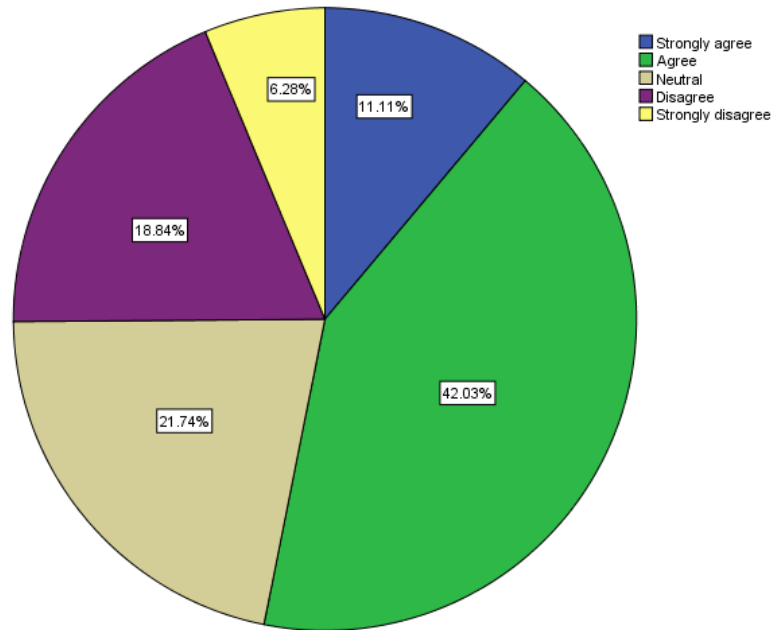
Figure 12. Pie Chart 7: The percentage of level of agreement of the students who find the LMS increases their academic productivity in general

Pie chart 7 gives an overview of the level of agreement of the students based on the three stages of self-regulation. The pie chart presents whether the students find the LMS as a helpful medium that increases their productivity level and learning outcomes in general. The chart illustrates that 53% of the sample population is in an agreement whereas approximately 25% show a certain level of disagreement. The level of agreement, that is 53% represents a certain level of correspondence with the mean level of agreement with the three stages of self-regulated learning of the students at NUST which is approximately 46%. This implies that nearly half of the sample population finds the LMS as a helpful medium to achieve self-regulated learning.
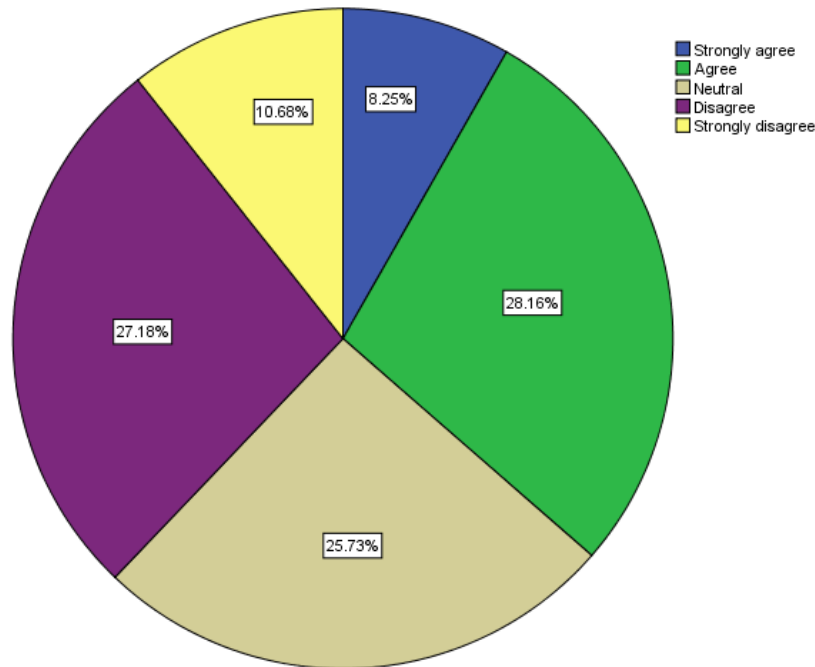
Figure 13. Pie Chart 8: The percentage of level of agreement of the students who perceive the LMS is being effectively utilized

Pie chart 8 gives an overview of the level of agreement of those sample students who hold a view that the LMS at NUST has been effectively utilized in a way that could help them achieve self-regulated learning. The pie chart shows that approximately 36% of the students show a certain level of agreement whereas 38% show a disagreement while 26% are neutral. As we can see that the level of disagreement is higher in this case which points us towards two assumptions. Either the students are not trained well by the instructors to effectively use the LMS or the students possess low motivational beliefs for self-regulated learning even in the presence of enough training on the use of the LMS. The frequency table 5 show that contrary to 62% of the sample students only 38% responded that the institution provides training on the use of LMS through one way or the other. As mentioned earlier in the literature review, self-regulation is not something that is a student's inherent ability and the instructors must provide enough guidance to help students achieve it. This signifies that lack of essential training is one of the major reasons why a large percent of the sample students hold this opinion.

4.4. Histograms Representing the Use of the LMS Based on the Respective Variables

This section of the study presents histograms to demonstrate the scale variables used in the study, that is, the frequency of use of the LMS based on intervals for specific purposes such as using

discussion forums, using the LMS to seek help from professors and peers. The histograms are generated using SPSS. A brief explanation is provided with each histogram below. The histograms will help to elaborate on the results later in this study.

Mean = 3.19
Std. Dev. = 1.242
N = 210
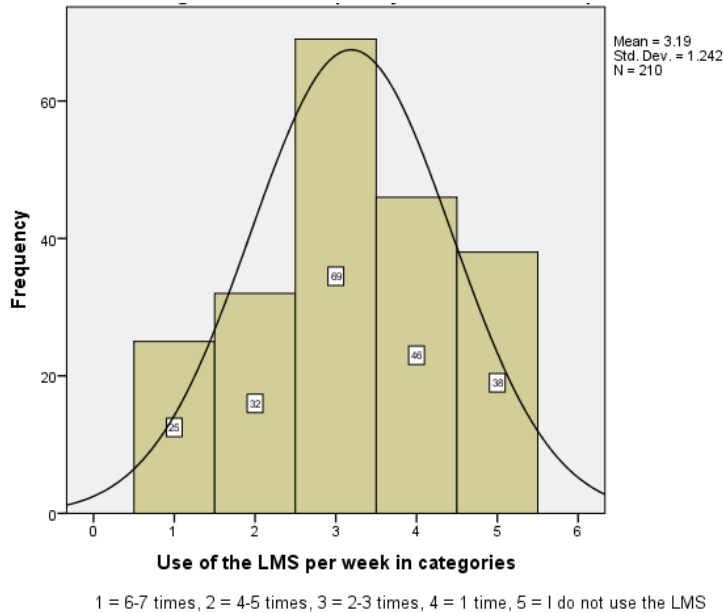
Figure 14. Histogram 1: The frequency of the use of the LMS per week
Histogram 1 shows the frequency of the use of the LMS by the students at NUST. The use of the LMS implies the use of any WBPT available on the LMS by the students. The histogram shows that majority of the sample students make the use of the LMS for one purpose or the other based on varied frequencies whereas 38 students that make approximately 19% of the sample size do not use LMS at all. It can also be seen that the mean frequency lies somewhere between the students using the LMS 2-3 times per week.
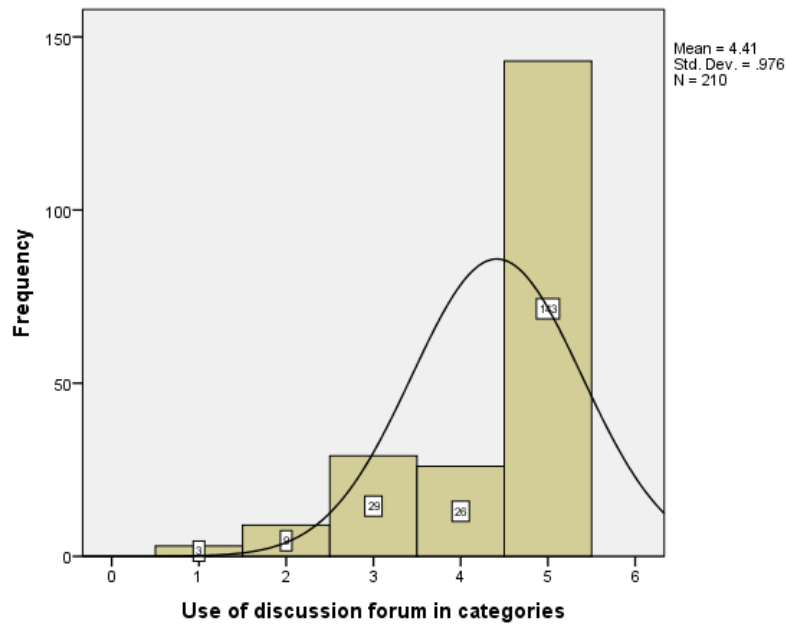
1 = 6-7 times, 2 = 4-5 times, 3 = 2-3 times, 4 = 1 time, 5 = I do not use the discussion forums

Figure 15. Histogram 2: The frequency of use of the discussion forums per week

Histogram 2, based on the intervals, provides an overview of the frequency of use of the discussion forums by the students. The histogram shows that a significant percentage of the students, that is, 143 students, that makes approximately 67% of the sample do not use the discussion forums. Moreover, the mean frequency of the use of the discussion forums is quite low with the students using the discussion forums once a week. This signifies that the students may lack the motivation to use the collaborative tools like discussion forums or they are not encouraged by the teachers to use them.

1 = 6-7 times, 2 = 4-5 times, 3 = 2-3 times, 4 = 1 time, 1 = I do not use the LMS to seek help
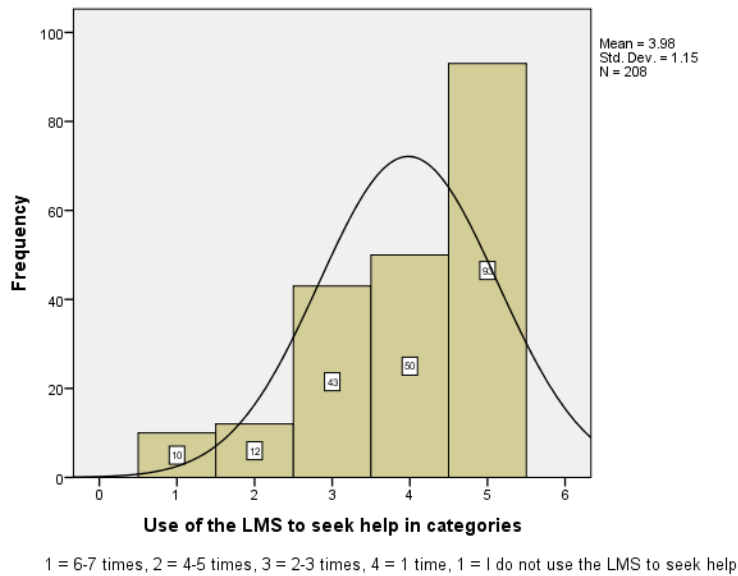
Figure 16. Histogram 3: The frequency of use of the LMS per week to seek help from professors and peers

Histogram 3 gives an overview of the frequency of the LMS to seek help from the professors and the peers. This includes posting questions concerning the course contents or any other academic related query using discussion forum or through messages. A similar trend can be seen in the histogram where 93 students which make approximately 44% of the sample do not use the LMS for seeking help. It can also be seen that the mean frequency of the usage of the LMS to seek help lies close to 4 which signifies the on average the students use the LMS once a week to seek help.

4.5. Level of Statistical Significance

As we already know the study employs a stratified probability random sampling. This sampling technique will help to generalize findings for the impact that LMS bears on self-regulated learning at NUST. However, according to Bryman (2012, p. 347) even when a probability sample has been chosen the research findings may not be generalizable to the population. Therefore, it is important to choose a level of confidence. The level of confidence will allow making inferences that the result findings are statistically significant and have not occurred by chance. This study uses Fisher's 95% threshold for the level of confidence. This means that for instance, only when we are 95% certain that there exists a significant relationship between the use of LMS and self-regulated learning should we accept our hypothesis which means that out of 100, there are 5 or fewer chances that the correlation has occurred by chance.

This is also termed as *testing statistics.* If the probability of obtaining the value of the test statistics is by chance less than 0.05 than it means that the hypothesis is true, that is, there is less than 5% chance that our data does not support our prediction. The concept will be used later while explaining the correlation and multiple linear regression models.

4.6. Bivariate Analysis

The research employs a bivariate analysis to explore the relationship between the variables. *Spearman's rho* is a bivariate analysis technique that shows the linear relationship between the two variables through a correlation coefficient r (Bryman, 2012, p. 341). Spearman's rho has a limitation that it will provide only an index whether the use of the LMS has a positive or negative association with self-regulated learning. Therefore, for further analysis and to find out the extent to which the use of the LMS impacts self-regulated learning at NUST the research employs multiple linear regression using SPSS.

4.6.1. Spearman's rho

Spearman's rho is a basic bivariate analysis and a useful statistic that in general forms the basis of other advanced statistical analysis like multiple regression and factor analysis. The reason this study employs a Spearman's rho is that our research hypotheses tell us that the variables under study are associated with each other. The variables under study are both ordinal and scale variables respectively. Therefore, Spearman's rho is a suitable statistical test to find out the correlation for a pair of ordinal variables or when one is an ordinal and other is a scale variable respectively (Bryman, 2012, p. 344). Spearman's rho is a method of estimating whether there exists a positive or negative correlation between the two variables.

Spearman's rho in this study foremost informs us about the level of correlation that exists between the student's familiarity and perceived self-regulated learning. Secondly, it informs us about the level of correlation between the use of the LMS and their self-regulation. Lastly, it demonstrates whether there exists a positive or negative correlation between the use of the LMS and the student satisfaction with their learning outcomes and productivity level.

At this stage, we are quite familiar with the three phases of self-regulated learning. The students were asked various questions in the survey based on the three phases of self-regulated learning. The scores from the responses based on the three phases of self-regulated learning have been

combined using SPSS to form a single mean score for self-regulated learning. Likewise, the students were asked various questions which were based on the frequency of the use of the WBPT available on the LMS and thus a mean score for the use of the LMS per week has been calculated using SPSS. It is important to note that the variables that have been combined are measured in the same way. For instance, by looking at the questionnaire it can be noted that all the variables based on self-regulation are worded in a positive way like "LMS helps me to plan and set my learning objectives, LMS helps me to monitor and evaluate my personal progress etc." The students had to rate their level of agreement from 1 representing strongly agree and 5 strongly disagree. Likewise, the frequency of the use of the LMS is based on intervals and these intervals are assigned the values from 1 to 5 in SPSS where 1 represents the highest frequency of use of the LMS (i.e., 6-7 times per week) and 5 represent the lowest frequency, (i.e., the students do not use the LMS to support their studies). The same procedure applies for calculating the mean score for satisfaction with the learning process and productivity level using SPSS.

An important point to note here is that some of the scores obtained contained decimal digits while computing the mean scores. Hence the mean scores have been rounded off to the nearest whole number. For instance, a mean score of 1.75 has been rounded off to 2. This has been essentially done to avoid complications while running the respective statistical tests.

Our first hypotheses - *the students at NUST who find themselves familiar with the tools available on the LMS perceive better self-regulated learning* is based on the existing literature which proposes that the students who find themselves acquainted with the tools available on the LMS hold the opinion that using technology to support the studies can result in a better self-regulated learning. Based on this assumption I expect to have a positive correlation between the two respective variables, that is, as the student familiarity with the LMS increases, self-regulation increases. Table 6 is obtained using SPSS which shows the type of correlation that exists between the two respective variables mentioned here. Spearman's rho is used because we know that the variables are normally distributed as shown in the histograms. In addition, the variables have a linear relationship.

Table 6. Representing correlation between student familiarity with the LMS and perceived self-regulated learning

Correlations

			Student familiarity with the LMS	Self-regulation
Spearman's rho	Student familiarity with the LMS	Correlation Coefficient	1.000	.262**
		Sig. (2-tailed)	.	.000
		N	213	207
	Self-regulation	Correlation Coefficient	.262**	1.000
		Sig. (2-tailed)	.000	.
		N	207	207

**. Correlation is significant at the 0.05 level (2-tailed).

Looking at the correlation table we can observe across the diagonal that both the scores are 1. This is because correlating a variable with itself, for instance, self-regulated learning with self-regulated learning will yield a perfectly positive correlation.

The first value 0.262 is our actual correlation coefficient which tells us about the strength of the linear relationship between the student familiarity with the LMS and perceived self-regulated learning.[8] The value 0.262 tells that the correlation between the two respective variables is a weak positive correlation. The second thing to look at the table is the significance value. The reason it is important to check the significance level is to tell whether the correlation between the variable does exist or if it just occurred by a chance. As mentioned earlier, I have chosen the significance level of 0.05 for my test. It can be seen in the table that the significance value obtained is smaller than the level of significance (i.e., 0.000134). This implies that the correlation obtained is statistically significant and has not occurred by chance which means that students who find themselves familiar with the LMS perceive that the LMS helps to achieve better self-regulated learning. Therefore, we have enough evidence to state that as the familiarity with the LMS increases the perceived self-regulated learning of the sample students increases.

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[8] The correlation coefficient lies between 1 and -1.

Hence the hypotheses; *the students at NUST who find themselves familiar with the tools available on the LMS perceive better self-regulated learning* holds true and is accepted.

Table 7 presented below demonstrates if using the tools available on the LMS is correlated to self-regulated learning at NUST.

Table 7. Use of the LMS and its Impact on Self-Regulated Learning
 Correlations

			Use of the LMS	Self-regulation
Spearman's rho	Use of the LMS	Correlation Coefficient	1.000	-.046
		Sig. (2-tailed)	.	.509
		N	210	207
	Self-regulation	Correlation Coefficient	-.046	1.000
		Sig. (2-tailed)	.509	.
		N	207	207

The table shows a correlation value of -0.046. This value of the correlation signifies that there exists a small negative correlation between the use of the LMS and self-regulated learning. The value -0.046 is very small close to zero therefore for better understanding I would interpret this case as there exists no correlation between the respective variables. It can be seen in the table that the significance value obtained for this correlation is 0.509 which is greater than the chosen level of significance. This implies that the correlation obtained is not statistically significant and might have occurred by a chance. Therefore, my hypotheses; *the students at NUST who use the web-based pedagogical tools available on the LMS report better self-regulated learning* does not hold true and is rejected. However, the significance value 0.509, as mentioned earlier, suggests that there is not enough evidence that a similar correlation exists in the population as well. In other words, there are 50 out of 100 chances that the result obtained has occurred by chance.

Table 8. Use of the LMS and students' satisfaction with their learning outcomes and productivity level

Correlations

			Use of the LMS	Satisfaction with quality of learning process and productivity level
Spearman's rho	Use of the LMS	Correlation Coefficient	1.000	-.007
		Sig. (2-tailed)	.	.923
		N	210	207
	Satisfaction with quality of learning process and productivity level	Correlation Coefficient	-.007	1.000
		Sig. (2-tailed)	.923	.
		N	207	207

The table 8 shows there exists a very small negative correlation of -0.007 between student satisfaction with their learning process and productivity level and using the tools available on the LMS. In other words, since the correlation value is close to zero I would accept that there exists no relationship between the respective variables for the rest of this study. The second question to answer is whether the relationship is significant or not? The table shows that the significance value that is 0.923 is greater than the chosen level of significance, which means that the correlation obtained is not statistically significant and might have occurred by a chance. Therefore, the hypothesis; *a high percentage of students using the LMS report satisfaction with their learning outcomes and productivity level* does not hold true and is rejected.

It must be noted that I am using a sample of the students at NUST and not the entire population and there exists a small negative correlation between the respective variables in the sample. However, the significance value suggests that there is not enough evidence that a similar correlation exists in the population.

Based on table 6,7 and 8 which use Spearman's rho to investigate the relationship between the respective variables we accept H_1 and reject H_2 and H_3 respectively. The hypotheses are further tested to investigate whether the results are in conformity using regression analysis.

4.7. Regression

This study employs a multiple linear regression to predict the value of the dependent variables. While running the multiple linear regressions all the independent variables, that is, student familiarity with the LMS, the use of the LMS in general, the use of the discussion forums and the use of the LMS to seek help from professors together are used to predict the value of self-regulated learning and student satisfaction with their learning outcomes and productivity level respectively.

4.7.1. Statistical Model for Multiple Regression

The statistical model employed in the study that explains the relationship between the dependent and independent variables respectively is explained by two linear multiple regression equations. The first model pertains to the use of the LMS and self-regulated learning and the second model pertains to the use of the LMS and students' satisfaction with their learning outcomes and productivity level respectively.

The formula for the first model is: $Y_{sr} = a\ X_f + b\ X_u + c\ X_d + d\ X_s + Z$; where Ysr refers to the student self-regulation, X_f refers to the student's familiarity with the LMS, X_u refers to the use of the LMS for various purposes, X_d refers to the use of the discussion forums, Xs refers to the use of LMS for seeking help and Z is the intercept, while *a*, *b*, *c,* and *d* are the regression coefficients. Similarly, the formula for the second model is $Y_s = a\ X_f + b\ X_u + c\ X_d + d\ X_s + Z$; where Y_s is the student satisfaction with their learning outcomes and productivity level. The independent variables used in the second model are the same as explained in the first model. This technique will inform us how strong is the relationship between the use of the LMS and self-regulated learning and student satisfaction with their learning outcomes and productivity level respectively at NUST.

4.7.2. Multiple Linear Regression
4.7.2.1. Using the LMS and Self-Regulated Learning

To run multiple regression, four independent variables including student familiarity with the LMS, use of the LMS per week, use of the discussion forums and use of the LMS to seek help

from the professors are used to predict the value of self-regulation and student satisfaction with their learning outcomes and productivity level respectively. Results obtained using SPSS are shown below.

Table 9. Multiple regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.419[a]	.176	.160	.863

a. Predictors: (Constant), Use of the LMS per week to seek help from professors and peers, Student familiarity with the LMS, use of discussion forum per week, Use of the LMS per week

For multiple regression, a suitable approach, to begin with, is to look at the adjusted R-square rather than R because the adjusted R-square measures the total proportion of the total variability in the dependent variables that is explained by the independent variables. The regression table shows that the adjusted r-squared is 0.160. By converting it into percentage it can be stated that about 16% of the total variability in self-regulated learning is explained by the regression model obtained or 16% of the total variability in self-regulated learning is explained by student familiarity with the LMS and the use of the LMS for respective purposes. However, at the same time, it does not imply that the value of R-square is not useful here. If there is a big difference between the R-square and adjusted R-square it suggests that some of the independent variables that we have included in the regression model are redundant. The regression model shows that the difference between R-square and adjusted R-square is a small 2 percent. This suggests that all the independent variables have a significant importance in the regression model and the variability in the dependent variables is explained by each of the independent variables respectively.

While analyzing Spearman's rho we can see that use of the LMS and self-regulated learning at NUST are not correlated. Therefore, one might ask why a 16% variability in self-regulation arises because of the use of the LMS. The reason is while running the multiple regression, student familiarity with the LMS forms a part of the predictor variable and therefore results in the variability. Therefore we conclude that the relationship between the use of the LMS, when combined with students' familiarity with the LMS and self-regulated learning, is weak.

SPSS produces two more statistical test results of significant importance in addition to the regression model which are ANOVA and coefficients. Interpreting ANOVA and coefficients can further give a better understanding about the degree of relationship between the predictor and outcome variables respectively.

Table 10. ANOVA model representing the significance of F-statistics

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	32.137	4	8.034	10.782	.0.001[b]
	Residual	150.523	202	.745		
	Total	182.660	206			

a. Dependent Variable: Self-regulation
b. Predictors: (Constant), Use of the LMS per week to seek help from professors and peers, Student familiarity with the LMS, use of discussion forum per week, Use of the LMS per week

In the ANOVA table presented above the key statistic to look at is the F-statistics. The value of the F statistics is obtained using the first three columns which are the sum of squares, the degree of freedom and mean square respectively. Here we are not concerned about how the F statistics is obtained using the three columns; we are interested in what F statistic signifies. The F statistic in ANOVA is interpreted along with the significance value (i.e., the p-value). Our null hypothesis for the F-test is that the model has no explanatory power which implies that all the coefficients on the independent variables are zero. This means that none of the independent variables helped to predict the dependent variables which mean the model is useless.

The next question here is do we reject our first two null hypotheses based on this model. For that purpose, we must look at the significance or the p-value. The model shows that p-value is 0.001 which is less than the 0.05.[9] Therefore, we conclude that there is very strong evidence that we reject the null hypothesis for the F test. This signifies the model obtained is useful to explain that student familiarity and using the LMS for various purposes helped to predict the self-regulated learning. Since the value of the F-statistics is significant therefore we move on to interpret the coefficients.

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[9] According to Pearson the p-value of the coefficient r is not significant if it is greater than 0.05 significance level.

Table 11 presented below is of significance importance because it tells us about the relationship between the dependent and the independent variables of the coefficients respectively.

Table 11. Model representing the significance of the t-statistics, standardized and unstandardized coefficients
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	T	Sig.
1	(Constant)	3.048	.451		6.765	.000
	Student familiarity with the LMS	.202	.085	.160	2.368	.019
	Use of the LMS per week	-.246	.053	-.325	-4.666	.000
	Use of discussion forum per week	.102	.065	.104	1.558	.121
	Use of the LMS per week to seek help from professors and peers	-.038	.056	-.046	-.673	.502

To begin with, I will look at the rows and a corresponding t statistic to it. The table shows the t-statistic value for student familiarity with the LMS is 2.368 and a significance value of 0.019 respectively. Our null hypothesis for the t-statistic is that the coefficient for the null hypothesis is zero, that is, the student's familiarity with the LMS does not help to predict the self-regulation perceived by the students. The question is whether the t-statistic value for student familiarity with the LMS is significant? The answer is yes because the p-value for the t statistic is 0.019 which is less than 0.05. Therefore, we reject the null hypothesis of the t-statistics. This signifies that the students who find themselves familiar with the LMS do perceive better self-regulated learning. A similar relationship was obtained earlier using the correlation table 1. The value of spearman's rho in the correlation table 6 calculated to 0.262 which shows a positive correlation between the predictor and the outcome variable respectively.

Similarly, the t-statistics for use of the LMS per week is -4.666 with a significance value of $2.6074E^{-8}$. Our null hypothesis for the t-statistic is that use of the LMS does not help predict the self-regulated learning. Since the p-value for the t statistics is way less than 0.05, we reject the t-statistic null hypothesis. This signifies that self-regulated learning of the students is predicted by the use of the LMS. A similar negative correlation was obtained earlier (see correlation table 6).

In a similar way, the p values of the use of the discussion forums and using the LMS to seek help from the professors and peers stand at 0.121 and 0.502 respectively which is greater than the 0.05. Therefore, the null hypothesis, in this case, use of the discussion forum and the LMS to seek help does not help predict the student self-regulation, for the t-statistics is accepted. In other words, the independent variables do not have the ability to predict the dependent variables. Based on these results we accept H_1 and reject H_2 respectively.

Now let us talk about the unstandardized coefficients in the model. Here we need to check two things. First, whether the coefficient is positive or negative according to what our theory suggests. In the case of student familiarity with the LMS and perceived self-regulated learning it is expected that as the familiarity with the LMS increases, student perception of better self-regulated learning increases, that is, we expect a positive coefficient. The results show that indeed we have a positive coefficient of 0.202. On the other hand, the use of the LMS has a negative coefficient of -0.246 which implies that the as the use of the LMS increases, self-regulation decreases which is against what we expect. Likewise, the variable, use of the discussion forum has a positive coefficient of 0.102 which is what we expect that is an increase in the use of the discussion forums will result in an increase in self-regulated learning. On the other hand, using the LMS to seek help is expected to increase the self-regulated learning however it has a negative coefficient of -0.38. This provides us grounds to accept H_1 and reject H_2 respectively.

The next stage is the interpretation of the coefficients. What exactly do the coefficients signify? In general, the coefficients of the independent variables in a multiple regression can be interpreted in the following way. For every one-unit increase in the independent variable in a model the dependent variable will increase or decrease by the value of the coefficient, holding all other independent variables constant.

Based on the general rule of interpretation, the coefficient of the first variable, student familiarity with the LMS can be interpreted in the following way. The model predicts that for one unit increase in student familiarity with the LMS the perceived self-regulation will increase, holding using LMS for discussions and seeking help constantly. Thus, the model supports our first hypothesis and provides evidence for accepting it. In a similar way, the coefficient for use of the LMS is -0.246. We can state that the model predicts for an additional unit of increase in the use of the LMS per week, that is, from 6-7 times to 8-9 times per week, self-regulated learning will

decrease by approximately 0.24 units holding student familiarity with the LMS and using discussion forums on the LMS constant. Similarly, for the third independent variable, use of the discussion forum, the model predicts that for each one unit increase the use of the discussion forums per week self-regulated learning increases by 0.102 units or 10 percent. Lastly, for using the LMS to seek help from the professors and the peers, the model predicts that for each one unit increase in the use of the LMS for seeking help self-regulated learning at NUST decrease by 0.38 units. Therefore, the model does not support the second hypothesis and it is rejected (i.e., the students who use the Web-Based Pedagogical Tools available on the LMS do not report better self-regulated learning at NUST).

4.7.2.2. Using the LMS and Student Satisfaction with their Learning Outcomes and Productivity Level

Table 12. Multiple regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.491[a]	.241	.226	.852

a. Predictors: (Constant), Use of the LMS per week to seek help from professors and peers, Student familiarity with the LMS, use of discussion forum per week, Use of the LMS per week

As talked earlier while running a multiple regression we are more interested in looking at the adjusted R-square instead of the R-square. The reason adjusted R-square is preferred has been explained earlier (see the model summary explanation for use of the LMS and self-regulated learning). R-square in the model presented above measures the proportion of the total variability in the satisfaction level that is explained by the variable, use of the LMS. Table 12 shows that the adjusted R-square is 0.226 so we can report that about 23% of the variability in the satisfaction level is explained by the use of the LMS at NUST. Next thing to look at is the ANOVA table which is presented below. The 23% variability can be justified using a similar explanation as explained in the earlier section. However, the results explained below provide a further explanation why we reject H_3.

Table 13. ANOVA model representing the significance of F-statistics

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	46.657	4	11.664	16.072	.151[b]
	Residual	146.600	202	.726		
	Total	193.256	206			

a. Dependent Variable: Satisfaction with quality of learning process and productivity level

b. Predictors: (Constant), Use of the LMS per week to seek help from professors and peers, Student familiarity with the LMS, use of discussion forum per week, Use of the LMS per week

As we know that the null hypothesis for the F-test in a multiple regression is that the model has no explanatory power which means that all the coefficients on the independent variables are zero. In other words, familiarity, and the use of the LMS for various purposes do not help to predict the satisfaction level of the students with their learning outcomes and productivity level. What is important here whether we should reject or accept the null hypothesis of the F-statistics. It can be seen in the model summary that the p-value for the F statistics is 0.151 which is greater than 0.05. Therefore, we conclude that we have a strong evidence to accept the null hypothesis of the F-statistics. This implies that our model is useless, that is, none of the independent variables helps to predict the dependent variables. Since the model has failed the F-test, according to the general statistic rules there is no point to continue to explain the unstandardized and standardized coefficients. Therefore, we conclude that the student's familiarity with the LMS and the use of the WBPT on the LMS does not impact the satisfaction level of the learning outcomes and productivity level of the students at NUST. Therefore, our hypothesis, *a high percentage of students using the LMS report satisfaction with their learning outcomes and productivity level* does not hold true and is rejected. This signifies that using the LMS does not result in a higher satisfaction level of the students with their studies. The next section discusses and presents the implications of the research findings.

Chapter Five: Discussion and Implication of Results

The purpose of this chapter is to summarize and deduce inferences from the results and discuss how they answer the objectives of the study. This chapter precisely interprets the results in the light of the literature review and provides an explanation of the main objectives of the study. The hypotheses are explained in a chronological order. Based on this a precise interpretation has been provided for each of the findings.

5. Do the students who find themselves familiar with the LMS perceive better self-regulated learning?

The results obtained show that, yes, the students who find themselves familiar with the LMS perceive to have a better self-regulated learning. Referring to the results and analysis section, the correlation table 3 explicates that the student's familiarity with the LMS at NUST has a positive relationship with the student perception of better self-regulated learning at NUST. Therefore, it can be inferred that the students at NUST hold this perception that an effective use of the LMS can ensue better learning process. Nevertheless, it is crucial to note here that this research question only inquires about the student's opinion on the LMS and does not investigate the genuine effect of the use of the LMS at NUST. Zimmerman (2008) in his study discovered a comparable result where the students who possessed a better understanding of the WBPT available on the LMS reported a higher level of self-direction and self-regulation. Our results depict that the correlation coefficient r is significant at a p-value of 0.262 which supports our first hypothesis. Thus, I conclude that the student perception about the LMS at NUST is that LMS can prove to be a helpful medium to support the studies.

One of the grounds that the students hold this perception about the LMS is because in a developing country like Pakistan the students may conceive that merely introducing technology can assist to streamline the education system and learning process however it may not be the case. One of the four rationales presented by Mac Keogh (2001) is an account of the students' perception. According to him the catalytic aspect of the education can result in transforming the education system in terms of teacher-student relationship, administration, and student learning outcomes, However, Bjørke (2016) explains that simply introducing technology in education might not ameliorate the education and learning process. On the contrary, changing the ways

how the education is delivered is critical which can be achieved by an effective use of the technology.

The later part of the interpretation elucidates the potential reasons that may have caused to reject the other two hypotheses. Why does not the use of the LMS help to achieve self-regulated learning at NUST? Based on that further justifications are provided as to why the students do not report higher satisfaction level with their learning outcomes and productivity level.

5.2. Does the use of the LMS improve self-regulated learning and subsequently student satisfaction with their learning outcomes and productivity level at NUST?

The results show that employing the LMS in the education system does not improve the self-regulated learning of the students at NUST and consequently, the students do not report better satisfaction with their learning outcomes and productivity level. The results obtained do not support second and third hypotheses of the study. The correlation table 4 shows a small negative or no correlation between the use of the LMS and self-regulated learning. Likewise, there exists a small negative or no correlation between the use of the LMS and student satisfaction with their learning outcomes and productivity level represented in the correlation table 3. The correlation values lie at -0.046 and -0.007 for the former and latter respectively which are close to zero. Therefore, I will interpret the results based on the assumption that there exists no correlation between the use of the LMS and self-regulated learning.

To make it easier to understand let us break down the variables used in the multiple regression. I will interpret each of the variable and its probable effect on the self-regulated learning. This will subsequently allow making inferences about the level of satisfaction of the students with their learning outcomes and productivity level. The explanation to student familiarity with the LMS that forms the first predictor variable of the multiple regression models has been described earlier while interpreting the first hypothesis. Moving on to the next variable, table 11 shows that there exists a significant negative correlation between the use of the LMS and self-regulated learning. The result is quite astonishing and one might ask how the use of the LMS can be negatively correlated to the self-regulated learning. Going back to the literature, Starr (2001) in the study found out that lack of motivation is one of the critical factors that might hinder an effective use of technology in the education system. Therefore, even the technology (LMS) has been employed in the education system at NUST yet an effective self-regulated learning is far from

being achieved. Based on these findings and the literature, it can be stated that one of the reasons why there does not exist a correlation between the use of the LMS and self-regulated learning is the lack of motivation on the part of the students who do not use the tools available on the LMS. Furthermore, the teachers may not be playing a good role in motivating the students to make the LMS a consistent part of their studies. Further interpretation to why there exists a lack of motivation among the students is explained in the succeeding paragraphs.

Frequency table 3 depicts that majority of the students use the LMS just for checking their attendance percentage or downloading lectures. It is mandatory for the students at NUST to have 70% attendance to sit for the exams and pass the course. Therefore, the students mostly use the LMS when they want to track their attendance percentage. Dabbagh and Kitsantas (2013) found out that a lack of motivation and training can result in maladaptive strategies. As observed in the case of students at NUST the maladaptive strategies adopted by them result in the non-optimal use of the LMS and therefore does not reinforce self-regulated learning. Furthermore, results show that very little percentage of 27% and 5% of the student use the collaboration and communication tools and the hypermedia tools respectively. Approximately 80% of the sample students does not make the use of the LMS to seek help from the professors concerning studies. All these percentages again signify that the LMS at NUST is not effectively utilized at NUST. A further explanation to this question succeeds.

We can see that there exists a staggeringly big difference between the students' perception of the impact of the LMS on self-regulation and when they actually are using the LMS. It can be deduced that in addition to the lack of motivation and motivational beliefs respectively the adoption of maladaptive strategies is an underlying reason. An explanation to why the students adopt maladaptive strategies is the lack of an adequate training on the use of the LMS. The results obtained show that a big 62% of the sample students responded that the university does not provide training on the LMS. This means that the students find it hard to grasp an understanding of the various WBPT and therefore lack the motivation to use them. According to Zimmerman and Kitsantas (2005), it is essential to teach the self-regulatory processes to the students to eliminate the maladaptive practices to achieve an optimal level of utilization of the tools. In this case, the role of the teachers is an imperative. Dabbagh and Kitsantas (2013) in their study found out that teachers can play a significant role in creating awareness about the WBPT

among those students who possess lower self-regulatory skills. This study also gives us an indication that the students at NUST might possess a lower level of self-regulatory skills and therefore an adequate training is indispensable.

In addition to what has been mentioned earlier, a lack of motivation on the part of the teachers to use the LMS themselves and encourage the students as well can be an implicit reason we find no correlation between the use of the LMS and self-regulated learning at NUST. Because if the teachers lack the motivation to make an effective use of the LMS it is very hard for them to play the role of a motivator for the students.

Bjørke (2016) explains with the paradigm shift towards technology the role of the teacher must shift from being a traditional instructor to a facilitator. However, at NUST, it does not seem to be the case. An explanation to this assumption is based on my four-year personal experience at NUST. I used to be a bachelor's level student at NUST. Attendance on the LMS is strictly followed by the students as well as the teachers. Through my four years of personal experience, I discovered that there has been an institutional pressure on the teachers to use the LMS strictly for taking attendance and sharing the lectures. Other tools available on the LMS like collaboration tools, hypermedia tools, communication tools remain unused. The use of these tools remains at the discretion of the teachers. And since the teachers are not dictated by the institution to use other WBPT, the use of the LMS remains ineffective. Therefore, the results depict that there does not exist a correlation between the use of the LMS and self-regulated learning at NUST.

What has been mentioned in this section forms the basis for why technology (LMS) does not increase the satisfaction level of the students with their learning outcomes and productivity level. The results incurred do not support our third hypotheses. There is a simple answer to this; students do not engage the LMS for setting their goals and monitoring and evaluating their personal progress. The level of satisfaction with the learning outcomes and productivity level is related to self-regulation. A research study conducted by Zimmerman and Kitsantas (1999) shows that setting specific goals help the students to focus on specific tasks and actions. The LMS which must be used as a tool to facilitate the learning process is maladaptively used as a means to track the mandatory attendance level. Therefore, the results demonstrate regardless of using the LMS the students do not report better satisfaction level in terms of their learning

outcomes and productivity level. Based on these outcomes we can deduce that the LMS is ineffectively utilized at NUST.

Chapter Six: Conclusion and Recommendations

This chapter summarizes the principal themes in the study. The chapter concludes the study in the context of effective use of the technology in the education system that could contribute towards the development of the society in a broader context. Based on the resulting findings this chapter offers recommendations that could amend the way the LMS is used at NUST to achieve effective technology assisted learning.

6. Conclusion

Education plays a substantial role in the development of any society. Education, economic growth, and social development go hand in hand. Education results in human empowerment and demarginalization of the poor people by offering them equal opportunities which indirectly contributes towards the socio-economic development. However, to unleash the true potential of the human brain the ways the education is delivered must change. There is a dire need to shift from the traditional paradigm to digital paradigm of learning respectively. Therefore, employing technology in the education system is an imperative.

The use of technology to facilitate the learning process is becoming popular. Nevertheless, in most of the developing countries employing technology in education continuously fails to streamline the education system. The reason is that merely throwing technology into the classrooms cannot suffice. An appropriate amalgamation of technology with adequate methods of teaching is an imperative. Therefore, it bespeaks a need to effectively utilize the technology in education to boost the learning process for the students rather than engaging in maladaptive practices.

This study has been carried out to investigate a similar issue of the LMS and self-regulated at NUST in Islamabad, Pakistan. Specifically, the study examines if the use of the LMS reinforces the student self-regulation at NUST and therefore do the students report better satisfaction with their learning outcomes and productivity level.

Results indicate that there exists a correlation between the student familiarity with the LMS and their perception about a better self-regulated learning. Most the students find themselves familiar with the WBPT available on the LMS and therefore hold the perception that it could help them achieve self-regulated learning. However, further results incurred negate the existence of a

correlation between the actual use of the LMS and self-regulated learning at NUST. On average, approximately 70% of the sample students reckon that that LMS does not serve as a platform to collaborate with the peers and share ideas with them. Moreover, neither the students use the LMS to seek assistance from the professors and nor do they use the hypermedia tools to explore information on the web. The reason is the students lack the motivation to effectively use the tools. It must be kept in mind that a lack of motivation arises because the students do not get an adequate training to use the LMS effectively. Therefore, various WBPT like discussion forums, hypermedia tools, communication tools remain unutilized. Results show that in general, the use of various WBPT remains at a low percentage of 1-2 times per week on average which is quite low. This signifies that students do not use the LMS very often to support their studies.

In addition to that, students possess lower self-regulatory skills and exhibit maladaptive behavior when it comes to the use of the LMS. The students majorly exhibit maladaptive behavior while using the LMS to keep track of their attendance to sit for the exams. All these indicators are the reasons that no correlation has been found between the use of the LMS and self-regulated learning at NUST.

Furthermore, the results show that there exists no correlation between the use of the LMS and the student level of satisfaction with their learning outcomes and productivity level. Regardless, the technology (LMS) has been employed in the education system at NUST the students do not report better satisfaction. This is in confirmation with the explanation provided above. No doubt, when the LMS is not utilized optimally and maladaptive strategies prevail employing technology in the education system cannot streamline the education system and create better learning environment respectively. Consequently, the true potential, which could lead to thriving socio-economic development, of such education systems may remain untapped due to an ineffective use of the technology.

Therefore, based on the result findings we can precisely state that an ineffective use of technology (LMS), due to the respective reasons as mentioned above, does not assist students in achieving self-regulated learning and better satisfaction with the learning outcomes and productivity level as expected. The next section provides some recommendations to improve the use of the LMS at NUST for better learning.

6.1. Recommendations

In this section, I will very precisely highlight the areas based on the results and the ways the LMS is used at NUST can be improved. Foremost, the results demonstrate that 95% of the students use the LMS to check attendance. While interpreting the data we have seen the reason a big percentage of the sample students use the LMS for tracking attendance is to keep a 70% attendance record which will allow them to sit for the respective course exam. This is essentially a maladaptive behavior that the students exhibit and can be changed by teaching them self-regulatory skills. A proper training session on the utilization of the LMS in an imperative. Therefore, in this regard, the teachers can provide guidance, especially to those students who possess lower self-regulatory skills. This can serve to increase the level of motivation among the students to use the LMS for better self-regulated learning.

Additionally, an awareness about the role which the LMS can play to boost the student learning process must be instilled in the students by the teachers by educating them about the LMS through LMS workshops. A special emphasis on the tools like collaboration and communication and hypermedia tools respectively can assist the students to enhance their learning outcomes and productivity level. This will allow the students to share their ideas and collaborate with the peer irrespective of the time frame which consequently will create new sets of knowledge.

Another probable implication that we have seen in the previous chapter was the lack of motivation on the part of the teachers which can be solved through institutional pressure where the administration can enforce the teachers to utilize the tools available on the LMS.

The recommendations are based on the statistical results derived from the primary data, therefore, if taken into account can improve the way the LMS is used in the education system at NUST. This will consequently streamline the education system and create a better learning environment where the students can thrive and enhance their self-regulated skills. This study, therefore, contributes to the development of the society, especially in the education sector where NUST and other universities can take lessons to effectively utilize the technology in the education system to facilitate the learning in higher education in Islamabad, Pakistan.

Chapter Seven: Evaluation

This chapter provides an evaluation and assessment of the entire study. Furthermore, it discusses the reliability and validity of the study. Moreover, this chapter explicates the ethical considerations and finally, the chapter ends with explaining the limitations and future research directions.

7. Assessment of the Research Process

The research process was divided into several stages including formulating the hypothesis, reviewing the literature, collecting, and analyzing data and writing up. In the beginning, the research started with a broader context focusing on the technology and its impact on the quality of education. According to Bryman (2012, p. 15), the social research is full of false starts and blind mistakes and changes occur in the research plans. The research intended to cover all the universities situated in Islamabad, Pakistan. However, this was too much work compared to the scope and limited time constraints. While reviewing the literature and formulating the hypothesis the research narrowed down to the use of the LMS and its impact on self-regulated learning at NUST. The study has exercised some flexibility over the discourse of the entire research process however simultaneously it has appreciated the methodological principles that had been planned before starting the research process (Bryman, 2012, p. 16). All the loopholes in the study remain my responsibility.

Since the study employs a quantitative approach based on descriptive and inferential statistics it is objective and values free, that is, it does not reflect the personal beliefs or feelings of the researcher. According to Durkheim (1938) while conducting the social research all the preoccupation and preconceptions must be eradicated. However, since I had been the part of NUST, therefore some of the interpretations might have been influenced based on my four years of personal experience. As mentioned earlier there was no point at any time where the intrusion of sympathy or affection has occurred during the study. The researcher takes this advantage due to the quantitative nature of the study where there did not arise a need during the study to establish a connection with the respondents.

7.1. Reliability

According to Bryman (2012, p. 169) reliability refers to the consistency of a measure of a concept. The first factor that that forms the basis to explain whether the measure is reliable is

stability. The measures used in the study, self-regulation, use of the LMS, students learning outcomes and predictivity level are based on the existing theories and are therefore stable and may not vary over time. However, there might arise certain issues over a long period of time. For example, more advancements in the technology or the ways it can be used etc.

Second, the research is internally reliable because all the variables are measured on an equal scale between 1 to 5 which means that score from one variable can be related to another variable and hence reliable.

7.2. Validity

Validity is an important criterion in social research and reflects the integrity of the research (Bryman, 2012, p.47). In a quantitative research, it is of prime importance to check the measurement validity which means that does our variables reflect the concept that it intends to denote? All the variables that served as a mean to carry out this study are based on the existing literature and therefore are valid. For a research to be considered valid it must be reliable. For example, all the measures under self-regulation denote the concept of self-regulation, so does the use of the LMS and students learning outcomes and productivity level respectively. Therefore, we are confident enough to say that our measures represent the concepts and are valid.

As we know that the data for the study has been collected using a stratified random sampling. A stratified random sample is a probability sample which allows us to generalize beyond the respondents (Bryman, 2012, p. 48). Based on this the study has an external validity limited to NUST. This means that the results can be generalized for the student population at NUST.

7.3. Ethical evaluation

The ethical concern in a research study distinguishes between the acceptable and non-acceptable behavior respectively while conducting a research. Contrary to the non-acceptable behavior, acceptable behavior is those standard rules that govern any research area. Likewise, social research is also governed by certain ethical standards and behavior that must be considered. These include whether there is a harm to the participants, lack of informed consent, invasion of privacy and lastly deception (Bryman, 2012, p.135).

According to Bryman (2012, p. 143), the research should be *designed, reviewed, and undertaken* in such a way that it ensures *integrity, quality, and transparency.* Bearing in mind the ethical

concerns while conducting a research increases the caliber and integrity of both the researcher and the research respectively. Therefore, to gauge the quality of the research this section explicates the ethical concerns that are considered throughout the discourse of the research study.

Foremost, the research study is a quantitative research which aims to examine if the use of the LMS bears a potential impact on student self-regulation. This, for example, signifies that the questions are not aggressing student personal experiences which may bring harm to the students in any form. This is ensured by designing such questions that do not aggress the personal beliefs or trigger any past memory in the participants. The participants are given questionnaires and they can decide what do they want to answer.

The research study is overt since the topic does not demand any covert observation. The questions are explicitly stated clearly depicting the purpose of the research. Thus, the issue of lack of consent for using information is eliminated from the study. Privacy of the participants is maintained since the questionnaires are anonymous. The research study under any circumstances has not tried to deceive the prospective participants of the study. However, an important ethical consideration which must be noted here is that some of the respondents assumed deceptively that the questionnaire was administered by the University in order to make improvements to the usage of the LMS at NUST and not for research purpose[10]. This concern very likely arose because of the fact that the students might not have read the introduction to the questionnaire and jumped right int answering the question.

Another ethical concern that might arise is whether the benefit obtained as a result of this study is mutually inclusive for both the respondents and the researcher? The research at the end provides some suggestions which if applied can assist in using the LMS at NUST to its optimal level for self-regulated learning. However, whether the suggestion would be taken into account or not depends upon the institutional discretion and if by the time the suggestions are implemented the respondents might have graduated from the university and may not benefit from it.

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[10] The researcher came to know this because some students wrote few suggestion in addition to answering the questions

7.4. Limitations and Future Research Directions

The methodology section explains in detail the sampling technique employed while conducting the research. Reiterating, this research study has used a stratified random probability sample which allows generalizing for the larger population, that is, all the students based at NUST who use the LMS for self-regulated learning. However, it does not imply that findings from this research study have broader applicability. The generalization may only be bound to NUST and might not be applicable to other universities using LMS.

There might be several factors which imply that the potential impact of the LMS on self-regulated learning might be higher or lower among other universities in Islamabad, Pakistan. There might be higher or lower level of training by the instructors on how to effectively utilize LMS for better learning outcomes. The students might have different educational backgrounds and may find it difficult to grasp an understanding of the LMS. The LMS might not be used in the same way as it is utilized at NUST and there might be other reasons too. This can be understood as a limitation of the research approach and the methodology employed, meaning that there are limits to generalizing the research findings (Bryman, 2012, p. 205).

NUST is soon shifting from LMS to a Campus Management System (CMS). CMS is a more advanced form of an LMS and will serve as a broader platform and includes everything from student registration (when the student enrolls) until they graduate. According to Bryman (2012) when there is prominent change it is difficult to generalize the findings. Additionally, it becomes impossible to assess a time limit for which the findings can be generalized. Therefore, as soon as NUST shifts to the CMS even though at that time if the students still use the LMS, this limitation must be appreciated that the findings may not be generalized because shifting to CMS will certainly impact the frequency of the use of the LMS.

A possible future research direction can be to study what approach NUST adopts towards the use of the CMS. Another interesting research direction will be to make a comparison between the students at NUST who do and do not do use the LMS respectively and compare their learning outcomes. Moreover, this study can be used for further research to compare the learning processes and outcomes of the students at NUST with other universities situated in Islamabad which does not use technology in the education system. This would help to make improvements in the way how the technology is used in higher education in Pakistan.

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Appendices

Appendix I: Informed Consent Letter

UNIVERSITY OF AGDER

Date: 11 November 2016

Visiting Address:
Gimlemoen 17
Phone: +47 38141620
Fax: +47 38141028

To Whom It May Concern

Ubaid ur Rehman

This is to certify that Mr Ubaid ur Rehman from Pakistan is a student at the University of Agder, Norway. He is pursuing our MSc degree in Development Management and Planning and is planning to conduct fieldwork in Pakistan. His research is focusing on the impact of ICT integration in education system on the quality of higher education, using National University of Sciences and Technology and Urdu University in Islamabad, Pakistan as a case.

Mr Ubaid ur Rehman is planning to conduct his fieldwork from December 2016 to February 2017. I would be most grateful if he could be rendered any necessary assistance during the period of his fieldwork.

I would like to take this opportunity to thank you in advance for your assistance in this matter.

With Best Wishes,
Yours Sincerely,

Aleksandra Lazareva
PhD Research Fellow
Department of Global Development and Planning

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Appendix II: Survey

Thank you for participating in the survey "The impact of Information Communication Technology (ICT) and Learning Management System (LMS) on the quality of education".

This survey is administered to examine how does LMS impacts the quality of higher education at NUST. This questionnaire will approximately take 7 to 10 minutes. All answers to the question will be kept anonymous and no individual will be identifiable.

If you have any queries regarding the survey later you can send an email to m_ubyd@live.com. Your time and effort in answering the questionnaire are highly appreciated.

General Information:

1. What is your gender?
   o Male
   o Female

2. Which level of school are you in?
   o Bachelors
   o Masters
   o I am a NUST Alumni

3. Which department are/were you in?
   o Department of Engineering
   o Department of Social Sciences
   o Department of Business Studies

For question 4 and 5 choose on a scale from 1 to 5:

4. To what extent do you find yourself familiar with the Learning Management System (LMS) at NUST?
   1. Very well familiar
   2. Well familiar

3. Somewhat familiar

4. Barely familiar

5. Not familiar at all

5. To what extent do you find the LMS helpful in supporting the studies?

    1. Very helpful

    2. Helpful

    3. Somewhat helpful

    4. Barely helpful

    5. Not helpful at all

From question 6 to 9 multiple options can be chosen:

6. For what purposes, do you use LMS for?

    o Check attendance

    o Downloading lectures

    o Uploading assignments

    o Accessing digital library

    o Online discussions

    o Checking plagiarism

    o Checking results

    o Checking latest news

    o Checking upcoming events

    o Other (Please specify) _____

7. For what purposes teachers use LMS for?

    o Taking Attendance

    o Uploading lectures

    o Uploading assignments and project tasks

    o Providing course relevant resources

    o Creating online discussion forums

- o Checking plagiarism
- o Uploading results
- o Uploading latest news
- o Other (Please specify) _____
- o Some teachers do not use LMS

8. LMS serves as a place to
    - o Collaborate with peers
    - o Share ideas
    - o Work on individual and group tasks and activities
    - o Get assistance and guidance from the peers and professors regarding course content
    - o Establish individual goals
    - o Establish group goals
    - o Explore and locate information on the web
    - o Build networks with peers

9. The university trains the students on how to use LMS through
    - o LMS workshop
    - o Presentation or Lecture
    - o The university does not provide training on the use of LMS

From question 10 to 12 please rank yourself based on the frequency of use of LMS:

10. I use LMS to support my studies
    - o 6-7 times in a week
    - o 4-5 times
    - o 2-3 times
    - o 1 time
    - o I do not use LMS to support study

11. How often do you use discussion forum on LMS to discuss a topic?

- o 6-7 times in a week
- o 4-5 times
- o 2-3 times
- o 1 time
- o I do not use LMS for discussions

12. How often do you use LMS to seek help about course content from professors and peers?

- o 6-7 times in a week
- o 4-5 times
- o 2-3 times
- o 1 time
- o I do not use LMS for seeking help

From question 13 to 19 please evaluate the statements on a scale from 1 to 5 by encircling, where 1 is strongly agree, 2 is agree, 3 is neutral, 4 is disagree and 5 is strongly disagree.

13. LMS improves the quality of learning process.

    1   2   3   4   5

14. LMS helps me to plan and set my learning objectives.

    1   2   3   4   5

15. LMS helps me to monitor and evaluate my personal progress.

    1   2   3   4   5

16. Monitoring and evaluating personal progress enhance skills like planning and time management to achieve better learning.

    1   2   3   4   5

17. LMS helps me to reflect on my personal progress and make self-improvements.

1   2   3   4   5

18. LMS increases my productivity in learning

    1   2   3   4   5

19. LMS at NUST is being effectively utilized to facilitate the learning process

    1   2   3   4   5

Please choose on a scale from 1 to 4:

20. Are you aware of the hypermedia tool available on LMS that provides access to the digital library?
    o Yes
    o No

21. If yes, do you use the digital library while completing individual and group course assignments? Please encircle (1 = Each time I do an assignment, 4 = I do not use the digital library)

    1   2   3   4

Appendix III: Coding Manual

Variables	Code
Gender	Male – 0 Female – 1
Level of school	Bachelors – 0 Masters – 1
Respective departments where the students are based	Department of Engineering – 0 Department of Social Sciences – 1 Department of Business Studies – 2
Student familiarity with the LMS	Very well familiar – 1 Well familiar – 2 Somewhat familiar – 3 Barely familiar – 4 Not familiar at all – 5
Student's perception about the helpfulness of the LMS	Very helpful – 1 Helpful – 2 Somewhat helpful – 3 Barely helpful – 4 Not helpful at all – 5
Use of the LMS[11]	6-7 times in a week – 1 4-5 times – 2 2-3 times – 3 1 time – 4 I do not use LMS to support study – 5
Self-regulation[12]	Strongly agree – 1 Agree – 2 Neutral – 3 Disagree – 4 Strongly disagree – 5
Missing data	555

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[11] There are other variables in the survey which come under the use of the LMS and are coded in a similar way
[12] There are other variables in the survey which come under self-regulation and are coded in a similar way