

*AN ASSESSMENT OF FACTORS THAT IMPACT ON THE PERFORMANCE OF
CISCO ACADEMIES: THE SOUTH AFRICAN SITUATION*

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*Submitted in partial fulfilment of the requirements for the degree
MAGISTER IN BUSINESS ADMINISTRATION
in the Faculty of Business and Economic Sciences
at the Nelson Mandela Metropolitan University*

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NOVEMBER 2012*

DECLARATION

I, **Gratitude Kudyachete**, hereby declare that:

- the work in this dissertation is my own original work;
- all sources referred to have been documented and acknowledged; and
- this dissertation has not been previously submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification at any other recognised educational institution.

Gratitude Kudyachete

Date

ACKNOWLEDGEMENTS

I hereby express my appreciation and gratitude to the following individuals and organisations that contributed to the completion of this dissertation:

- To God Almighty for His grace, mercy and divine enablement and for sustaining me through such a challenging time.
- Professor C. A. Arnolds for his patient guidance, support and inspiration in the preparation of this dissertation.
- My wife Annah and children for their support, love and patience during such a challenging time. “Mwari vakukomoborei – Marwa makakunda”.
- My work supervisor, Prof. Dalenca Pottas, for her encouragement and support.
- The Cisco Academy management teams at NMMU, Cape Peninsula University of Technology, Central University of Technology, Mangosuthu University of Technology and CIDA ICT academy for their support in the collection of data for the study. You made the whole undertaking possible.
- The Glad Tidings Fellowship church members for their prayers.

ABSTRACT

Information and Communication Technology (ICT) is a catalyst for economic development and has been seen to provide new business opportunities and a source of competitive advantage. The acute ICT skills gap in South Africa is widely acknowledged. Such a shortage has cost the South African economy dearly, resulting in the government adopting a multi-pronged approach to the problem. The various interventions have yielded limited success leaving room for other players to contribute to the solution. The Cisco Academy programme, executed through the establishment of Cisco Academies in educational institutions, is a professional education programme focused on the provision of computer networking skills and other basic information technology technical skills. Its comprehensive approach has seen it playing a complementary role to those of the government and other stakeholders.

This study focused on the factors that affect Cisco Academy performance. The primary objective was to improve the academic performance of the Cisco Academies in South Africa. More specifically the study assessed the effect of instructor quality, use of technology tools, multi-culture needs, motivation, supporting infrastructure and accessibility on academy performance.

The sample consisted of 166 respondents from five Cisco Academies in South Africa. Techniques such as multiple regression analysis, two sample t-tests and analysis of variance were employed on the empirical data. It was established that instructor quality and use of technology tools were the significant determinants of academy performance. It was also established that the Cisco Academy programme is making a significant contribution towards addressing the ICT skills shortage. A number of recommendations are made for the government, Cisco Academies and Cisco systems itself. Recommendations for future research are also provided.

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CHAPTER 1

SCOPE OF THE STUDY

1.1 INTRODUCTION

The Cisco Networking Academy is an educational programme that aims to empower students so that they can build, design and troubleshoot modern computer networks. Launched in 1997 by the market leader in computer networking products and solutions, Cisco Systems, the programme has grown from a high schools project to one of a stature that sees its placement in universities and pulls government, the private sector and non-governmental organizations into partnerships. Organizations such as UNDP, USAID and the International Telecommunications Union have recognized its significance as a development tool and have been involved in a variety of ways. Up to the present, over one million students have gone through the system and 5% of them are in Africa (Cisco Networking Academy, 2012).

South Africa is a priority country for Cisco Systems as far as the academy programme is concerned. South Africa has 59 Cisco Academies with about 2500 students currently engaged in the programme either in an integrated form with their degree or diploma programmes or as stand-alone technology certificate programmes. According to the Cisco Academy Learning Management System, not all Cisco Academies give satisfactory performance. There are academies that are being closed owing to failure to perform in accordance with expectations. The main training centre for Sub-Saharan Africa is located at the Nelson Mandela Metropolitan University. Regarding this problem, the Cisco Academy management team at Nelson Mandela Metropolitan University and the Cisco Systems Academy management team are concerned by the limited success of some the institutions.

According to a study by Delialioglu et al. (2010), participant characteristics, curriculum characteristics and institutional characteristics may affect the student outcomes. These were findings made in a developed country. From the African perspective, Ng'ambi (2006) argues that infrastructure development and human

capacity development are critical to the success of the employment of ICT in development.

It is hoped that the present study will pinpoint the factors that affect Cisco Academies in South Africa. Once these factors are identified, they should lead to strategies that improve the overall success of the academies.

The purpose of this study is to assess the factors that have an impact on the performance of the Cisco Academies in South Africa. The report will also establish the extent to which each factor affects the different institutions that run the Cisco Academy programme.

1.2 PROBLEM STATEMENT

Many South African government departments and other stakeholders are interested in the development of ICT skills. Lotriet, Matthee and Alexander (2010) in their recent research paper claim that job creation is the main reason for the efforts that the South African government is making to direct attention towards ICT skills development. The authors cite initiatives such as the Accelerated and Shared Growth Initiative for South Africa (AsgiSA) and the Joint Initiative on Priority Skills Acquisition as evidence of the government's recognition of ICT skills shortages. Indeed job creation is a major factor but the overall economic benefit is huge. The embracing of ICT to the point where it is a major enabler of business processes has moved it from being a source of competitive advantage to more of a norm.

The acute ICT skills gap in South Africa is widely acknowledged. Beer (2010) claims that the South African ICT shortages projected in 2006 may now have deteriorated. Such a situation calls for a multi-pronged approach by all stakeholders.

In recognition of the role of the Cisco Academy as a tool for development, institutions such as USAID, the International Telecommunications Union and UNDP partnered with Cisco Systems and took the programmes to a number of African countries which included South Africa. The aim was to stimulate economic development by empowering these countries with ICT skills. In such projects, there has been a

mixture of both successes and failures as some institutions and their students have failed to perform as expected.

According to Dennis et al. (2006), the success as manifested in student outcomes depends on school factors, student factors and programme delivery factors. This was applied to the Cisco Academy course – Cisco Certified Network Associate. School factors are those issues that are characteristic of the institution before the academy programme is brought on board and may include the geographical location or the area's economic development level. Student factors include demography, motivation and ability. Programme delivery refers to those factors that have to do with how teaching is delivered. The Cisco Academy course material is standard and accessible online. Tests and continuous assessments are also delivered online except for the practical examination. The practical examination is still designed by Cisco Systems.

According to Delialioglu et al. (2010), participant characteristics, curriculum characteristics and institutional characteristics may affect the student outcomes. According to Dennis et al. (2006), institutional factors do not affect academy or student performance. However, Delialioglu et al. (2010) find significant contributions from school factors. This leads to a contradiction in findings. While these findings may apply to the developed countries, their applicability to South Africa is uncertain.

Ngwenyama, Andoh-Baidoo, Bollou and Morawecynski (2006: 3) argue that 'recent studies have found a positive correlation between investment in ICT and economic growth in developed countries, but evidence for developing countries is not as extensive'. Ng'ambi (2006) argues that Infrastructure development and human capacity development are critical to the success of the use of ICT in development. While there have not been proper scientific studies in Africa, the Cisco Academy managers agree to some extent that infrastructure and instructor factors are important. It is therefore important that institutional factors be investigated further. In addition, Eccles and Wigfield (2002) argue that the motivation of the students has a bearing on the overall performance of a student. The student needs to have the right skills, knowledge background and interest in order to succeed. Bichelmeyer et al. (2006) claim that the majority of instructors agree that Cisco's standardized

curriculum makes teaching effective. They further assert that the majority of instructors are professionals with vast experience in networking. In the South African context, most instructors teach the Cisco Academy programme in addition to their core teaching duties. The instructors hail from diverse educational backgrounds which may have a bearing on their effectiveness. While South Africa is an economic powerhouse in Africa, the Cisco Academy programme targets disadvantaged communities and in such areas there could be infrastructural and human capacity issues. To add to this problem Cisco has made South Africa a focus country as far as the Academy programme is concerned.

Given the lack of pertinent data for the South African context, it is imperative that factors that really affect the success of the Cisco Academy programme should be established. The current research has not produced much of relevance. Even though the Cisco Academy programme for Sub-Saharan Africa has its head offices in South Africa, if proper data and information to inform strategic decisions are not established, then the programme may continue to deliver erratically. Proper and adequate investment by government, non-governmental organizations and the private sector may not happen unless the specific issues that affect the programme are conclusively established.

The problem statement in this study is based on the following thesis statement:

An assessment of the impact of factors affecting the performance of Cisco Academies in South Africa.

1.3 CONCEPTUAL FRAMEWORK

Owing to the standard nature of Cisco Academy courses, most of the learner and delivery factors are not examined in this study. Institutional and instructor factors make up the majority of the factors examined. Academy performance, the dependent variable is measured by a score of student marks in the final online and practical examinations.

The independent variables investigated are:

- Supporting Infrastructure
- Instructor quality
- Multi-culture needs
- Motivation
- Accessibility
- Technology tools

1.3.1 Supporting infrastructure

With South Africa being essentially a third-world country, one of the major factors affecting development in South Africa is infrastructure. Cisco Academies require special equipment and internet facilities. Academies have been known not to always have adequate infrastructure in place. Infrastructure is a major cost component in the establishment of Cisco Academies.

1.3.2 Instructor quality

Even though Cisco provides standard tools and ready-made teaching materials, South Africa's general standard of education has not been high, particularly in disadvantaged communities. This factor needs to be probed further.

1.3.3 Multi-culture needs

South Africa, unlike many other African countries, is quite diverse in its culture. Language diversity requires that instructors are particularly sensitive in the delivery of instruction. The study needs to establish how this rather peculiar factor is currently affecting the Cisco Academies.

1.3.4 Motivation

It is generally accepted that a student's performance is affected by his/her level of motivation. The Cisco Academy programme endeavours to build its own tools and techniques to improve overall academy performance and this study would benefit if the extent of the effect of motivation could be established.

1.3.5 Accessibility

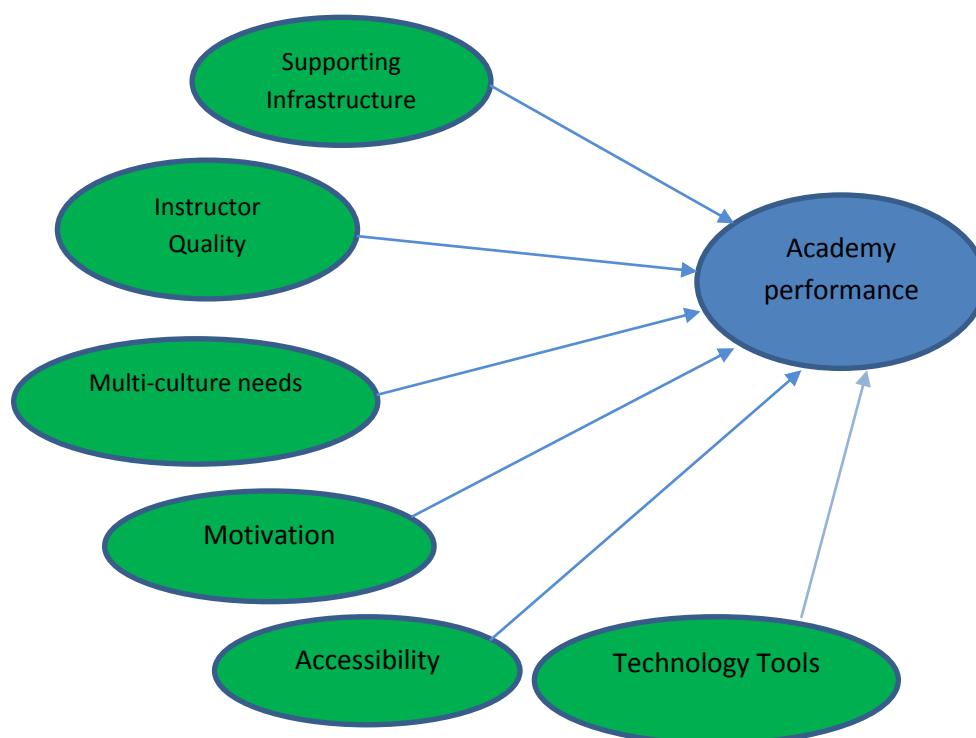
Having been established more than a decade ago, the Cisco Academy programme can be expected to have reached maturity and its growth strategies now need to be refined. The closeness of academies, the ease with which students enrol for classes at a particular academy and the adequacy of the transport system to their academies are points that need to be established so as to refine Cisco Academy growth strategies in South Africa.

1.3.6 Technology tools

The Cisco Academy programme makes intensive use of teaching technologies and tools. The assumption has been that these tools are useful. It is important to establish the extent of their use and impact

The conceptual model used in the study is shown in Figure 1.1.

FIGURE 1.1 THE CONCEPTUAL MODEL



1.4 RESEARCH OBJECTIVES

The primary objective of the study is to improve the academic performance of the Cisco Academies in South Africa by investigating the factors that influence that performance.

The secondary objectives of the study are to:

- Establish the extent to which infrastructural needs affect the performance of Cisco Academies;
- Establish the extent to which the multi-culture environment affects the Cisco Academy programme;
- Determine the extent to which the use of technology tools affects the Cisco Academy performance;
- Determine the quality of instructors in the Cisco Academy programme;
- Determine the main determinants of Cisco Academy performance;
- Determine if Cisco Academies differ significantly in terms of their performances;
- Determine if gender groups perform differently;
- Determine if the educational level of students affects their performance in the Cisco Academy courses;
- Assess whether the Cisco Academy programme is making a positive contribution; and
- Determine strategies that will enhance the performance of the Cisco Academies.

In the investigation, the following questions needed to be answered:

- To what extent do infrastructural needs affect the performance of Cisco Academies?
- To what extent do multi-culture needs affect performance of students in the Cisco Academy programme?

- What is the quality of instructors in the Cisco Academy programme in South Africa?
- What are the main determinants of Cisco Academy performance?
- Do gender groups perform differently?
- Does the level of education affect the performance of students?
- Do students in different locations perceive the independent variables differently?
- Is the Cisco Academy programme making a positive contribution?
- What strategies are appropriate to improve the performance of the Cisco Academies?

1.5 RESEARCH DESIGN OBJECTIVES

In order to meet the objectives of the study, the following design objectives had to be addressed:

- Conduct secondary literature review / analyses: Literature from relevant information technology journals and magazines must be examined, including Cisco Academy papers which are published annually from the Learning Methodologies Platform in the Cisco Networking Academy (LMPCNA) conference. Articles on ICT skills development from South Africa must also be consulted.
- Develop a questionnaire based on secondary literature: In order to collect primary data, questionnaires must be designed and sent to academies in South Africa. Close-ended questions should be used.
- Test the questionnaire in a pilot study: The questionnaire should be sent to experts and also tested at one of the participating universities.
- Conduct data collection with the final questionnaire: Questionnaires must be sent to the participating academies. Owing to the existing relationships with the academies, it was hoped that there would be reasonable cooperation.
- Capture data using Excel
- Analyse data using Statistica
- Interpret results

- Record, draw conclusions and make recommendations to management

1.6 HYPOTHESES

Against the background of selected determinants in the conceptual model, the following null hypotheses were formulated:

H01: Supporting infrastructure exerts no influence on the performance of students in the Cisco Academies

H02: Instructor quality exerts no influence on the performance of students in the Cisco Academies

H03: Multi-culture needs exert no influence on the performance of students in the Cisco Academies

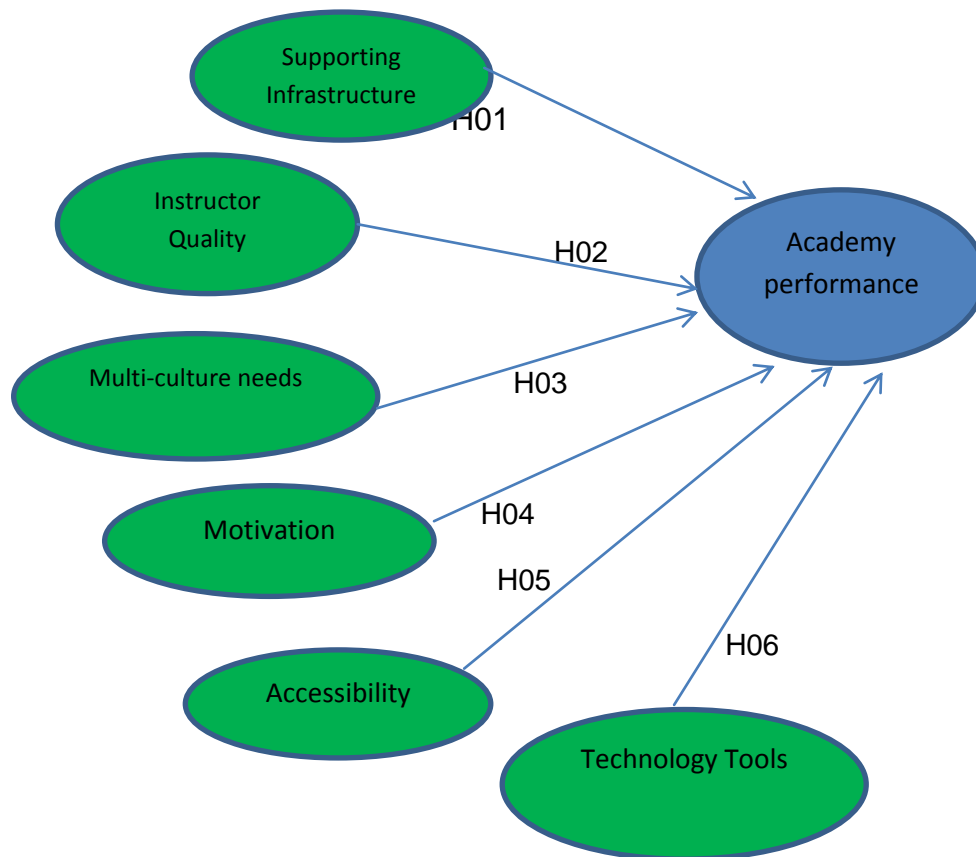
H04: Motivation exerts no influence on the performance of students in the Cisco Academies

H05: Accessibility of the institution exerts no influence on the performance of students in the Cisco Academies

H06: Use of technology tools exerts no influence on the performance of students in the Cisco Academy

The conceptual model and the hypotheses are shown in Figure 1.2.

FIGURE 1.2: THE CONCEPTUAL MODEL WITH HYPOTHESES



1.7 RESEARCH METHODOLOGY

The research paradigm, strategies, sample and measuring instruments will be discussed in this section.

1.7.1 Research paradigm

A phenomenological research paradigm is one that is anchored on a qualitative foundation with an emphasis on individual perception and interpretation. According to Veal (2005: 23), 'it rejects the idea that human behaviour can be studied in the same way as non-human phenomena and emphasizes the view that the social world is socially constructed and subjective'. With this approach, a researcher interacts with the research process so that meanings and understandings of the interrelationships in the situation are uncovered. Qualitative research deals largely with opinions and attitudes. Axiologically, the values of the researcher do play a part

in the whole research process (Patton, 1990). The researcher's bias makes it possible for different researchers to come up with different descriptions and interpretations of phenomena. In its conduct, it is unstructured and adaptive as the research proceeds. This approach makes extensive use of verbal information and according to Ary, Jacobs and Razavieh (1990) in order to understand perceptions the qualitative technique provides a detailed description, analysis and interpretation of phenomena. The inductive nature of this paradigm is such that the researcher creates a theory based on the research findings. Pertinent research methods for this paradigm include action research, case studies, ethnography and participatory inquiry.

The positivist paradigm assumes that the world is external and objective to the researcher. Veldsman (1992) explains that this paradigm has a quantitative approach that is formalized, explicitly controlled with a range that is more exactly defined. Neuman (2000) also agrees that the quantitative or empirical analytical research relates to data being expressed as numbers. With the researcher being independent of the research, the behaviour of the objects under study is explained on the basis of facts and observations of a quantitative nature. The values of the researcher do not interfere with the research process (Lincoln and Guba, 2000). This should then result in an unbiased interpretation. With freedom from context, the results should be reproducible. From the results derived from a particular sample, generalizations are made. The deductive nature of this approach is such that theories and models are developed ahead of the research undertaken. The relevant research methodologies for the positivist paradigm are cross-sectional studies, experimental studies, longitudinal studies and surveys.

The purpose of this study is to assess the factors that have an impact on the performance of the Cisco Academies in South Africa. This entails the establishment of the cause and effect between the dependent variable (academy performance) and the independent variables and the quantification of the extent to which these factors affect performance. Such tests are possible if the study is situated in the positivistic paradigm. It is important that external factors are controlled, bias eliminated and hypotheses tested and either rejected or accepted. Such requirements eliminate the use of a phenomenological research paradigm.

1.7.2 Sample

According to Webster (1985), a sample provides a statistical population whose properties are studied to obtain information about a whole. A population is a complete group of objects such as people or items which are used for measurement.

Sampling is the process or technique employed to select a representative part of a population for the purpose of determining some characteristics of the population (Coldwell and Herbst, 2004). The large sizes and inaccessibility of many populations normally drive the use of samples. Given these two issues, samples will give the researcher more economy, timeliness and precision.

The two major categories of sampling are probability and non-probability sampling. In probability sampling, every unit in the sampling frame has a known and equal chance of being selected. With adequate samples and a complete sampling frame, it is unbiased. Probability sampling techniques include: simple random sampling, systematic sampling, stratified sampling, cluster sampling and double sampling. On the other hand, non-probability sampling makes use of the expertise or judgment of the investigator. It would not be possible to assess errors or the extent of the sample's representativeness to the population under study. Examples of non-probability sampling methods are: convenience sampling, judgmental sampling, quota sampling and snowball sampling.

This research proposed to study the factors that affect Cisco Academies. Cisco Academies are hosted at institutions such as universities, high schools and Further Education and Training (FET) colleges. The major distinguishing feature among these institutions is the educational level of Cisco Academy students. The research therefore had to use a stratified sampling technique in order to have a truly representative sample. A simple random sample would then be taken from each one of these institutions. Such a technique is still a probability sampling technique that is preferable for the positivistic research paradigm which requires elimination of bias (Veal, 2005).

From a total of about 2500 Cisco Academy students in South Africa, the total sample size had to be 250 students. The flagship programme in the Cisco Academy is the Cisco Certified Network Associate (CCNA). This is made up of the courses CCNA 1, CCNA 2, CCNA 3 and CCNA 4. The students surveyed should have completed the CCNA 4 course. The criteria used to select the specific academies are as follows:

- The academy should have CCNA 4 graduates;
- The academy selected should help enhance the heterogeneity of the sample in terms of infrastructure, instructor quality, accessibility and diversity in language capabilities.

It would be ideal to have Schools and FET colleges participating in the study but these do not offer the CCNA programme. Respondents therefore had to be drawn from the following institutions which met the criteria outline above:

- Central University of Technology
- Nelson Mandela Metropolitan University
- Durban University of Technology
- Mangosuthu University of Technology
- Cape Peninsula University of Technology
- Walter Sisulu University
- University of Pretoria

1.7.3 Measuring Instruments

This research was located in the positivistic research paradigm and made use of a questionnaire as a measuring instrument. A questionnaire calls for a format that is straightforward and attractive (Wiersma, 2000). A set of appropriate and logically arranged questions constituted the questionnaire.

The following instruments were used in the study:

1.7.3.1 Motivation

The themes in motivation include: knowledge, will, skill, interest, goal, determination and enjoyment. Three items were taken from a scale developed by Eccles and Wigfield (2002). This uses a five-point Likert scale anchored as follows:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

The remaining items used the same five-point Likert scale anchored in the same way.

1.7.3.2 Instructor quality

The themes in instructor quality include: excellence, satisfaction and knowledge and clarity. The six items are all derived from the Participants Evaluation of Instructor and Program Quality (PEIPQ) scale developed in Australia over ten years (Marsh and Roche, 1997). A five-point Likert scale was employed and it was anchored as follows:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

1.7.3.3 Other instruments

For the remaining variables, namely supporting infrastructure, multi-culture needs, technology tools and accessibility, self-constructed items anchored on a five-point Likert scale were used. The themes in supporting infrastructure include: adequate,

sharing and working order. The themes in multi-culture needs include: sensitive, accommodation and harmony. The themes in technology tools include: collaboration, interaction and clarification. The themes in accessibility include: accessible, closeness and convenience.

The five-point Likert scale used was anchored as follows:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

1.7.3.4 Academy performance

The dependent variable was measured using the student final online and practical examination scores. While the scores are accessible from Cisco's Learning Management System, the students were asked to enter them on the questionnaire. The marks were anchored on a five-point scale as follows:

1. Below 60%
2. 60 -69%
3. 70 – 74%
4. 75 – 84%
5. 85 – 100%

The weakness of this variable is that, essentially, it makes use of only one variable. Another variable called Perceived Academy Performance was also used in parallel with the examination scores. The themes in this variable are: value, success and worthwhileness. This uses a five-point Likert scale anchored as follows:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree

4. Agree
5. Strongly agree

1.8 TERMINOLOGY

In the interest of clarity and understanding, the following terms and concepts are defined below.

1.8.1 Motivation

In their work, Sansone and Harackiewicz (2000) claim that motivation energizes and directs behaviour towards a particular goal. Bateman and Snell (1999) agree with the same definition but add that the same force also sustains one's efforts. For a learner, It is important to also note that will, which one may easily relate to this force, needs to be related to one's skill level to come up with a complete definition of motivation (Pintrich and De Groot, 1990). Skill without will, or will without skill will affect the perceived degree of motivation. In accordance with the above works this study used the definition of motivation as the force that drives and guides a learner towards high performance.

1.8.2 Academy performance

According to Gibson, Ivancevich and Donnelly (1994: 776), 'performance is the desired result of behavior'. In the Cisco Academy programme the desired outcomes of an academy include high student marks, success of students in the job market, success of students in starting their own business and impact of the academy on the disadvantaged communities. This study adapted the definition given by Gibson et al. (1994) and narrowed it to focus on high student marks. Academy performance is the overall ability of an academy to produce high student achievement as demonstrated in their examination marks.

1.8.3 Multi-culture needs

These are needs of learners which relate to their educational, cultural and ethnic backgrounds (Cronje, 2009). The multi-culture issues that are addressed are focused on those that may impede the learning process and include language barriers.

1.8.4 Instructor quality

Instructor quality revolves around aspects such as experience, subject matter knowledge, certification and educational qualifications. There are many more characteristics involved in teacher quality and, according to Balch (2011), instructor quality can be defined from the behavior exhibited by the instructor to yield increased student achievement. On this basis, the study used the definition of instructor quality as the ability of an instructor to teach in such a manner that there is a high student achievement.

1.8.5 Accessibility

This is the ease with which learners can access the Cisco Academy from their place of residence or employment. It is related to the distance that a learner travels, how easy it is to apply for a place at the academy and whether the learner has options in terms of which academy to consider.

1.8.6 Supporting infrastructure

For students to perform successfully, they need the institution to provide certain forms of infrastructure. They need classrooms with networked computers. These computers should be able to provide internet access for research and online examinations from Cisco. The laboratories also have to have networking equipment from Cisco which is used for practical exercises. Students would thus be asked questions to assess the adequacy of such infrastructure.

1.8.7 Technology tools

According to Dugger (2008: 4), educational technology is ‘the study of computers and the use of technological developments, such as computers, audio visual equipment, and media as tools to enhance and optimize the teaching and learning process and the environment in all school subjects’. Januszewski and Molenda (2008) also give a similar definition that encompasses study, practice and tools. The definition used in this study is that technology tools are “computers and software tools that are used to enhance and optimize the teaching and learning process”.

1.9 OUTLINE OF THE STUDY

This study is made up of five chapters. The contents of each of these chapters are as follows:

Chapter 1: Scope of the Study

This chapter serves an introductory purpose and also puts the study into context. This chapter gives the problem statement, research design objectives and also looks at the hypotheses, research methodology and provides a clarification of concepts and terms so that there is no ambiguity.

Chapter 2: The South African Information and Communication Technology (ICT) Skills Shortage

In this chapter, various research findings related to the South African ICT skills shortage are considered. Various theories and concepts related to academy performance as well as its determinants are examined in order to construct a theoretical model that embodies the relationships examined in the study. Directional hypotheses are formulated and related to the theoretical model.

Chapter 3: Research Methodology

This chapter explains the research methodology followed. The research paradigm, sample of the study and questionnaire design are discussed.

Chapter 4: Empirical Results

This chapter provides quantitative analyses of the results from questionnaires returned. Problems that may have been encountered in the distribution of questionnaires are also discussed.

Chapter 5: Descriptive Statistics

This chapter provides a discussion of the descriptive statistics based on the variables used in the study. Results are related to some of the information in Chapter 4.

Chapter 6: Discussions, Recommendations and Conclusions

This chapter provides a summary of the research findings, makes recommendations and draws conclusions. The recommendations and conclusions drawn are informed by the research results and the process followed.

CHAPTER 2

THE SOUTH AFRICAN INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS SHORTAGE

2.1 INTRODUCTION

The purpose of this chapter is to examine the literature related to the performance of students in the Cisco Academy programme. The overarching issue of the study is the “skills shortage” and the chapter begins by looking at the global skills shortage until it is narrowed down to South Africa. Literature related to the ICT skills shortage is then examined.

The chapter will also look at the variables related to academy performance and construct a hypothesized model that will govern the study.

2.2 GENERAL SKILLS SHORTAGE

According to the World Economic Forum report (WEF, 2010), the global human capital will rival, if not displace, the financial capital as the most important driver of economic growth. According to the same report, what seems to be the major issue is that filling jobs with the right skills is difficult. This underscores the need for concerted efforts in addressing the problem of skills. As far back as 1998, the McKinsey Company conducted a study and concluded that the most important corporate resource and the scarcest resource in the two decades that would follow would be talent (Fishman, 1998). Indeed this has been proven to be true as one of the present day buzzwords concerns the “war for talent”.

The Global competitiveness report on Africa notes that one of the major policy areas that are restricting Africa’s competitiveness is that of skills availability (WEF, 2011). According to Wegner (2008), technical and vocational skills development systems in Africa are being hindered by a shortage of qualified staff, obsolete equipment, wrongly adapted programmes and a lack of appreciation of the job market.

According to Bernestein (2010), authoritative studies on the South African economy invariably reveal that the skills shortage is a major constraint on the South African economy. For South Africa and many other countries as well, the understanding of what skills shortage means is important. In the work of Daniels (2007), it is noted that while economists always relate skills to productivity in the firm, the South African government literature ignores such a relationship and defines skills in both absolute and relative terms. At the heart of the meaning of the skills shortage issue is the idea that demand for certain skills exceeds supply. For the South African situation, a definition that takes cognizance of experience and qualifications leads to two types of skills:

- Scarce skills – This refers to ‘a scarcity of qualified or experienced people , currently or anticipated in the future, either (a) because such skilled people are unavailable or (b) because they are available but do not meet employment criteria’ (Daniels, 2007: 2).
- Critical skills – This term refers to specific skills within an occupation such as problem solving.

It is important to note that the concepts of scarce and critical skills both imply high skills. However for a developing economy like South Africa, low skills also need to be addressed (Kraak, 2005). This is particularly the case in labour-intensive forms of production or government projects aimed at stimulating employment of the masses.

According to Breier and Erasmus (2009), the National Scarce Skills list of 2006 specifies shortages amounting to more than 200 000 people. This list includes professional/occupational fields like management, social work, engineering, medicine, law, information and communications technology, schooling, city planning and artisan trades. Table 2.1 shows the skills shortage according to the Adcorp Employment Index (2011: 2).

TABLE 2.1 SKILLS SHORTAGE IN SOUTH AFRICA, 2011

<i>Occupation</i>	<i>Skills shortage (000s)*</i>
Manager	216.2
Professional	178.4
Technician	432.1
Clerk	86.6
Sales and service worker	104.3
Skilled agriculture	3.1
Craft and related trade	65.5
Plant and machine operator	72.0
Elementary worker	-967.6
Domestic worker	-247.4
<i>Total</i>	<i>-56.8</i>

Source: Adcorp Employment Index (2011: 2)

From Table 2.1, it can be seen that about 829 800 jobs were unfilled for high-skilled jobs. On the other hand, there is an oversupply of domestic and elementary workers.

2.3 ICT SKILLS SHORTAGE

ICT has undergone massive changes over the past decade. This is evident in applications such as mobile commerce, electronic commerce and social networking. That ICT is serving to provide new business opportunities and a source of competitive advantage is undeniable. In a nutshell, ICT is a catalyst for economic growth (GIT Report, 2009).

There has been extensive research on the international ICT skills shortage by governments, academics and professional bodies who all agree that this shortage is real (Calitz, 2010). According to Krakovsky (2010), the U.S Department of Labor's Bureau of Labor Statistics made an estimation of a growth of between 800 000 to 1.5 million computing jobs between 2010 and 2018, while Litecky, Prabhakar and

Arnett (2006) predicted an annual skills shortage growth rate of 10%. Countries such as Australia and some in Europe are likely to experience similar growth patterns and challenges.

The ICT skills shortage being experienced by South Africa is comparable to that in the global arena. While ITWeb (2009) gave a figure of 70 000 for the ICT skills shortage, Merkofer and Murphy (2010) projected that the ICT skills demand for 2009/2010 would exceed supply by 20%. It is glaringly apparent that ICT skills that are critical to business growth and success are in short supply. According to ITWeb (2010) and Kayle (2010) the lack of ICT skills is costing the economy dearly.

In their work, Alexander, Lotriet and Matthee (2009) claim that the skills required by South Africa range from low level, computer literacy skills needed by individual members of society to access technology based services, to high level technological skills needed by specialist ICT professionals. Kraak (2005) also argues that the ICT skills shortage is not confined to the high skills end only. On the other hand, ITWeb (2010) claims that the nature of the skills shortage is that the right skills are not available for the right job. In their work, Griesel and Parker (2009) also assert that regardless of one's career, ICT skills are needed by all employers. From all these works, one can see that the ICT skills shortage is broad and requires a multi-pronged approach.

2.4 RESPONSES TO ICT SKILLS SHORTAGES IN SOUTH AFRICA

Skills development in South Africa calls for concerted efforts from various stakeholders so that an enabling policy environment is established. The government of South Africa has not taken the problem lightly and there has been a flurry of activities in response to the skills problem.

2.4.1 Institutional and governmental interventions

The South African Qualifications Authority (SAQA) is the body that is responsible for registering educational standards and qualifications. SAQA stipulates that the learning outcomes of all South African qualifications should include critical cross-field

or generic skills to promote lifelong learning as well as discipline, domain-specific or specialized knowledge, skills and reflexivity (South African Gazette, 2007). According to the South African Gazette (2009), the National Qualifications Framework (NQF) is a comprehensive system for the classification, registration, publication and articulation of quality-assured national qualifications. The framework applies to educational institutions, skills development providers and professional designations.

In order to regulate all the higher education qualifications, programmes and national curricula, the South African government introduced the Higher Education Qualifications Framework (South African Gazette, 2007). The framework gives the basis for integrating all higher education qualifications into the National Qualifications Framework (NQF) and its structures for standards generation and quality assurance. Education institutions will have room to design educational offerings to realize their different visions, missions and plans and to meet the varying needs of the communities they serve.

With the SAQA, NQF and HEQF providing the bedrock for tackling the skills challenge, specific interventions from the government can be examined.

2.4.1.1 e-skills Institute (eSI)

The South African government, through the Department of Communications, established the e-Skills Institute to address issues to do with the e-skills shortage. According to the National e-skills Plan of Action (NeSPA, 2010), this institute primarily focuses on engaging a wide base of stakeholders in order to develop a national policy on e-Skills. According to the World Summit on the Information Society (WSIS, 2005), e-skills are essential in empowering individuals so that they can participate fully as citizens of the Information Society, and take advantage of all the opportunities before them. These opportunities are for employment and wealth creation, for taking advantage of innovative education and learning strategies, and for using new life-enhancing services, such as interaction with public authorities. This is a broad term but it is important to note that the capacities that it refers to have to do with knowledge, skills and competencies.

According to the National e-skills Plan of Action NeSPA (2010), in order to address the dire lack of e-skills, the e-Skills institute needs to develop skills in relation to the following goals:

- Employment readiness: targeting the improvement of the employment figures for graduates from tertiary institutions and reduced time from employment to productivity.
- Effective e-governance and service delivery: aimed at effective use of ICT for service delivery that is developmental, agile, competent, and citizen-centric
- Business development: aimed at providing skills needed within corporates, small, medium businesses and micro-enterprises (SMMEs) to exploit opportunities provided by ICT.
- Socio-economic development : aimed at an increased national productivity and competitiveness (particularly the increase of the uptake of e-government services)
- Research and development: aimed at informing policy and curriculum development, defining applications and evaluating progress.

The coordination of the e-skills development is done at four societal levels, namely:

- Academia: Higher Education Institutes and FET Colleges
- Corporate , Business and Industry
- National, Provincial and Local Government
- Civil Society, Labour and Non-governmental Organizations

The e-skills Institute was responsible for organizing the e-Skills summit held in Cape Town in July 2010. The summit gave rise to the establishment of knowledge production hubs in the various provinces.

2.4.1.2 The National e-skills Plan of Action (NeSPA)

The National e-skills Plan of Action is a culmination of a two year-long consultation process that involved a number of stakeholders and is a direct offshoot of the e-skills summit held in Cape Town in July 2010 (NeSPA, 2010). It is driven by the

Department of Communication through the e-Skills Institute. According to the National e-skills Plan of Action NeSPA (2010), the summit yielded a report that contains five action items for implementation and these are:

- The establishment of a high-level consultative process across Government, Education and Civil Society to refine and develop the NeSPA document, in order to inform the national budget process and engage with the Human Resource Development South African (HRDSA) Council;
- The establishment of nine collaborative e-skills Knowledge Production hubs in association with higher education institutions in each province in South Africa;
- The establishment of a research network for e-skills (ResNeS) across education, government, business and civil society, in order to develop research, evaluation, policy and international benchmarking;
- Development of a proposal to examine a national transfer pricing model to provide a level of free cell phone and Internet access; and
- Assistance in the development of a high-level advisory, implementation and evaluation process for all business sectors in South Africa.

At the very heart of these recommendations is the creation of a national system of physical network hubs located at higher education institutions.

2.4.1.3 Meraka e-skills Institute

The Meraka Institute is an operating unit of the Council for Scientific and Industrial Research (CSIR) and focuses on Information and Communication Technology. According to Meraka (2012), the institute aims to enhance the quality of life and also improve the economic competitiveness of South Africa by:

- Researching and developing new technology that enables ICT access, inclusion and use.;
- Researching, developing and transferring innovative ICT products, processes and services into the market ;
- Researching, developing, building and operating world-class cyber infrastructure; and

- Contributing skills and outcomes that are changing the profile of our ICT landscape.

The Meraka Institute endeavours to avoid duplication of any ICT skills programmes that are already underway, since its main goal is to leverage existing ICT education and training expertise, infrastructure and courses. It works in conjunction with tertiary institutions and private sector organizations in areas that include curriculum planning, course development and course planning.

2.4.1.4 Joint Initiative on Priority Skills Acquisition

The Joint Initiative on Priority Skills Acquisition (JiPSa) was established by the South African Cabinet in March 2006 to support the Accelerated and Shared Growth Initiative for South Africa (Jipsa, 2010). The Accelerated and Shared Growth Initiative for South Africa has the overall objective of reducing unemployment and poverty by half by 2014. The aims of the original JipSA were:

- Facilitating, strengthening and coordinating activities to address skills shortages;
- Accelerating the provision of priority skills to meet ASGISA's objectives;
- Mobilizing senior leadership in business, government, organized labour, and institutions concerned with education and training and science and technology to address national priorities in a more coordinated and targeted way;
- Identifying blockages and obstacles within the system of education and training that stand in the way; and
- Promoting greater relevance and responsiveness in the education and training system and strengthening the employability of graduates.

As part of its mission, Jipsa has to develop skills in teacher training for mathematics, science, information and communications technology and language skills. JipSA has since been incorporated in the project aimed at the Human Resource Development of South Africa (HRD-SA).

2.4.1.5 Higher Education South Africa

The institution known as Higher Education South Africa (HESA) represents all the 23 public universities and Universities of Technology. It was formed in 2005, merging the two statutory representative organizations for Universities and Technikons (Universities of Technology). Its focus is on the strengthening of research and innovation in higher education.

According to HESA (2012), one of its information services called NiSHE (National Information Service for Higher Education) aimed to provide information and guidance on the role and requirements of higher education to learners at schools, teachers, parents and FET colleges. This project has seen a drastic increase in applications to universities since 2003 (HESA, 2012).

2.4.1.6 Sectorial Education Training Authorities

There are currently approximately 23 Sectorial Education Training Authorities (SETAs) in South Africa, each tasked with the function of overseeing education, training and development for a particular economic sector, e.g. Textile Sector, Footwear and Leather Sector and the Banking Sector (SETA, 2012). The objective of establishing SETAs is to improve the level of skills available to the various economic sectors. To support this objective education and training in these sectors are provided to employees and the unemployed in line with the National Skills Development Strategy.

The Information and Communications Technology Sector Education and Training Authority (ictSETA) aims to develop South Africa into a knowledge-based economy in line with global trends. The ictSETA and all other SETAs are involved in establishing learnerships, development of training materials and providing their sectors access to money from the National Skills Fund.

2.4.2 Training models

The ICT skills that are needed in South Africa range from the very basic ones to the fairly advanced skills. The training landscape has been structured to deal with the different levels of skills demanded and this section looks at the various training institutions and models that are available.

2.4.2.1 South African Universities

Universities generally provide high level skills that are necessary to handle advanced technologies and demands of the working world. A major reconfiguration of the higher education system commenced in 2004 (CHE, 2010) and this saw the existing 36 institutions reduced to 23. The current system can be characterized as follows:

- 11 'traditional' universities that offer Bachelor degrees and have strong research capacity and fairly high proportions of postgraduate students.
- 6 universities of technology which are vocationally oriented institutions that award higher certificates, diplomas and degrees in technology. These were created from merged and unmerged technikons.
- 6 comprehensive universities created from the merger of technikons and traditional universities. These offer both Bachelor and technology qualifications and also conduct research and postgraduate study.

This radical restructuring of the higher educational system was expected to engender a variegated system where each institution would develop niche areas of expertise. Traditional universities continue to offer Bachelor of Computer Science degrees while the universities of technology and comprehensive universities offer the more vocationally oriented Bachelor of Technology degrees in ICT support services, communication networks and information systems.

2.4.2.2 South African FET Colleges

The Further Education Training (FET) colleges in their current form were constituted in 2002 and this resulted from the merger of former technical colleges, training

centres and colleges of education (Fisher, Jaff, Powell and Hall, 2003). According to McGrath (2004), the transformed FET colleges have the following attributes:

- large, multi-site institutions;
- increased autonomy;
- a mixture of specialization and multi-purpose institutions;
- a new quality assurance framework;
- an increased focus on open and distance learning;
- a greater focus on access for learners with special needs;
- better articulation and collaboration with higher education;
- a commitment to improved student support services; and
- a stress on partnerships with government and the private sector.

FET colleges provide a bridging interface between higher education and general education with the working world and endeavour to deliver intermediate-to-high skills. FET colleges can assist in the advancement of export-led growth strategies since they provide skills needed by organizations of such an orientation (Altman and Mayer, 2003). With the introduction of the Skills Development Levy as provided for in the Skills Development Act, these colleges were also expected to assist SETAs in the delivery of learnerships by augmenting the role of private training service providers and helping equip trainees for self-employment (McGrath, 2004).

On the ICT front, the FET colleges provide end-user training in computer packages, particularly the International Computer Driver Licence (ICDL) which is a certification programme in broad ICT skills. They also offer National Certificate programmes in Information Technology up to National Qualification Framework (NQF) level four. These programmes have a significant practical component.

Indeed, if FET colleges deliver according to the intent of the 2002 transformation, they can go a long way in alleviating the ICT skills shortage and boosting the economy.

2.4.3 Successes and failures of government interventions and educational institutions

The various government and institutional interventions and higher education reconfigurations have given birth to a new landscape as far as the skills shortage battle is concerned. Both successes and failures can be seen.

TABLE 2.2: MATRIC AND TERTIARY AGE GROUP BY COHORT 1995-2003

	All working-age South Africans		Working-age Africans	
Proportion, with	1995	2003	1995	2003
All 16 - 65 years				
Matric	17.88 (0.033)	21.24 (0.003)	13.66 (0.003)	17.42 (0.003)
Tertiary education	8.34 (0.028)	9.3 (0.003)	5.57 (0.003)	5.60 (0.003)
Age cohorts				
16 - 20 years				
Matric	12.81 (0.004)	11.35 (0.005)	9.36 (0.004)	8.16 (0.004)
Tertiary education	1.38 (0.002)	0.57 (0.001)	1.06 (0.002)	0.38 (0.0001)
21 - 25 years				
Matric	29.54 (0.007)	33.78 (0.007)	25.61 (0.007)	30.45 (0.008)
Tertiary education	8.04 (0.004)	6.49 (0.004)	5.79 (0.004)	4.78 (0.003)
26 - 35 years				
Matric	22.78 (0.005)	30.97 (0.006)	19.26 (0.006)	28.29 (0.006)
Tertiary education	12.13 (0.005)	13.43 (0.006)	9.45 (0.005)	9.29 (0.005)
36 - 45 years				
Matric	13.65 (0.005)	17.53 (0.005)	8.48 (0.004)	12.91 (0.005)
Tertiary education	10.71 (0.005)	13.06 (0.006)	6.72 (0.005)	7.72 (0.005)
46 - 55 years				
Matric	10.83 (0.005)	11.31 (0.006)	3.71 (0.003)	5.08 (0.004)
Tertiary education	8.55 (0.005)	10.85 (0.005)	3.64 (0.003)	5.74 (0.004)
56 - 65 years				
Matric	8.32 (0.005)	10.04 (0.007)	1.87 (0.002)	2.70 (0.003)
Tertiary education	6.19 (0.005)	8.81 (0.006)	2.51 (0.003)	2.42 (0.003)

Source: Dias and Posel (2007)

Table 2.2 is a summary of matric-level educational attainment for various age groups. The Table shows increasing educational attainment especially among the

young age groups. One can argue that the government initiatives have been effective in this respect. In their work McGrath and Akoojee (2007) argue that there is evidence of growth in learner numbers in FET colleges and also diversity in curriculum delivered and diversity of age groups.

The JipSA initiative's impact has been a subject of debate. According to JipSA (2008), before the initiative was phased out, the following were its successes:

- It created a platform to discuss national skills issues and draw the necessary attention;
- Created a culture of national commitment from various stakeholders; and
- Generated increased funding towards priority areas.

However it is also acknowledged that JipSA was a temporary measure (JipSA, 2008). The current skills shortages that are being experienced give an idea of its extent of success or lack thereof. The success of JipSA can, therefore, at best be seen in its ability to place the skills problem on the national agenda without necessarily reducing the skills shortage.

As has already been noted from the works of Merkofer and Murphy (2010), ICT skills demand outstripped supply by 20% and the reports of Kayle (2010) and Kraak (2005) also point to acute shortages in ICT. This has been partly attributed to poor preparation before students enter university education. Breier and Erasmus (2009) assert that the number of matriculants who can access university programmes such as engineering or medicine are still few. The authors further argue that FET colleges which replaced apprenticeship systems have not been able to clear the training backlog but have yielded trainees with inappropriate skills and experience. This argument is also sustained by the findings of Griesel and Parker (2009) who claim that higher education graduates have skills and competencies which are not synchronized with the demands and expectations of the employers. FET colleges have often resorted to offering end-user ICT training rather than the medium skills that are being demanded. Infrastructural challenges and poor remuneration have led to little or no training in fields like computer programming and computer networking.

While universities may be better equipped, their focus is more on theory rather than practical skills and this has led to reduced impact on the ICT skills that are needed.

It can be argued that since universities which should produce high end skills are being hampered by the feeder system and the FET colleges that should deliver intermediate skills cannot cope, the efforts that have so far been made have been positive but limited in impact.

The government efforts that have been made were well-intentioned. However, other interventions to complement these efforts and those of other stakeholders are necessary. This is particularly the case for the ICT sector which is a specialised field.

2.4.4 The Cisco Academy Programme

This section looks at the Cisco Academy programme which can complement the efforts the government is making.

2.4.4.1 Cisco Academy Programme overview

Cisco Systems is an American multinational corporation that designs, manufactures and sells networking equipment. The Networking Academy is Cisco's largest corporate social responsibility initiative. It was started in 1997 and has since established more than 10 000 academies in over 165 countries (Cisco Networking Academy, 2012). The thrust of the initiative is to pass on computer and networking skills as well as share Cisco's intellectual capital with people all around the world. In the Networking Academy Cisco uses a public-private partnership model to deliver the programme (Cisco Networking Academy, 2012). It partners with educational institutions, non-profit and non-governmental organizations, governments, and community centres to run the programme whose main objectives are to:

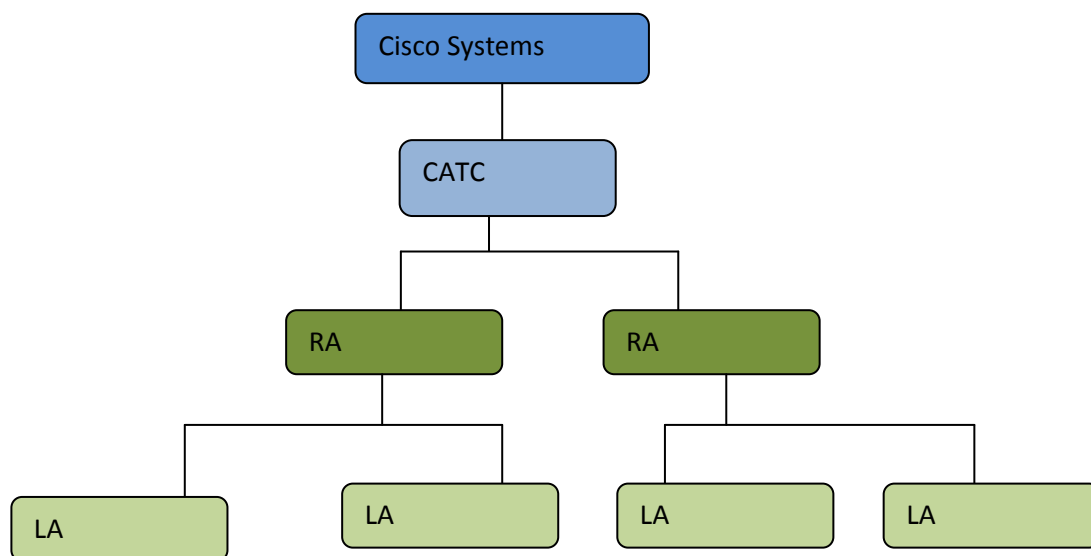
- Improve disadvantaged individuals' marketability in the IT and related industries by imparting technical and life skills, and relevant practical experience.
- Fill existing and future IT skills gaps.

- Benefit the local and national economy.
- Be of benefit to disadvantaged communities, regardless of location.
- Help to close the digital divide that exists between developed and developing economies.

The Networking Academy has a structure tailored to simplify administration of the programme. It has institutions that operate at three levels, namely:

- Cisco Academy Training Centre (CATC)
- Regional Academy(RA)
- Local Academy (LA)

FIGURE 2.1: THE CISCO ACADEMY HIERARCHICAL SYSTEM



Source: Own construction

An institution with a Local Academy status primarily recruits ordinary students for training on Cisco curricula and in accordance with the Cisco Quality Assurance Programme. Of the three types of institutions, Local Academies are in the majority. Regional Academies are responsible for recruiting Local Academies, training Local Academy instructors and individual students and ensuring that the Local Academies are operating according to the Cisco Quality Assurance Programme. Local Academies pay a small annual support fee (of around US\$800) to the Regional Academies. The Regional Academies normally administer Local Academies within

the country where they are located. Regional Academies pay support fees to the Cisco Academy Training Centres.

The topmost institution in the hierarchy of the Networking Academy structure is called the Cisco Academy Training Centre (CATC). This institution trains instructors of Regional Academies, organizes events to inform and empower Regional and Local Academies, and ensures that the Regional Academies meet Cisco's Quality expectations. The major components of quality are:

- Students – performance in the curricula and effect on employment prospects
- Instructors – training and certification
- Equipment – adequacy (student to equipment ratio and suitability for curricula changes)

Monitoring is made easy by the fact that institutions and classes exist in a Learning Management System called the Cisco Networking Academy Management System. The CATC's scope of responsibilities is regional rather than at country level. For Sub-Saharan Africa, there used to be only one CATC – the Nelson Mandela Metropolitan University in South Africa. A second CATC was appointed for East Africa in 2009. In addition Cisco provides some funding to the CATC to handle about 30% of its operational expenses.

2.4.4.2 The Cisco approach to training

In the Networking Academy, Cisco develops and freely gives curricula to the Academies. The curricula are well-researched, relevant, pedagogically rich and constantly updated in step with constant changes in information technology. The major emphasis of the programme is networking skills and to this end, Cisco allows academies to purchase equipment at a discount of 70%. Content is delivered in multiple languages through a blended learning model that combines classroom instruction with online curricula, interactive tools, hands-on activities, and online assessments that provide immediate feedback to the learner. The courses that are offered include:

Basic course:

- IT Essentials I: PC Hardware & Software

Intermediate Courses:

- Cisco Certified Network Associate
- Health Information Network

Advanced Courses:

- Cisco Certified Network Professional
- Cisco Certified Network Associate Security

While the courses utilize Cisco equipment and technologies, students who emerge from the training are also equipped to handle other vendors' equipment and technologies.

The basic course targets high school graduates who need to embark on a career in information technology. The intermediate courses target college graduates who are pursuing a career in computer networking. The intermediate and advanced courses are popular amongst employees of Internet Service Providers, Telecommunications (fixed-line and wireless) operators, Financial Services organizations and any other enterprise organizations with sizable networking infrastructures. Because of the rich theoretical content as well as practical exercise embedded in the curricula, many colleges and universities have integrated the Cisco curricula in undergraduate and master's degree programmes.

2.4.4.3 The Cisco Academy Programme at NMMU

In 1999, the Faculty of Computer Studies (at the then PE Technikon) approached the global Information Communication and Technology (ICT) giant, Cisco Systems, to form a training partnership. In 2000, the programme was implemented at the Technikon's Computer Studies Faculty.

The Faculty initially operated as a local and later a regional Cisco Academy. The programme was so successful that in 2006, Cisco Systems appointed the (then) NMMU regional Cisco Academy as a Cisco Academy Training Centre (CATC) responsible for the Sub-Saharan Africa region. The Sub-Saharan Africa Cisco

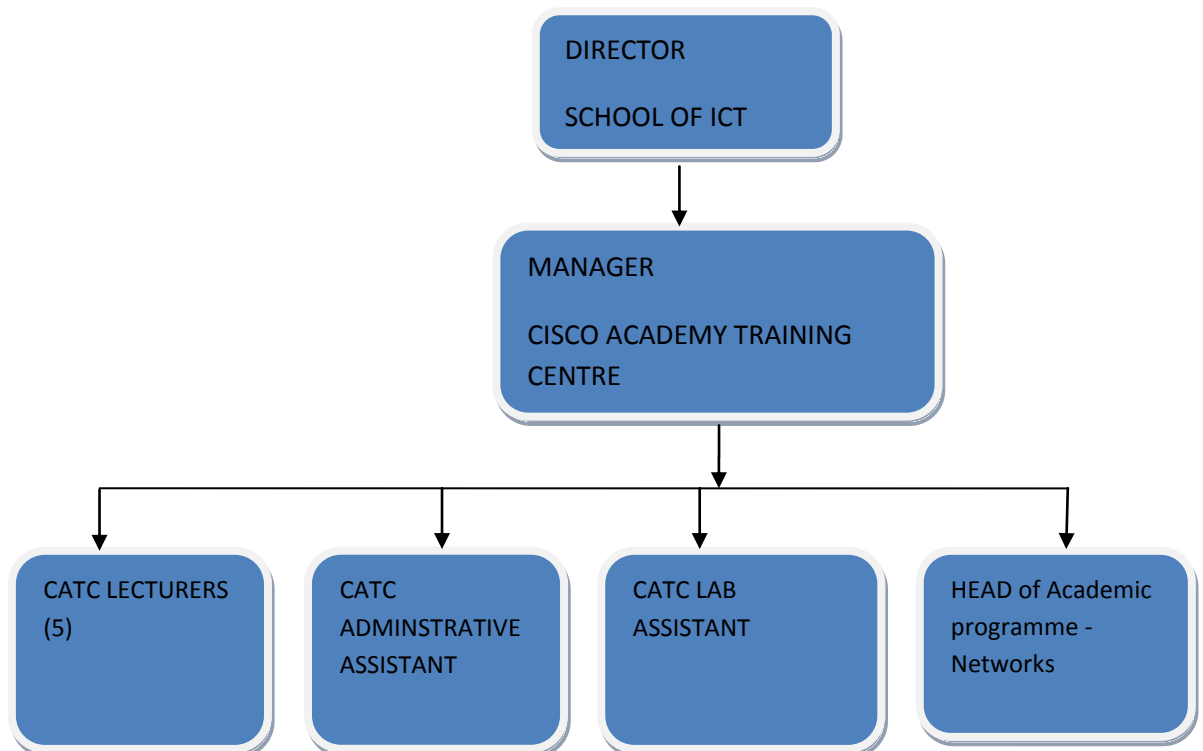
Academy Training Centre (SSA CATC) now operates as a unit of the School of ICT in the Faculty of Engineering, the Built Environment and Information Technology. The role of the SSA CATC is to manage and support Cisco programmes and Academies.

In 2008, the SSA CATC took on support for the CCNP (Cisco Certified Networking Professional) programme for the Middle East region as well and became the only CCNP CATC in the Africa and Middle East region. It is currently directly and indirectly involved with nearly 300 educational institutions running Cisco Academies in Africa and the Middle East. Altogether 11% of the Cisco international programme student population falls within the ambit of the SSA CATC at the NMMU.

Several of the Academy Programme courses are integrated into the diploma and degree programmes offered by the School of ICT.

The organogram depicting the placement of the CATC entity in the School of ICT is shown in Figure 2.2.

FIGURE 2.2: THE CATC ORGANOGRAM



Source: Own construction

2.4.4.4 Improving Cisco Academy performance

The Cisco Academy programme in South Africa has performed rather erratically. There have been institutions that have done very well and that even compete internationally. On the other hand, some academies have failed to produce students with reasonable scores and have had to be closed. Cisco, its partners such as the United Nations Development Programme (UNDP), government agencies and the academies themselves make investments into the programme and it is imperative that the programme delivers according to expectations.

According to Gibson, Ivancevich and Donnely (1994: 776), student performance can be defined as 'the desired result of behaviour'. Picciano (2002) states that performance of students is broad and can be measured as successful course completion, added knowledge or skill building. These two authors have definitions that encompass the perception of performance of students in the Cisco Academy programme. In the Cisco Academy programme the desired outcomes of an academy include high student marks, success of students in the job market, success of students in starting their own business and impact of the academy on the disadvantaged communities. For the purposes of this study the definitions given of performance will be narrowed to focus on high student marks. Academy performance in this study is defined as the overall ability of an academy to produce high student achievement as demonstrated in their examination marks. The academy performance will be the dependent variable. Selected determinants of academy performance will be investigated, namely instructor quality, technology tools, supporting infrastructure, multi-culture need, motivation and accessibility.

Instructor quality

According to Balch (2011), instructor quality can be defined from the behaviour exhibited by the instructor to yield increased student achievement. In their work, Bedard and Kuhn (2008) used student ratings of their satisfaction with the instructor to measure instructor quality. It can be seen that instructor quality indeed comes from a behaviour that is experienced by students. In this study, we are interested in

student outcomes and instructor quality will be understood as the ability of an instructor to teach in such a manner that there is a high student achievement.

The Cisco Academy course material is standard and accessible online. Tests and continuous assessments are also delivered online except for the practical examination. The practical examination is still designed by Cisco Systems. While the instructors largely use standard tools, measurement of instructor quality for the South African context is still important owing to the lack of pertinent instructor quality data. In addition, the Cisco Academy programme targets disadvantaged communities and in such areas there could be human capacity issues.

Technology tools

The general use of computers in business has increased and the educational sector has not been an exception. A lot of research work has gone into the investigation of the impact of educational technology on student performances.

According to Dugger (2008: 4), educational technology is 'the study of computers and the use of technological developments, such as computers, audio visual equipment, and media as tools to enhance and optimize the teaching and learning process and the environment in all school subjects'. Januszewski and Molenda (2008) also give a similar definition that encompasses study, practice and tools. For this study, we are interested in the tools aspect of educational technology. The definition used in this study is that technology tools are 'computers and software tools that are used to enhance and optimize the teaching and learning process'.

The Cisco computer networking curricula make use of multi-media tools. Video clips, simulators and flash media objects are employed in an endeavour to enhance teaching and ultimately the student performance. During the learning process students also make use of resources on the internet.

From the works of Ross and Bruce (2009), there is some evidence of the improvement of student achievement when technology tools are used to teach mathematics. On the other hand, Youssef and Dahmani (2008) examined works

which both support and disagree with the argument that technology impacts on student achievement. With Cisco's heavy investment in technology tools, it would be important to establish how this impacts student performance.

Supporting infrastructure

Ng'ambi (2006) argues that infrastructure development and human capacity development are critical to the success of the use of ICT in development. Ngwenyama et al. (2006) also argue that an investment in ICT infrastructure has a positive correlation with the level of economic development. One of the major problems that developing countries face is infrastructural development. The Cisco Academy programme targets disadvantaged communities and in such areas there could be infrastructural issues. Cisco Academy studies have often focused on the developed countries and it is important that the study on the South African situation validates the infrastructure problem as it relates to the Cisco programme delivery. In her work, Kiewiets (2005) asserts that the performance of FET colleges is affected by the physical infrastructure and facilities available at these institutions. Similar infrastructural needs are required for the Cisco Academies.

For students to perform successfully, they need the institution to provide a relevant and adequate supporting infrastructure. They need classrooms with networked computers. These computers should be able to provide internet access for research and online examinations from Cisco. The laboratories also have to have networking equipment from Cisco which is used for practical exercises.

Multi-culture needs

According to Cronje (2009), multi-culture needs are those needs of learners which relate to their educational, cultural and ethnic backgrounds. According to Meier and Hartell (2009), the rising cultural diversity in educational institutions necessitates that teachers teach and manage learners with cultures, languages and backgrounds that are unknown to them. If such a situation is not handled properly, it can lead not only to poor performance but even tension and prejudices. South Africa is one of the countries in Africa where cultural diversity is quite pronounced and it would be

important to establish how the Cisco Academy programme is being affected by such an issue.

The multi-culture issues that are addressed will focus on those that may impede the learning process and this will revolve around language barriers.

Motivation

In their work, Sansone and Harackiewicz (2000) claim that motivation energizes and directs behaviour towards a particular goal. Bateman and Snell (1999) agree with the same contention, but add that the same force also sustains one's efforts. Ryan and Deci (2000) add that motivation concerns the intention with which we do something in the first place. For a learner, It is important to note also that will, which one may easily relate to this force, needs to be related to one's skill level to come up with a complete definition of motivation (Pintrich and De Groot, 1990). Skill without will, or will without skill will affect the perceived degree of motivation. In view of these works, this study will define motivation as the force that drives and guides a learner towards high performance.

Students in the Cisco Academy hail from different backgrounds in terms of their education and skills levels. It would be important to establish how motivation affects student performance.

Accessibility

One of the current strategic questions in the Cisco Academy programme is whether to continue to grow the programme or consolidate what has already been achieved. In some countries, there are enough academies to serve their communities while in some the number of academies still needs to be increased so that students can easily enrol and also access their training institutions easily.

Accessibility will be defined as the ease with which learners can access the Cisco Academy from their place of residence or employment. It is related to the distance that a learner travels, how easy it is to apply for a place at the academy and whether

the learner has options in terms of which academy to consider. This variable is expected to yield information necessary to shape growth strategies for the Cisco Academy programme in South Africa.

2.5 THE HYPOTHESIZED MODEL TO IMPROVE THE CISCO ACADEMY PERFORMANCE IN SOUTH AFRICA

Against the background of selected determinants reviewed above, the following hypotheses were formulated:

H1: Supporting infrastructure exerts a positive influence on the performance of students in the Cisco Academies

H2: Instructor quality exerts a positive influence on the performance of students in the Cisco Academies

H3: Multi-culture needs exert a positive influence on the performance of students in the Cisco Academies

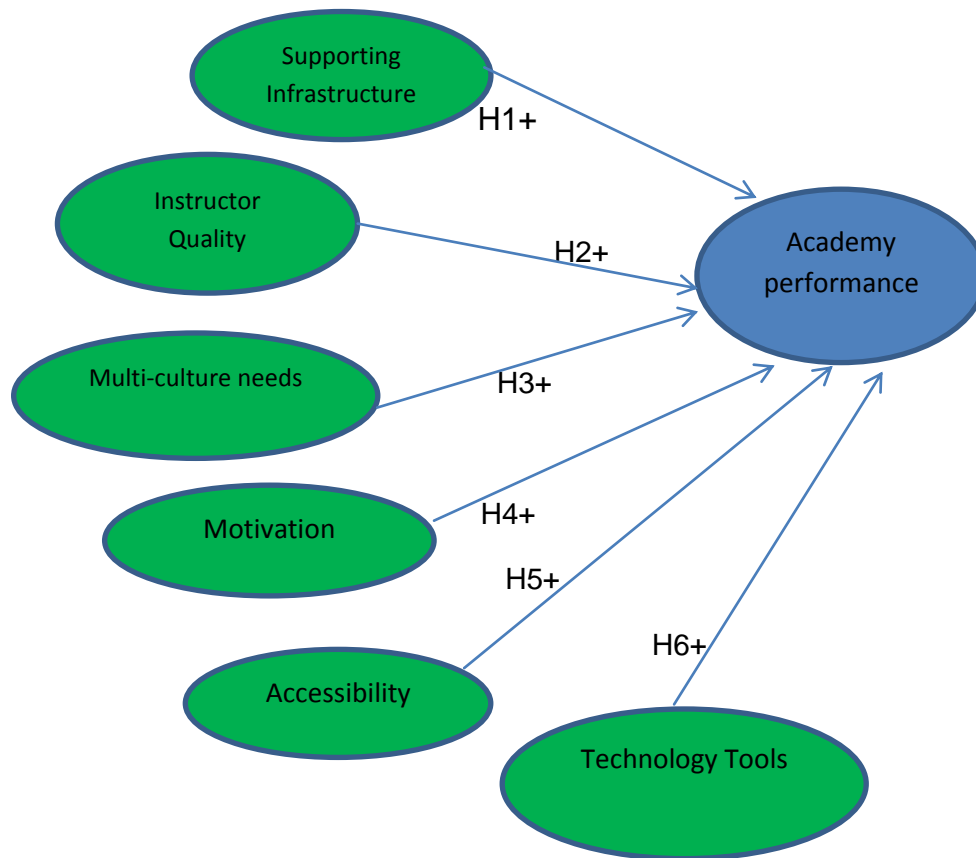
H4: Motivation exerts a positive influence on the performance of students in the Cisco Academies

H5: Accessibility of the institution exerts a positive influence on the performance of students in the Cisco Academies

H6: Use of Technology tools exerts a positive influence on the performance of students in the Cisco Academies

The conceptual model and directional hypotheses are shown in Figure 2.3.

FIGURE 2.3: THE CONCEPTUAL MODEL WITH DIRECTIONAL HYPOTHESES



The present study suggests that by improving the above-mentioned selected independent variables, the dependent variable (academy performance) will be improved.

2.6 SUMMARY

In South Africa, there has been a multi-pronged approach to the ICT skills shortage. The government has come up with interventions such as JiPSA, e-Skills institute, National e-Skills Plan of Action (NeSPA) and the Meraka e-Skills institute. As has been shown in this chapter, these interventions have had limited success in curtailing the skills shortage. Universities of technology, comprehensive universities, traditional universities and FET colleges have all been paying attention to the ICT skills shortage. As has been shown in this chapter, there still exist gaps as evident in the deficiencies in the feeder systems to universities and colleges and the lack of appropriateness and adequacy of the skills being produced by these institutions.

This chapter has shown that the current ICT skills landscape calls for more focused interventions to complement the existing efforts. The Cisco Academy offers a different approach which targets consistency in training delivery and use of “real” equipment in training. The Cisco Academy programme could play a significant role in addressing the acute skills shortage being experienced.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter deals with the research methodology which includes the research paradigm, strategies, population, sample and measuring instruments. It is important that appropriate research methods are employed so that the research undertaken is credible.

3.2 RESEARCH PARADIGM

Research methodology refers to the study of research methods employed in collecting and analysing data. It can also be defined as ‘a way to systematically solve the research problem’ (Kothari, 2006: 8). It is concerned with: why, what, from where, when, how to collect data and how to analyse it. There are two major research paradigms, namely the positivist, systematic or scientific approach and the qualitative, ethnographic or ecological approach (Kumar, 2011). The qualitative research paradigm is also called the phenomenological research paradigm (Veal, 2005). The two paradigms will be examined.

3.2.1 Phenomenological paradigm

With the phenomenological research paradigm, the qualitative researchers consider that reality only exists in the eyes and minds of the beholders (Locke, Silverman and Spirduso, 2010). The view is that the world is socially constructed and subjective. Owing to the presence of the researcher’s bias, reality is constructed differently by different individuals. This paradigm lends itself to effective use where it is necessary to find out people’s actions, motivations and assumptions.

The phenomenological research paradigm involves a qualitative process that is inductive and results in mutual shaping of factors. After the researcher has described the respondents’ experience, the researcher will then create a theory using the

assumptions inferred from these research findings (Groenewald, 2004). In other words, the general is inferred from the particular.

In the phenomenological paradigm, there are many types of research methodologies namely: action research, case studies, ethnography, feminist, grounded theory, hermeneutics and participatory inquiry. The ways of collecting data include interviews, documents, observation, archival records and physical artefacts.

3.2.2 Positivistic paradigm

In their definition of quantitative research, Mouton and Marais (1992) state that it is more highly formalized as well as more explicitly controlled, with a range that is more exactly defined and is close to the physical sciences. Neuman (2000) also agrees and adds that quantitative or empirical analytical research relates to data being expressed as numbers. These definitions show an inclination towards the positivistic paradigm.

The axiological assumption about the positivistic paradigm is that it is value-free and unbiased. With the researcher being independent of the research, the behaviour of the objects under study is explained on the basis of facts and observations of a quantitative nature. The values of the researcher do not interfere with the research process (Lincoln and Guba, 2000). This then leads to an unbiased interpretation.

Having made precise measurements, hypotheses are tested and statistical analyses performed. A quantitative research project tests the most important causal links to be found in the specific research domain. This relationship between variables is usually expressed as a hypothesis, and hypotheses are tested to answer the research question or to find empirical support for a theory (Neuman, 2000).

3.2.3 Differences between Quantitative and Qualitative research

The differences between quantitative and qualitative research can be pictured by placing them on a continuum. According to Jackson (1995), all types of research can

be placed between the extremes of pure quantitative and pure qualitative. Table 3.1 summarizes the differences between the two methods.

TABLE 3.1 DIFFERENCES BETWEEN QUALITATIVE AND QUANTITATIVE RESEARCH

Quantitative research	Qualitative research
Tests hypothesis that researcher begins with. Hypotheses are formulated beforehand and stated explicitly.	Captures and discovers meaning once the researcher becomes immersed in data.
Concepts are in the form of distinct variables. Concepts have an ambiguous meaning.	Concepts are in the form of themes, motifs, generalizations and taxonomies. Concepts can be interpreted in a number of ways.
Measures are systematically created before data collection is standardized. The researcher remains largely aloof.	Measures are created in an ad hoc manner and are often specific to the individual or researcher. The researcher is involved with the events/phenomena.
Data are in the form of numbers arising from precise measurement.	Data are in the form of words from documents, observations and transcripts.
Theory is largely causal and is deductive.	Theory can be causal or non-causal and is often inductive.
Procedures are standard and replication is assumed.	Research procedures are particular and replication is very rare.
Analysis proceeds by using statistics, tables or charts and discussing how what they show relates to hypotheses.	Analysis proceeds by extracting themes or generalizations from evidence and organizing data to present a coherent, consistent picture.

Source: Neuman (2000); Mouton and Marais (1992)

3.3 DATA VALIDITY AND RELIABILITY

The integrity of a research project is based on the validity and reliability of the research work undertaken. The concept of validity and reliability relating to measuring instruments will be examined below.

3.3.1 Validity

Research errors, faulty research procedures, poor samples or misleading measurement can undermine validity. Validity is the ability of an instrument to measure what it is intended to measure (Kumar, 2011). According to Uys and Basson (1991), validity can be defined as the degree to which the researcher has measured what he has set out to measure. While in the positivistic paradigm the interest is in determining whether the measuring instrument measures what it is supposed to measure, the phenomenological approach endeavours to establish if the researcher gained full access to the knowledge and meanings of respondents.

Validity can be looked at in two ways, namely external validity and internal validity. External validity refers to data's ability to be generalised across persons, settings and times. On the other hand, internal validity refers to the ability of the instrument to measure what it is purported to measure. There are different types of internal validity which are:

- Content validity – This is the degree to which the content of the items adequately represents the universe of all relevant variables under study. The methods of evaluation could be judgmental or panel evaluation.
- Criterion-related validity – This can be either predictive or concurrent validity. Predictive validity is judged by the degree to which the instrument can forecast an outcome. Concurrent validity is the ability to reflect the present status of the criterion.
- Construct validity – This is determined by judging the contribution of each construct to the total variance observed in a phenomenon.

3.3.2 Reliability

With reliability, one is interested in whether an instrument can produce findings consistently or in a repeatable manner (Kumar, 2011). In quantitative research, a reliable research instrument consistently produces the same results on different occasions. In qualitative research, a reliable research instrument means that similar observations can be made by different researchers on different occasions. One can sum up reliability as the degree to which the scale is free of random or unstable error, in other words, dependable, consistent and stable in the measurement scores it produces.

According to Collis and Hussey (2003), there are different approaches to reliability and these are:

- Stability – This requires that there are consistent results with repeated measurements of the same person with the same instrument.
- Equivalence - Equivalent forms of test are administered to the same persons at a single time period and scores correlated. Parallel-form or inter-rater correlation is performed on the data.
- Internal consistency – With this approach, consistency or stability of performance is checked among items in one administration. Internal consistency can be measured using the Spearman-Brown formula, Kuder-Richardson (KR20) or Cronbach's alpha.

With Cronbach's alpha, values are expressed on a scale of 0 to 1. A value of 0.7 is generally accepted as being reliable. A value of 0.50 is acceptable for basic or exploratory research (Collis and Hussey, 2003).

The questionnaires were checked for validity by means of a pilot study. The target was a Cronbach's alpha value of at least 0.50.

3.4 POPULATION

A population is a complete group of objects such as people or items which are used for measurement. The Cisco Academy programme in South Africa has about 59 academies with about 2500 students enrolled in a programme every year. The academies offer courses such as IT Essentials, CCNA 1-4, CCNA Security and CCNP.

Cisco Academies are hosted at institutions such as universities, high schools and Further Education and Training (FET) colleges. The major distinguishing features among these institutions are the educational levels of Cisco Academy students and the infrastructure. Universities tend to have better infrastructure and higher educational standards compared with schools and FET colleges.

3.5 SAMPLE

In the majority of cases studying the entire population is not practical. Researchers often resort to studying a sample which is a subset of the population (Goddard and Melville, 2001). What is critical is that the sample is representative of the population of research interest.

Sampling is the process or technique employed to select a representative part of a population for the purpose of determining some characteristics of the population (Coldwell and Herbst, 2004). The two major categories of sampling are probability and non-probability sampling. In probability sampling, every unit in the sampling frame has a known and equal chance of being selected. On the other hand, non-probability sampling makes use of the expertise or judgment of the investigator. It would not be possible to assess errors or the extent of the sample's representativeness of the population under study.

Of the 2500 Cisco Academy students enrolled in the programme every year, about 1700 students graduate each year. Of these graduands about 250 graduate with CCNA 4 certificates. Even though there are many programmes, CCNA is the flagship programme for Cisco Academies. With Cisco Academies being hosted in diverse

institutions the researcher aimed to use stratified sampling in order to have a truly representative sample. However, of the 59 academies in South Africa, only eight academies have produced CCNA 4 graduates. It was important to consider CCNA 4 graduates because these have the widest experience of the Cisco Academy programme. The criteria employed in selecting the academies for participation were:

- The academy should have CCNA 4 graduates at the time of the study;
- The academy selected should help enhance the heterogeneity of the sample in terms of infrastructure, instructor quality, accessibility and diversity in language capabilities.

The following academies met the criteria for selection and were contacted:

- Nelson Mandela Metropolitan University
- Cape Peninsula University of Technology
- Central University of Technology
- University of Pretoria
- Central Johannesburg College
- CIDA ICT Academy
- Mangosuthu University of Technology

Given that the CCNA 4 graduands were not that many, full participation of Cisco Academy administrators and their students was important. Any student who was available would be considered for participation and the administrators had to clarify issues to the students.

3.6 DATA COLLECTION STRATEGY

The research intended to ascertain first-hand the different factors that affect the performance of the Cisco Academy from the perspective of the students. Any device used for data collection is called an instrument (Goddard and Melville, 2001). Methods of data collection that could have been used are observation, interviewing and questionnaires since these get to the primary source.

It was decided to use a questionnaire for the following reasons:

- The researcher had limited resources and was not going to be able to travel around South Africa to conduct interviews or observations.
- Some questions were sensitive for the respondents to answer in the presence of another person.
- It was important for the respondents to remain anonymous.
- It was important to get responses from the primary source.

According to Wiersma (2000) and Rossi (1983), a questionnaire has to meet the following requirements:

- It should be in a format that is straightforward and attractive.
- It should meet the objectives of the research
- It should reflect accurate information about the research study
- It should be executable within the time and resources available.

Since the research was anchored in the positivistic paradigm, close-ended questions whose responses are easier to analyse were used.

3.7 DATA COLLECTION PROCEDURE

In order to enrich the questionnaire and establish clarity of some of the question items in the questionnaire, a focus group session was held with former students and instructors in the Cisco Academy. The number of participants taking part in the focus group was five.

Permission to conduct research was requested from the Heads of Information Technology departments in the Cisco Academies involved in the research. Once the permission was granted, questionnaires were emailed or taken in person to some of the participating institutions by the researcher. The Cisco Academy administrators were the facilitators of the research and it was made clear that the CCNA 4 instructor should not administer the questionnaires.

A pilot study was done with students in the School of ICT at the Nelson Mandela Metropolitan University. This helped to confirm the reliability of the measuring instrument and further check if the students would understand the questions.

3.8 ETHICAL CONSIDERATIONS

Collecting data from people raises ethical concerns such as taking care to avoid harming people, having adequate regard for their privacy and respecting them as individuals (Goddard and Melville, 2001). The research focused on students as respondents. In research ethics, students are regarded as a sensitive group particularly where issues such as marks are involved. According to Kumar (2011), it is unethical if information is collected without the knowledge of participants and their expressed willingness and informed consent. The study had to be subjected to a full ethical clearance process to ensure that questions as well as information in the covering letter met the ethical requirements. The study was cleared by the Research Ethics Committee (Human) of the university and the **ethics clearance number H12-BES-IOP-016** was assigned to it.

3.9 SUMMARY

This chapter discussed the research methodology that was used in the study. The research methods, population, sample, procedure, ethical issues, validity and reliability were examined. The next chapter will present the empirical results of the study.

CHAPTER 4

EMPIRICAL RESULTS

4.1 INTRODUCTION

Chapter Three dealt with the research methodology that was employed. It discussed the research paradigm, strategies, population, sample and measuring instruments. The concepts of reliability and validity were also discussed.

This chapter presents the empirical results of the study. The results of the pilot study as well as the main study will be presented. A separate chapter, Chapter Five, will discuss the descriptive statistics of the study.

4.2 PILOT STUDY

According to Lancaster (2005: 108), a pilot study tests the suitability of the data techniques employed. A pilot study can highlight items that are difficult to answer so that the researcher can refine the questionnaire. The data can also help to test validity and reliability.

A pilot study was conducted with 56 students from the School of ICT at the Nelson Mandela Metropolitan University. The results for reliability are shown in Table 4.1.

The initial Cronbach alphas show that the data gathered by the use of the instruments showed acceptable reliability, except for accessibility ($\alpha = 0.21$). The alpha coefficient could however be improved to 0.62 if items ACCS 3 and 5 were deleted or improved. It was therefore decided to improve items ACCS 3 and ACCS 5 in order to retain them as measures of accessibility. All the Cronbach alphas were above 0.60 and were therefore retained for further analysis.

TABLE 4.1 CRONBACH'S ALPHA FOR ACADEMY PERFORMANCE MEASUREMENT

Variable	Cronbach's alpha	Comment
Accessibility	0.21 (0.62 with ACCS 3 and 5 deleted or improved)	Acceptable
Infrastructure	0.72	Acceptable
Instructor Quality	0.61	Acceptable
Motivation	0.72	Acceptable
Multi-culture needs	0.66	Acceptable
Perceived Academy performance	0.81	Acceptable
Technology tools	0.72	Acceptable

The data were also checked for content and face validity which were satisfactory. With both face validity and reliability results being satisfactory, it was decided to proceed with the study.

4.3 THE MAIN STUDY

With satisfactory results for reliability and validity the final study was conducted.

4.3.1 Research response

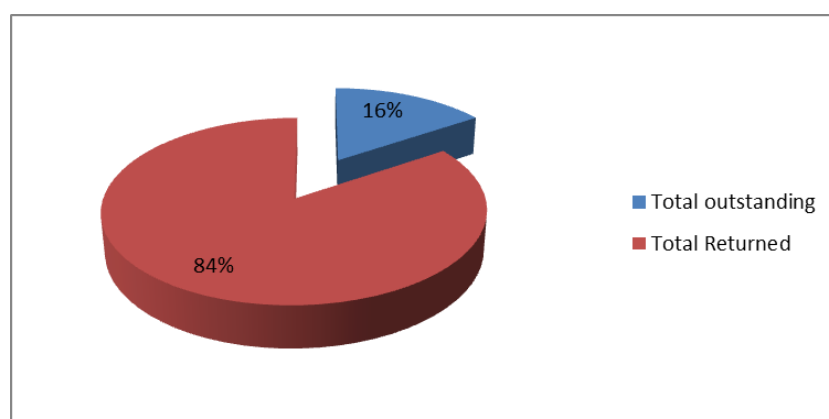
The questionnaires were sent out to participating Cisco Academies towards the end of September 2012. The participating academies and their locations were:

- Nelson Mandela Metropolitan University (Port Elizabeth)
- Cape Peninsula University of Technology (Cape Town)
- Central University of Technology (Bloemfontein)
- CIDA ICT Academy (Johannesburg)
- Mangosuthu University of Technology (Durban)

TABLE 4.2 QUESTIONNAIRE RESPONSES

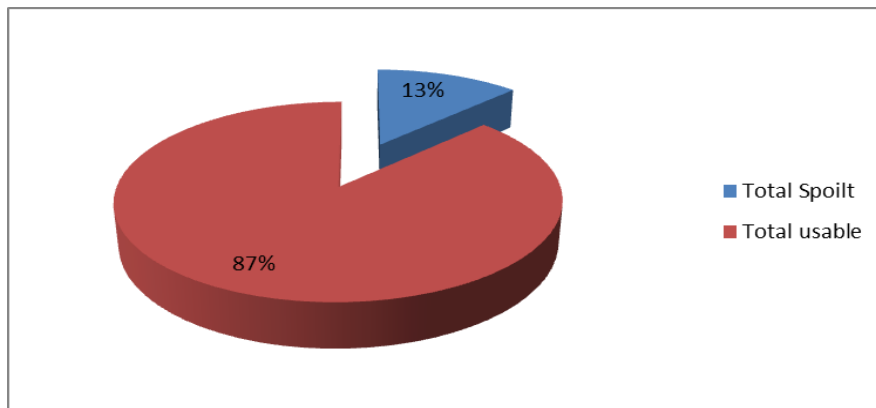
Academy	Total Administered	Returned	Usable
NMMU	92	79	75
CPUT	40	36	29
CUT	60	50	40
MUT	21	21	18
CIDA ICT ACDEMY	12	4	4

As shown in Table 4.2, a total of 225 questionnaires were administered. One hundred and ninety (190) questionnaires were returned. This translated into a response rate of 84% which is fairly high.

FIGURE 4.1 QUESTIONNAIRE RESPONSE RATE

Of the one hundred and ninety (190) questionnaires returned, one hundred and sixty-six (166) were usable. This translated into 87% usable questionnaires as shown in Figure 4.2.

FIGURE 4.2 USABLE QUESTIONNAIRES AS A PERCENTAGE OF TOTAL QUESTIONNAIRES RETURNED



4.3.2 Results of biographical section of the questionnaire

Section C (see Annexure B) of the questionnaire relates to general information about the respondents. This section gives us biographical details which are used to facilitate comparisons with the dependent variables.

From Table 4.3 it can be seen that there were more males than females in the survey. In all, males totaled 69.9% compared with 30.1% females.

There were only two age categories in the survey, namely: the 20-29 years age group and the 30-39 years age group. The majority of the respondents, 97.6% were in the 20-29 years age range.

The participants either had a diploma or matric certificate. They were fairly evenly balanced with 56% having matric certificates compared with 44% who had already attained diplomas.

The participants were drawn from cities in five provinces in South Africa. Port Elizabeth contributed 44.6% of the participants. Bloemfontein contributed 24.1% of the participants and was followed by Cape Town with 17.5%. Durban contributed 11.4% of the participants with Johannesburg contributing only 2.4%.

The demographic composition of the sample is depicted in Table 4.3.

TABLE 4.3 DEMOGRAPHIC COMPOSITION

	Number of Responses	Percentage of responses
Gender		
Male	116	69.9
Female	50	30.1
Total	166	100.0
Education		
Matric	93	56.0
Diploma	73	44.0
Total	166	100.0
Age		
20-29	162	97.6
30-39	4	2.4
Total	166	100,0
Location		
Port Elizabeth	74	44.6
Cape Town	29	17.5
Durban	19	11.4
Bloemfontein	40	24.1
Johannesburg	4	2.4
Total	166	100.0
Home Language		
Xhosa	70	42.2
English	10	6.0
Afrikaans	20	12.0
Zulu	26	15.7
Sotho	21	12.7
Setswana	10	6.0
Others	9	5.4
Total	166	100.0

Most of the home languages in South Africa were represented. With the bulk of the participants based in the Western and Eastern Cape provinces, Xhosa-speaking people made up 42.2%. The other languages involved were Sotho, isiZulu, Afrikaans and Setswana.

4.3.3 Reliability and validity of results

It was important to first assess the data quality and its effectiveness as related to the academy performance under consideration. Without such tests the data would not be credible (Collis and Hussey, 2003: 58).

4.3.3.1 Reliability

The data from the final study were first analyzed to establish internal consistency by means of Cronbach's alpha coefficients. The results are shown in Table 4.4.

TABLE 4.4 CRONBACH'S ALPHA VALUES OF MEASURING INSTRUMENTS

Variable	Cronbach's alpha		
	Initial value	Items deleted	Final value
Accessibility	0.35	ACCS 3 and ACCS 5	0.61
Infrastructure	0.76		0.76
Instructor quality	0.80		0.80
Motivation	0.70		0.70
Multi-culture needs	0.73		0.73
Technology tools	0.71		0.71
Perceived academy performance	0.78		0.78

After deleting ACCS 3 and ACCS 5, all Cronbach alpha coefficients were above 0.60 and acceptable.

4.3.3.2 Validity

To establish the validity of the data, it was decided to perform confirmatory factor analyses and the results in Table 4.5 were obtained.

TABLE 4.5 CONFIRMATORY FACTOR ANALYSES RESULTS OF THE MEASURING INSTRUMENT

Variable	Measuring items	RMSEA
Accessibility	ACCS 1,2,4,6	0.02
Infrastructure	INFR 1-9	0.06
Instructor quality	IQUA 1-7	0.04
Motivation	MOTN 1-6	0.04
Multi-culture	MULC 1-6	0.05
Technology	TECH 1-7	0.07
Perceived Academy Performance	PPER 1-6	0.09

The Perceived Academy performance showed poor validity, missing the 0.08 cut-off point for Root Mean Square Error of Approximation (RMSEA). MacCallum, Browne and Sugawara (1996) regard values between 0.08 and 0.10 as mediocre fit. Kelley and Lai (2011) however argue that an RMSEA of 0.10 is often acceptable in smaller samples. In this study, the sample size was 166, which is relatively smaller in comparison with samples of more than 300 respondents that are usually used in structural equation modelling (SEM). On this basis, and because it was the only dependent variable, the variable academy performance was retained for further analyses.

4.3.4 Multiple regression analysis based on perceived Academy Performance

The relationships amongst academy performance and its determinants were tested using the STATISTICA software package. Specifically the influence was tested of technology tools, motivation, accessibility, infrastructure, instructor quality and multi-culture needs on Cisco Academy performance. Two dependent variables were used

in the study and these were CCNA Aggregate and Perceived Academy Performance. CCNA aggregate was essentially one measure and less preferable to Perceived Academy Performance which utilized a number of measuring items. The results of multiple regression analysis are shown in Table 4.6.

TABLE 4.6 MULTIPLE REGRESSION ANALYSIS: PERCEIVED ACADEMY PERFORMANCE

DEPENDENT VARIABLE: Perceived Academy Performance						
$R^2 = 0.41602408$						
$F(6,159) = 18.1879, p < 0.0000$						
N=166	b*	Std.Err.- of b*	B	Std.Err.- of b	t(159)	p-value
Intercept			0.941497	0.297501	3.164686	0.001861
Infrastructure	-0.00679	0.081308	-0.00638	0.076388	-0.08353	0.933534
Instructor quality	0.235472	0.081159	0.225280	0.077646	2.901361	0.004243**
Multi-culture needs	-0.03781	0.084600	-0.03535	0.079091	-0.44700	0.655478
Motivation	0.147352	0.081272	0.148272	0.081779	1.813087	0.071704
Accessibility	0.081685	0.078275	0.068113	0.065270	1.043564	0.298271
Technology tools	0.362114	0.081477	0.384112	0.086427	4.444372	0.000016***

Note: * = significant at $p < 0.05$

** = significant at $p < 0.01$

*** = significant at $p < 0.001$

The main determinants of Academy Performance are instructor quality ($b^* = 0.24$, $p < 0.01$) and technology ($b^* = 0.36$, $p < 0.001$). Other variables are not significantly related to Academy Performance. The six independent variables explain 42% ($R^2 = 0.416$) in the movement of Academy Performance. They are therefore important determinants of Academy Performance, but instructor quality and technology significantly influence Academy Performance.

4.3.4.1 The influence of supporting infrastructure on academy performance (perceived academy performance)

Hypothesis H1 stipulated that supporting infrastructure exerts a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H01: Supporting infrastructure does not exert an influence on Cisco Academy performance.

According to the respondents, supporting infrastructure does not exert a significant influence on Cisco Academy performance. The alternative hypothesis H1 is not supported while the null hypothesis H01 is supported. This means that improving the supporting infrastructure will not necessarily lead to an improvement in the Cisco Academy performance.

4.3.4.2 The influence of instructor quality on academy performance (perceived academy performance)

Hypothesis H2 stipulated that instructor quality exerts a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H02: instructor quality does not exert a positive influence on performance in the Cisco Academies.

According to the respondents, instructor quality exerts a significant positive influence on Cisco Academy performance ($b^* = 0.24$, $p < 0.01$). The alternative hypothesis H2 is supported while the null hypothesis H02 is not supported. This means that improving the instructor quality could lead to an improvement in the Cisco Academy performance.

4.3.4.3 The influence of multi-culture needs on academy performance (perceived academy performance)

Hypothesis H3 stipulated that multi-culture needs exert a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H03: multi-culture needs do not exert a positive influence on the performance of students in the Cisco Academies.

According to the respondents, multi-culture needs do not exert a significant influence on Cisco Academy performance. The alternative hypothesis H3 is not supported while the null hypothesis H03 is supported. This means that paying more attention to the multi-culture needs will not necessarily lead to an improvement in the Cisco Academy performance.

4.3.4.4 The influence of motivation on academy performance (perceived academy performance).

Hypothesis H4 stipulated that motivation exerts a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H04: motivation does not exert a positive influence on the performance of students in the Cisco Academies.

According to the respondents, motivation does not exert a significant influence on Cisco Academy performance. The alternative hypothesis H4 is not supported while the null hypothesis H04 is supported. This means that increasing the motivation levels of course participants will not necessarily lead to an improvement in the Cisco Academy performance.

4.3.4.5 The influence of accessibility on academy performance (perceived academy performance).

Hypothesis H5 stipulated that accessibility of the institution exerts a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H05: accessibility does not exert a positive influence on the performance of students in the Cisco Academies.

According to the respondents, accessibility does not exert a significant influence on Cisco Academy performance. The alternative hypothesis H5 is not supported while the null hypothesis H05 is supported. This means that improving the accessibility of Cisco Academies will not necessarily lead to an improvement in the Cisco Academy performance.

4.3.4.6 The influence of technology tools on academy performance (perceived academy performance).

Hypothesis H6 stipulated that use of technology tools exerts a positive influence on the performance of students in the Cisco Academies. The null hypothesis formulated in this regard was:

H06: use of technology tools does not exert a positive influence on the performance of students in the Cisco Academies.

According to the respondents, use of technology tools exerts a significant positive influence on Cisco Academy performance ($b^* = 0.36$, $p < 0.001$). The alternative hypothesis H6 is supported while the null hypothesis H06 is not supported. This means that improving the use of technology tools could lead to an improvement in the Cisco Academy performance.

4.3.5 The influence of independent variables on the CCNA aggregate score

Multiple regression analysis was also carried out to determine the influence of independent variables on the CCNA aggregate score. The results are shown in Table 4.7.

TABLE 4.7 INFLUENCE OF INDEPENDENT VARIABLES ON CCNA AGGREGATE

DEPENDENT VARIABLE: CCNA Aggregate						
$R^2 = 0.09651019$						
$F(6,159) = 2.8307, p < 0.0000$						
N=166	b*	Std.Err.- of b*	b	Std.Err.-of b	t(159)	p-value
Intercept			0.1513482	0.552230	2.74067	0.006833
Infra- structure	-0.16573	0.101134	-0.232361	0.141794	-1.6387	0.103248
Instructor quality	0.15096	0.100949	0.215545	0.144129	1.49550	0.136767
Multi-culture needs	-0.11139	0.105229	-0.155415	0.146811	-1.0586	0.291385
Motivation	0.067703	0.101089	0.101666	0.0.151800	0.66973	0.503999
Accessibility	-0.02363	0.097362	-0.029406	0.121155	-0.2427	0.808541
Technology tools	0.292420	0.101344	0.462900	0.160428	2.88541	0.004452**

Note: ** = significant at $p < 0.01$

The main determinant of Academy Performance is technology tools ($b^*=0.29$, $p<0.01$). The other variables are not significantly related to Academy Performance. The six independent variables explain 9.7 % ($R^2 = 0.097$) in the movement of Academy Performance. The value R^2 was small because only one measure was used for CCNA Aggregate. Therefore only the use of technology tools has a significant influence of the CCNA aggregate scores.

4.3.6 The main determinant for CCNA written results

The performance of students in practical and written examinations may not necessarily be the same. It was important to examine such performance separately. The relationships between academy performance (CCNA written results only) and its determinants were tested. The determinants under consideration were supporting infrastructure, instructor quality, motivation, multi-culture needs, accessibility and technology tools. The results are shown in Table 4.8.

TABLE 4.8 MULTIPLE REGRESSION ANALYSIS: CCNA WRITTEN RESULTS

DEPENDENT VARIABLE: CCNA Written						
$R^2 = 0.07015693$						
$F(6,159) = 1.9869, p < 0.0000$						
N=166	b*	Std.Err.- of b*	B	Std.Err.- of b	t(159)	p-value
Intercept			1.797331	0.654061	2.74796	0.006695
Infrastructure	-0.123372	0.102848	-0.20138	0.167880	-1.1995	0.232107
Instructor quality	0.053495	0.102753	0.088857	0.170676	0.52062	0.603363
Multi-culture needs	-0.138669	0.106923	-0.22546	0.173849	-1.2969	0.196556
Motivation	0.205118	0.103043	0.358347	0.180019	1.99061	0.048248*
Accessibility	0.012960	0.099294	0.018970	0.145341	0.13052	0.896320
Technology tools	0.168756	0.103267	0.310778	0.190176	1.63416	0.104215

Note: * = significant at $p < 0.05$

The value of $R^2(7\%)$ is very small owing to one measure being used for CCNA written scores.

Upon inspection of Table 4.8, it is seen that all other variables (except motivation) have $p > 0.05$. Therefore at 5% level of significance these variables are insignificant in estimating performance in the CCNA written examination. Only motivation ($b^* = 0.20$,

p < 0.05) was significantly related to the CCNA written results. Motivation is therefore the only determinant of CCNA written results in this study.

4.3.7 The main determinant of CCNA practical results

The Cisco Academy programme generally places slightly more emphasis on practical skills compared with theoretical knowledge. The relationships between academy performance (CCNA practical results only) and its determinants were tested. The determinants under consideration were supporting infrastructure, instructor quality, motivation, multi-culture needs, accessibility and technology tools.

TABLE 4.9 MULTIPLE REGRESSION ANALYSIS: CCNA PRACTICAL RESULTS

DEPENDENT VARIABLE: CCNA Practical						
$R^2 = 0.10598197$						
$F(6,159) = 3.1217, p < 0.0000$						
N=166	b*	Std.Err.- of b*	b	Std.Err.- of b	t(159)	p-value
Intercept			1.420432	0.640974	2.21605	0.028117
Infrastructure	-0.160136	0.100847	-0.26124	0.164521	-1.5879	0.114305
Instructor quality	0.192025	0.100754	0.318779	0.167261	1.90587	0.058483
Multi-culture needs	-0.078247	0.104843	-0.12715	0.170370	-0.7463	0.456583
Motivation	-0.009069	0.101038	-0.01583	0.176417	-0.0897	0.928590
Accessibility	-0.124901	0.097362	-0.18272	0.142433	-1.2828	0.201424
Technology tools	0.333525	0.101258	0.613868	0.186371	3.29380	0.001220**

Note: ** = significant at p < 0.01

The value of R^2 (10.5%) is very small owing to one measure being used for CCNA practical scores.

Upon inspection of Table 4.9, it is seen that all other variables (except technology tools) have $p > 0.05$. Therefore at 5% level of significance these variables are insignificant in estimating performance in the CCNA practical examination. The results show that only technology tools ($b^* = 0.33$, $p < 0.01$) were significantly related to CCNA practical examination results, making the latter the only determinants of the CCNA practical examination results.

4.3.8 Analysis of Variance (ANOVA) results

In order to perform statistical tests to determine whether the means of the groups involved in the study are equal, the Analysis of Variance (ANOVA) was used.

4.3.8.1 Differences in Cisco Academy performance among the location groups

TABLE 4.10 CISCO ACADEMY PERFORMANCE MEAN SCORES

	Mean Academy Performance	Mean CCNA Written Score	Mean CCNA Practical Score	Mean CCNA Aggregate
Location 1	4.19	3.77	3.36	3.53
Location 2	3.89	2.36	2.75	2.50
Location 3	3.72	2.84	3.10	3.00
Location 4	3.92	3.12	2.10	2.51

TABLE 4.11 THE UNIVARIATE TESTS OF SIGNIFICANCE FOR ACADEMY PERFORMANCE

	SS	Df	MS	F	p	Partial eta-squared	Non-centrality	Observed power (alpha=0.05)
Intercept	1101.7	1	1101.74	3074.82	0.000	0.95024	3074.828	1.000000
LOCATIO	6.254	4	1.564	4.364	0.002	0.09781	17.455	0.928200
Error	57.688	161	0.358					

Table 4.11 shows that the null hypothesis ($p < 0.01$) that there is no difference in academy performance among the location groups is rejected. There are groups that

perform better than others. Table 4.10 confirms that Location 1, Port Elizabeth, performs significantly better than the other locations.

4.3.8.2 Differences in perception of variables amongst the location groups

Six independent variables were considered in the study. In order to test if the different location groups differ in the way they perceive the variables, the analysis of variance (ANOVA) was performed. Table 4.12 shows the perceptions of location sites with respect to independent variables. The values used are average mean scores.

TABLE 4.12 PERCEPTIONS OF LOCATION SITES WITH RESPECT TO INDEPENDENT VARIABLES

	Accessibility	Infra-structure	Instructor Quality	Motivation	Multi-culture needs	Technology Tools
Location 1	3.71	3.72	4.16	3.92	3.68	4.02
Location 2	3.40	3.72	3.80	3.80	3.57	3.90
Location 3	3.46	3.02	3.88	3.88	3.38	3.62
Location 4	3.77	3.78	4.17	3.95	3.77	3.71

From Table 4.12 it appears that Location 4 (Bloemfontein) is rated in all independent variables higher than the other locations except in technology tools. Location 1 (Port Elizabeth) is rated the highest in technology tools.

ANOVAs were conducted to ascertain whether these differences in ratings were significant. The results showed that the differences were significant, except for motivation. It appears that the location groups were similar with regard to their motivation to perform well in the course.

4.3.9 Two Sample T-tests

The Cisco Academy programme tries to ensure that disadvantaged groups such as women are accommodated in its courses. Being essentially a professional education

programme, it also appeals to participants from different educational backgrounds. It was considered important to establish if there were significant differences in performance between the genders as well as the different educational groups. Two-sample t-tests were conducted on the data.

4.3.9.1 Differences among gender groups with regard to results

In order to establish if gender groups differ significantly with regard to results two-sample t-tests were conducted on the following:

- Perceived academy performance
- CCNA written results
- CCNA practical results
- CCNA aggregate results

Differences in perception of academy performance

A two-sample t-test was done to determine if gender groups differ significantly in terms of perceived academy performance. Table 4.13 shows the results.

TABLE 4.13 TWO-SAMPLE T-TEST FOR PERCEIVED ACADEMY PERFORMANCE BY GENDER

	Mean - 1	Mean - 2	t-value	df	p
ACPERF	4.09	3.88	2.045	164	0.042

Table 4.13 shows that males and females differ significantly ($p < 0.05$) with regard to their perceptions of how successfully the academy performs. It appears that males (mean = 4.09) rate the academy performance higher than females (mean = 3.88).

Differences in CCNA written results

A two-sample t-test was done to determine if gender groups differ significantly in terms of CCNA written results. Table 4.14 shows the results.

TABLE 4.14 TWO-SAMPLE T-TEST FOR CCNA WRITTEN RESULTS BY GENDER

	Mean - 1	Mean - 2	t-value	df	p
CCNA Written	3.347826	3.100000	1.352964	163	0.177941

Table 4.14 reveals that males and females do not differ with regard to the CCNA written results.

Differences in CCNA practical results

A two-sample t-test was done to determine if gender groups differ significantly in terms of CCNA practical results. Table 4.15 shows the results.

TABLE 4.15 TWO-SAMPLE T-TEST FOR CCNA PRACTICAL RESULTS BY GENDER

	Mean - 1	Mean - 2	t-value	df	p
CCNA Prac	3.008696	2.800000	1.138131	163	0.256736

Table 4.15 shows that males and female do not differ significantly with regard to practical examination results.

Differences in CCNA aggregate results

A two-sample t-test was done to determine if gender groups differ significantly in terms of CCNA aggregate results. Table 4.16 shows the results.

TABLE 4.16 TWO-SAMPLE T-TEST FOR CCNA AGGREGATE RESULTS BY GENDER

	Mean - 1	Mean - 2	t-value	df	p
CCNA Aggre	3.117241	2.920000	1.257188	164	0.210473

Table 4.16 indicates that males and females do not differ significantly with regard to CCNA aggregate results.

4.3.9.2 Differences among education groups with regard to examination results

From the data collected, there were two educational groups, namely: those who had completed matric and those who had completed a diploma. Two-sample t-tests were done to establish if there were significant differences among these educational groups with respect to:

- CCNA aggregate results
- CCNA written results
- CCNA practical results
- Perceived academy performance

Differences in perceived academy performance

A two-sample t-test was done to determine if educational groups differ significantly in terms of perceived academy performance. Table 4.17 shows the results.

TABLE 4.17 TWO-SAMPLE T-TEST FOR PERCEIVED ACADEMY PERFORMANCE BY EDUCATIONAL GROUP

	Mean - 2	Mean - 1	t-value	df	p
ACPERF	4.196347	3.897849	3.148169	164	0.001952

The empirical results show that the educational groups differ significantly with regard to their perceptions of how successfully the academy performs. The diploma group rates perceived academy performance higher than matric groups.

Differences in CCNA written results

A two-sample t-test was done to determine if educational groups differ significantly in terms of CCNA written examination results. Table 4.18 shows the results.

TABLE 4.18 TWO-SAMPLE T-TEST FOR CCNA WRITTEN RESULTS BY EDUCATIONAL GROUP

	Mean - 2	Mean - 1	t-value	df	p
CCNA Written	3.767123	2.880435	5.696857	163	0.000000

Table 4.18 shows that the educational groups differ significantly with regard to their performance in the CCNA written examination. The diploma group performed better than the matric group.

Differences in CCNA practical results

A two-sample t-test was done to determine if educational groups differ significantly in terms of CCNA practical examination results. Table 4.19 shows the results.

TABLE 4.19 TWO-SAMPLE T-TEST FOR CCNA PRACTICAL RESULTS BY EDUCATIONAL GROUP

	Mean - 2	Mean - 1	t-value	df	p
CCNA Prac	3.383562	2.597826	4.946887	163	0.000002

The empirical results show that the educational groups differ significantly with regard to their performance in the CCNA practical examination. The diploma group performed better than the matric group in the CCNA practical examination.

Differences in CCNA aggregate results

A two-sample t-test was done to determine if educational groups differ significantly in terms of CCNA aggregate results. Table 4.20 shows the results.

TABLE 4.20 TWO-SAMPLE T-TEST FOR CCNA AGGREGATE RESULTS BY EDUCATIONAL GROUP

	Mean - 2	Mean - 1	t-value	df	p
CCNA Aggre	3.536986	2.681720	6.604148	164	0.000000

Table 4.20 indicates that the educational groups differ significantly with regard to their CCNA aggregate scores. The diploma group performed better than the matric group in the CCNA aggregate scores.

4.4 SUMMARY

In this chapter, the data collected in the study were presented. Statistical techniques were employed to evaluate the data for validity and reliability. Multiple regression analysis, analysis of variance, and two-sample t-tests were conducted on the data. These techniques were employed to determine the important determinants on academy performance, test associations and to test significance of relationships.

The results of multiple regression analysis indicated that only technology tools and instructor quality are significant determinants of academy performance. The results of the ANOVA tests indicated that the Cisco Academies perform differently. The ANOVAs also showed that academies perceived the independent variables differently except for motivation. Two-sample t-tests showed that the male students rate their academy performance more highly compared with their female counterparts but the two groups do not differ in their performance in the CCNA examinations. Two-sample t-tests also indicated that diploma students perceived academy performance more highly compared with matric students and that diploma students performed better than their matric counterparts.

The next chapter, Chapter Five, will provide an analysis of the descriptive statistics.

CHAPTER 5

DESCRIPTIVE STATISTICS

5.1 INTRODUCTION

The purpose of this chapter is to present and discuss the descriptive statistics obtained from the study. The primary objective of the study was to assess the factors that impact on the performance of Cisco Academies in South Africa. To achieve this objective, the respondents were asked to indicate their levels of agreement with individual questionnaire statements about the independent variables: accessibility, supporting infrastructure, motivation, multi-culture needs, instructor quality and technology tools. They were also asked to indicate their levels of agreement with questionnaire statements about the perceived academy performance. This chapter will look at the descriptive statistics relating to these variables.

5.2 DESCRIPTIVE STATISTICS

This section provides the descriptive statistics relating to the variables: instructor quality, technology tools, accessibility, supporting infrastructure, motivation, multi-culture needs, and perceived academy performance. The responses to questionnaire items were originally measured according to a five-point Likert scale. However for this analysis, the range of responses was classified into three categories, namely: Disagree, Neutral and Agree as shown in Table 5.1. The values used are percentages.

TABLE 5.1 SCALE FOR DESCRIPTIVE STATISTICAL ANALYSIS

Initial range	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
New Range	Disagree		Neutral	Agree	

5.2.1 Instructor quality

Table 5.2 depicts the responses on how the participants view instructor quality as it relates to academy performance.

TABLE 5.2: DESCRIPTIVE STATISTICS: PERCEPTIONS ON INSTRUCTOR QUALITY

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev.
IQUA1	The instructors of my Cisco Academy courses present/ presented concepts in an understandable way.	8.4	17.5	74.1	3.98	0.97
IQUA2	The instructors of my Cisco Academy courses have/had good knowledge of their subjects.	0.6	14.5	84.9	4.45	0.76
IQUA3	The instructors of my Cisco Academy courses answer/ answered student questions in a satisfactory way.	8.4	18.1	73.5	3.96	0.95
IQUA4	The instructors of my Cisco Academy courses are/were helpful during the conduct of laboratory exercises.	3.0	16.9	80.1	4.21	0.90
IQUA5	If given a/ another chance, I would take more courses with my Cisco Academy instructors.	3.6	13.9	82.5	4.28	0.90
IQUA6	My Cisco Academy instructor is/ was available for consultation outside of normal hours.	20.5	21.7	57.8	3.63	1.25
IQUA7	My Cisco Academy instructor makes/ made the topics interesting.	7.8	18.1	74.1	4.02	0.95

Average mean score= 4.08: Average agree =75.3%: Average neutral=17.2%: Average Disagree=7.5%

From the multiple regression analysis results in Chapter 4, section 4.3.4.2, instructor quality was found to exert a significant influence on Cisco Academy performance. The average mean score of 4.08 shows that participants were generally satisfied with instructor quality. From Table 5.2, 75.3% of the participants agree that the instructor quality is high.

About 74.1% of the respondents reported that instructors presented concepts in an understandable manner and only 8.4% were not satisfied. The mean score was 3.98. To corroborate this, 73.5% of the participants also indicated that the instructors answered student questions in a satisfactory manner and 74.1% of the students also reported that instructors made the topics interesting. The Cisco Academy instructors are always challenged to be as clear as possible and present concepts in multiple ways. The training on teaching methods provided by training centres and the use of technology tools could be helping in this regard.

There is ample evidence that instructors have good knowledge of their subjects. About 84.9% of the respondents reported that instructors had good knowledge of the courses that they teach. This question item also produced the highest mean score of 4.45. The strict instructor qualifying process and thorough training that instructors are subjected to could be contributing to such a perception. This could also be aided by the fact that most of such instructors are academic lecturers in computer networking. Only 0.6% of the respondents were not satisfied.

About 80.1% of the respondents indicated that the instructors were helpful in the conduct of laboratory exercises against only 3% who did not agree. Laboratory practices are quite challenging and instructors are required to guide their students closely. The instructors seem to be doing well in this regard.

About 82.5% of the participants indicated that they would take another course with their instructors. The Cisco Academy programme has courses at different levels and one of the areas of focus is student retention from one level to the next. The instructors seem to be playing a role in improving retention of students in the Cisco Academy programme.

There is evidence that instructors are available outside normal hours. About 57.8% of the respondents indicated that their instructors are available to put in extra hours. Of all the items under instructor quality, this item has the smallest mean score of 3.63. It appears that a reasonable percentage of instructors (about 40%) do not necessarily go the extra mile which could be a result of lack of motivation.

In summary, the results indicate that instructor quality is contributing to the performance of the Cisco Academy. It would be beneficial to pay close attention to this factor.

5.2.2 Technology tools

Table 5.3 depicts the responses on how the participants view technology tools with respect to academy performance.

TABLE 5.3: DESCRIPTIVE STATISTICS: PERCEPTIONS ON TECHNOLOGY TOOLS

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev.
TECH1	In my Cisco Academy courses, the use of tools such as packet tracer increases/ increased student collaboration.	4.8	13.9	81.3	4.22	0.88
TECH2	In my Cisco Academy courses, the use of multimedia flash objects /animations helps/ helped to clarify networking concepts.	7.8	30.1	62.1	3.77	0.93
TECH3	In my Cisco Academy courses, the use of packet tracer helps/ helped to clarify networking concepts.	1.2	15.1	83.7	4.30	0.79
TECH4	In my Cisco courses, the use of video clips helps/ helped me to understand networking concepts.	21.1	28.9	50.0	3.42	1.19
TECH5	In my Cisco Academy courses, the use of technology tools like flash objects/animations and packet tracer helps/ helped me to score better marks.	7.2	23.5	69.3	3.86	0.96
TECH6	In my Cisco Academy courses, the use of technology tools helps/ helped to improve my overall learning.	2.4	21.1	76.5	4.07	0.82
TECH7	In my Cisco Academy courses, the availability of on-line discussion tools helps/ helped me to understand networking concepts.	18.1	27.7	54.2	3.55	1.15

Average mean score= 3.88: Average agree =68.2%: Average neutral=22.9%:
Average Disagree= 8.9%

From the multiple regression analysis results in Chapter 4, section 4.3.4.6, technology tools were found to exert a significant influence on Cisco Academy performance. The average mean score of 3.88 shows that participants were generally satisfied with technology tools as they relate to academy performance. From Table 5.3 it can be seen that 68.2% of the participants agree that the instructor quality is high.

There is evidence that the use of technology tools such as packet tracer positively contributes to collaboration in the Cisco Academy. About 81.3% of the participants indicated that technology tools like the simulator, packet tracer, are useful and the mean score was 4.22. Collaboration, particularly where challenging concepts are concerned, enhances learning and the simulator and other technology tools are contributing positively in this regard.

About 62.1% of the respondents indicated that the use of multimedia flash objects helped them to understand networking concepts. About 50% of the respondents also indicated that the use of embedded video clips made a positive contribution in the same regard. The packet tracer tool, which also has some visualization features was rated highly with a mean score of 4.30 and had 83.7% of the respondents agreeing that it contributed to understanding networking concepts. About 54.2% of the respondents also indicated that the online-discussion tools helped to clarify networking concepts. Networking concepts can be difficult to comprehend but the use of technological visualizations appears to be making a positive contribution in the clarification of these concepts.

There is evidence that the use of technology tools like flash objects/animations and packet tracer helped the respondents to score higher marks. Almost 70% of the respondents indicated a positive influence of technology tools in scoring high marks and the mean score was 3.86. Such evidence corroborates the factual observation that concepts are being made clearer by technology tools and therefore instructors should be encouraged to use these tools as teaching aids.

There is evidence that the overall learning experience is being positively affected by use of technology tools. About 76.5% of the respondents indicated that use of

technology tools helped to improve their overall learning. The mean score was 4.07. Respondents acknowledged the fact that technology tools complement the other efforts that are made in teaching the course.

The results indicate that the Cisco Academies should continue to make use of technology tools since these help to improve the overall learning experience of students. Instructors who desire to get better results with students should increase their employment in teaching Cisco Academy courses.

5.2.3 Accessibility

Table 5.4 depicts the responses on how the participants view accessibility with respect to academy performance.

TABLE 5.4: DESCRIPTIVE STATISTICS: PERCEPTION ON ACCESSIBILITY

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev.
ACCS1	I travelled a short distance to the Cisco Academy.	30.1	28.3	41.6	3.18	1.33
ACCS2	The Cisco Academy was easily accessible through public and private transport.	16.9	33.1	50.0	3.54	1.14
ACCS3	It would have been better to have another Cisco Academy closer to where I stay/stayed.	19.3	25.3	55.4	3.63	1.34
ACCS4	The application process for a place in the Cisco Academy is/ was user-friendly.	6.0	27.7	66.3	3.90	0.96
ACCS5	The Cisco Academy which I attend/ attended is/ was the only choice available to me.	22.9	23.5	53.6	3.46	1.32
ACCS6	The timetable for Cisco Academy courses at my university/college makes/made it easy for me to attend classes.	5.4	24.1	70.5	4.04	0.92

Average mean score= 3.63: Average agree = 56.2%: Average neutral=27.0%:
Average Disagree= 16.8%

From the multiple regression analysis results in Chapter 4, section 4.3.4.5, accessibility was found not to be significantly related to academy performance. However all the six independent variables were found to explain 42% in the movement of academy performance which still makes accessibility one of the important determinants.

The items ACCS 3 and ACCS 5 failed to load when the data were tested for reliability (see Table 4.4). This may have happened because of the way the questions were formulated or because the participants may not consider academy closeness or a wide choice as being very important to their overall performance.

A mean score of 3.18 on the shortness of the distance travelled seems to indicate general agreement. However only 41.6% of the participants agreed with this question item. It is quite worrisome as this indicates that participants still desire the academies to be closer for more convenience.

There seems to be ample evidence from the descriptive statistics in section 5.2 that the academies are doing well when it comes to accommodating participants through scheduling. The highest mean score of 4.04 was scored for students who agreed that the academies' timetable made it easy for them to attend classes. The percentage of such participants was 70.5%.

The average mean score of 3.63 shows that participants were generally satisfied with the accessibility of Cisco Academies. From Table 5.4 it can be seen that 56.2% of the participants agree that Cisco Academies are accessible. However it is also important to note that just over 40% of the participants were not necessarily satisfied, which is a significant amount. On the whole, while accessibility may not contribute significantly to overall academy performance, the participants were generally satisfied.

5.2.4 Supporting infrastructure

Table 5.5 depicts the responses on how the participants view supporting infrastructure with respect to academy performance.

TABLE 5.5: DESCRIPTIVE STATISTICS: PERCEPTIONS ON SUPPORTING INFRASTRUCTURE

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev
INFR1	In my university/college, there are/were enough computers in the training laboratory.	9.0	18.7	72.3	4.06	1.06
INFR2	In my university/college, the computers are/were always in good working condition.	15.1	31.9	53.0	3.61	1.09
INFR3	In my university/college, the speed of the internet access is/was good.	16.9	31.3	51.8	3.54	1.12
INFR4	In my university/college, the Internet is/was always available.	16.3	25.3	58.4	3.69	1.17
INFR5	In my university/college, the number of people sharing networking equipment during laboratory exercises is/was small.	25.9	35.5	38.6	3.19	1.20
INFR6	In my university/college, the laboratories are/were large enough for the numbers of students in the class.	19.9	25.9	54.2	3.57	1.20
INFR7	In my college/university, the training room is/was properly ventilated/air-conditioned.	2.4	16.9	80.7	4.25	0.86
INFR8	In my college the laboratory is/was available after class hours for me to continue working.	21.1	21.7	57.2	3.57	1.37
INFR9	In my college/university, the networking equipment and cables are/were always in a good condition.	15.7	34.9	49.4	3.52	1.03

Average mean score=3.67: Average agree =57.3 %: Average neutral=26.9%:
Average Disagree= 15.8%

From the multiple regression analysis results in Chapter 4, section 4.3.4.1, supporting infrastructure was found not to be significantly related to academy performance. It is possible that instructor quality and technology tools compensated for supporting infrastructure. However all six independent variables were found to explain 42% in the movement of academy performance which still makes accessibility one of the important determinants.

While the mean score concerning condition of network cables was 3.52 and that for equipment sharing was 3.19 which still indicate general satisfaction, these were the lowest mean scores. It is even more important to note that only 49.4% of the respondents agreed that network cables were in good condition and that 38.6% of the respondents were happy with the numbers of students sharing equipment. The students were also not so happy with the maintenance of the computers and the internet speed. It appears that maintenance of cables is lacking and that academies still need to invest more in the actual laboratory equipment such as routers and switches.

It is evident that the training rooms have proper ventilation with 80.7% of the participants agreeing. This gave the highest mean score of 4.25. Students were also happy with the actual personal computers being used as 72.3% of the respondents reported satisfaction with a mean score of 4.06.

On the whole there is general satisfaction with regard to supporting infrastructure. The average mean score was 3.67. The percentage of those who agreed was 57.3.

5.2.5 Motivation

Table 5.6 depicts the responses on how the participants view motivation as it relates to academy performance.

TABLE 5.6: DESCRIPTIVE STATISTICS: PERCEPTIONS ON MOTIVATION

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev.
MOTN1	Before starting the class, my interest in the Cisco Academy courses was very high.	13.9	22.9	63.2	3.79	1.07
MOTN2	I maintain/maintained a high interest in the Cisco Academy courses.	4.2	21.1	74.7	4.12	0.93
MOTN3	The Cisco Academy courses are/were very important for my career development.	3.6	11.5	84.9	4.33	0.82
MOTN4	The skills and knowledge that I had before starting the Cisco Academy courses are/were relevant to these courses.	27.1	31.9	41.0	3.20	1.19
MOTN5	I enjoy/enjoyed talking about the Cisco Academy courses to other people.	6.0	21.1	72.9	4.02	0.96
MOTN6	I enjoy/enjoyed the Cisco Academy course material that challenges/ challenged me.	2.4	22.9	74.7	4.05	0.83

Average mean score=3.92: Average agree =68.6%: Average neutral=21.9%:
Average Disagree= 9.5%

From the multiple regression analysis results in Chapter 4, section 4.3.4.4, motivation was found not to be significantly related to academy performance. However all six independent variables were found to explain 42% in the movement of academy performance which still makes motivation one of the important determinants.

In general, motivation is a factor when it comes to performance in an educational programme. It is possible that instructor quality and technology tools compensated for supporting infrastructure. The way some questions were formulated may also not have been correct or the questions were irrelevant. For example only 41% of the

participants had prior knowledge before starting the Cisco Academy programme. Prior interest may also not be so high before the commencement of the course as some students are not fully sure about their choice of Cisco Academy courses. This could be the case when it comes to full-time academic students who may have a broad appreciation of computer networking but are still unsure about the Cisco Academy courses.

About 84.9% of the respondents reported that the Cisco courses were important for their career development. Such responses gave a mean score of 4.33. It appears that after going through the course, the students become even more convinced of the value of the course and this is further heightened by their experience in industry. Further corroboration of the value of the Cisco course is the observation that 74.7% of the respondents maintained a high interest in the course. Even though prior interest may not be high, engagement in the course seems to raise the necessary motivation.

On the whole, the average percentage of participants who agreed that they were motivated was 68.6% with an average mean score of 3.92. There is evidence that the respondents were indeed motivated.

5.2.6 Multi-culture needs

Table 5.7 depicts the responses on how the participants view multi-culture needs with respect to academy performance.

TABLE 5.7: DESCRIPTIVE STATISTICS: PERCEPTIONS ON MULTI-CULTURE NEEDS

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev
MULC1	In my Cisco Academy courses, sufficient measures are/were taken to deal with the students' language difficulties/weaknesses.	19.9	40.4	39.8	3.34	1.08
MULC2	In my Cisco courses, the cultural differences are/were handled in a mature manner.	10.8	27.1	62.0	3.80	0.98
MULC3	In my Cisco Academy courses, harmony is/was created among people of different cultures.	6.6	36.1	57.2	3.72	0.90
MULC4	In my Cisco Academy courses, students of poorer education backgrounds receive/received the necessary assistance.	17.5	35.5	47.0	3.47	1.13
MULC5	I enjoy/enjoyed the cultural diversity in my Cisco Academy classes.	10.2	30.7	59.0	3.71	1.02
MULC6	In my Cisco Academy courses, I can/could collaborate with people of different ethnical backgrounds easily.	6.6	22.9	70.5	3.99	0.98

Average mean score=3.67: Average agree =55.9%: Average neutral=32.1%:
Average Disagree= 11.9%

From the multiple regression analysis results in Chapter 4, section 4.3.4.3, multi-culture needs were found not to be significantly related to academy performance. However all six independent variables were found to explain 42% in the movement of academy performance which still makes motivation one of the important determinants.

Cultural diversity is one of the features of South African society. However the way the questions were asked may not have been correct. Some questions may have been irrelevant or the issues that they represent were being addressed by instructor quality and technology tools. For example, language difficulties may be compensated for by the online course material which allows students to work at their own pace. An instructor may not have to work evidently to harmonize people of different cultures when people are mature or he/she may still use the same language as a medium of instruction.

There is evidence that the students could easily collaborate amongst themselves. About 70.5% of the respondents reported easy collaboration amongst themselves. The mean score for such a perception was 3.99. About 62% of the respondents also reported that cultural differences were handled in a mature manner.

It appears that people of different cultures could collaborate easily and that the instructors are mature in handling cultural differences. This may also explain the reason for multi-culture differences not significantly contributing to academy performance. It would appear that specific cultural issues are not evident (most of those satisfied with specifics were around 50%) but general statements were rated with the greatest levels of satisfaction.

5.2.7 Perceived academy performance

Table 5.8 depicts the responses on how the participants perceive academy performance.

TABLE 5.8: DESCRIPTIVE STATISTICS: PERCEPTIONS ON ACADEMY PERFORMANCE

Code	Statement	Disagree	Neutral	Agree	Mean	Std. Dev.
PPER1	Considering the amount of money and effort I put into achieving good results in my Cisco Academy courses, I believe I am doing well.	5.4	26.5	68.1	3.86	0.88
PPER2	I am successful in achieving the results I want in my Cisco Academy courses.	6.6	26.5	66.9	3.81	0.91
PPER3	The marks in my Cisco Academy courses are above average.	6.0	31.3	62.7	3.76	0.94
PPER4	My results in my Cisco Academy courses make my studies worthwhile.	5.4	25.3	69.3	3.95	0.98
PPER5	The computer networking knowledge I now have is more than what I had before studying the Cisco Academy courses	3.6	12.7	83.7	4.40	0.84
PPER6	The computer networking skills I now have are more than what I had before studying the Cisco Academy courses.	3.6	14.5	81.9	4.40	0.87

Average mean score=4.03: Average agree = 72.1%: Average neutral=22.8%:
Average Disagree= 5.1%

While the validity of perceived academy performance was poor, it was still accepted as in the argument advanced by Kelly and Lai (2011) that poor validity for small samples is still acceptable.

The highest mean scores of 4.40 were scored in support of the increased knowledge and skills that the respondents possessed after undergoing training in the Cisco Academy. More than 80% of the respondents agreed that they possessed significantly more knowledge and skills after the training. The Cisco Academy programme seems to be imparting useful skills and knowledge to the trainees.

About 62.7% of the respondents agreed that their marks were above average and this was with the lowest mean score of 3.76. While participants may have been generally satisfied, there is a significant proportion of about 31% who have average marks. This may suggest that the Cisco Academy courses are still challenging. This is corroborated by a not so high 66.9% of the respondents who agreed that they were successful in achieving the results that they desire in the Cisco Academy courses.

On the whole, the participants seem to perceive performance in the Cisco Academy favourably since about 72% of the respondents were satisfied with such performance and this was at a high average mean score of 4.03.

5.3 SUMMARY

The chapter considered the descriptive statistics from the data obtained from respondents. The respondents were particularly satisfied with the use of technology tools and instructor quality. The respondents were also fairly well motivated in doing the Cisco Academy programme. It was established that the students were satisfied with the academy performance.

CHAPTER 6

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The last two chapters presented the empirical results of the study. This chapter discusses the empirical results and their managerial implications. The results are related to other research findings in the literature and conclusions drawn. Recommendations are made on specific strategies that can be adopted as well as potential future studies.

6.2 DISCUSSION OF RESEARCH FINDINGS

This section evaluates the regression analysis, two-sample t-tests, ANOVA analysis and the descriptive statistical analysis of each variable as it relates to the literature. The discussion will endeavour to meet the research objectives by answering the research questions given in Chapter One, section 1.4 which are:

- To what extent do infrastructural needs affect the performance of Cisco Academies?
- To what extent do multi-culture needs affect the performance of students in the Cisco Academy programme?
- What is the quality of instructors in the Cisco Academy programme in South Africa?
- What are the main determinants of Cisco Academy performance?
- Do gender groups perform differently?
- Does the level of education affect the performance of students?
- Do students in different locations perceive the independent variables differently?
- Is the Cisco Academy programme making a positive contribution?

Conclusions on each variable are then drawn from the research findings.

6.2.1 Instructor quality

In Chapters One and Two, the literature review suggested that instructor quality is an important factor as far as student outcomes are concerned. According to Dennis et al. (2006), programme delivery factors that encompass the instructor's competence affect the student's performance. Bichelmeyer et al. (2006) further claim that the Cisco Academy course material is standard and this benefits teaching and learning.

In Chapter four, section 4.3.4, the multiple linear regression analysis of results established that one of the main determinants of Cisco Academy performance is instructor quality. The ANOVA results in section 4.3.8 also established that the different locations perceive the independent variables, including instructor quality, differently. The locations in Port Elizabeth and Bloemfontein were rated highly with respect to instructor quality and these two generally performed better than the rest of the locations. Academies with poor overall performance did not exhibit very good instructor quality. These findings mean that in order to increase Cisco Academy performance, management needs to improve instructor quality. Academies which ignore investment in instructor quality will perform poorly. This agrees with the claim of Dennis et al. (2006) that teaching factors affect student performance.

The descriptive statistics yielded an overall average mean score of 4.08 to show that the students are generally satisfied with the performance of the instructors. Of particular note are the high ratings of instructors with respect to knowledge of the subject matter and the finding that the students were very willing to continue with Cisco Academy courses with the same instructors. The instructors were found to be not so keen to make themselves available outside normal class hours. These findings mean that on the whole the Cisco Academy instructors are doing well. Cisco's framework of training and Quality Assurance plan pertaining to instructor training seem to be yielding positive results. In the plan Cisco gives stringent requirements for instructor training and the need to meet certain certification levels in order to be certified as a Cisco Academy instructor. It is also possible that instructors are not motivated enough to render assistance outside class hours. This calls for employee engagement strategies.

6.2.2 Technology tools

In Chapter Two, the literature review revealed that some researchers agree that educational technology improves student performance while some disagree. The works of Youssef and Dahmani (2008) looked at evidence for and against the utility of educational technology.

In Chapter Four, section 4.3.4, the multiple linear regression analysis of results established that one of the main determinants of Cisco Academy performance is technology tools. The ANOVA results in section 4.3.8 also established that the different locations perceive the independent variables, including instructor quality, differently. One of the best performing locations in Port Elizabeth was rated most highly with respect to technology tools. Academies that were more poorly rated did not score highly with regard to use of technology tools. It is important that management pays attention to the use of technology tools so that the overall academy performance is improved. While technology tools can be viewed only as teaching aids, they become mandatory for computer networking which needs visualizations and simulations in order to clarify deep concepts. Such findings are supported by the work of Ross and Bruce (2009).

The descriptive statistics in section 5.2.2 gave an average mean score of 3.88 to indicate a fairly high level of satisfaction with the use of technology tools. Nearly 70% of the respondents were satisfied. In addition, the descriptive statistics revealed that visualization, collaboration and handling of difficult concepts are made easier through the use of online discussion tools, multimedia flash objects, video clips and the packet tracer simulation tool. The packet tracer simulation tool seems to be rated highest as it received more than 80% support with a mean score of more than 4.20 for its use in explaining difficult concepts and also in promoting collaboration. In order to improve overall student outcomes it is important that instructors are encouraged to make use of the packet tracer tool. Difficult concepts can be explained easily using this tool and greater collaboration and interaction can be realized.

From the results in section 4.3.7, technology tools were also found to be the greatest determinant of CCNA practical results. The main tool for simulation of practical computer topology is packet tracer. This is further evidence of the utility of the packet tracer tool in conducting practical exercises.

6.2.3 Supporting infrastructure

In Chapters One and Two, the literature review gave a measure of support to the positive effect of infrastructure development on ICT. Ng'ambi (2006) argues that Infrastructure development is critical to the success of ICT. On the other hand, Ngwenyama, et al. (2006) finds inconclusive evidence about the effect of infrastructure development in the growth of ICT in developing countries.

In Chapter Four, section 4.3.4, the multiple linear regression analysis of results established that supporting infrastructure is not a significant determinant of Cisco Academy performance. This seems to support the findings of Ngwenyama, et al. (2006). Improving the supporting infrastructure would not necessarily lead to an improvement in the Cisco Academy performance. There seem to be other factors that compensate for this.

From the descriptive statistics in Chapter Five, section 5.2.4, it is evident that the training rooms have proper ventilation with 80.7% of the participants agreeing. Students were also happy with the actual personal computers being used as 72.3% of the respondents reported satisfaction with a mean score of 4.06. However the accessories such as network cables and the actual networking devices such as routers and switching are more critical. Only about 50% of the students were happy with the cables and sharing of the networking devices. The maintenance of computers and internet speeds also had about 50% support which is not so good. This may explain why a simulator like packet tracer is particularly popular as discussed in section 6.2.2. Management needs to improve investment in the actual laboratory networking gear and maintenance so that satisfaction levels are enhanced. This will, however, not necessarily improve the overall performance.

6.2.4 Multi-culture needs

In Chapter Two it was found that Meier and Hartell (2009) claim that cultural diversity in educational institutions will lead to prejudices, tensions and ultimately poor performance if they are not addressed by teachers. With South Africa's well-known cultural diversity such a claim seemed reasonable.

In Chapter Four, section 4.3.4, the multiple linear regression analysis of results established that multi-culture needs are not a significant determinant of Cisco Academy performance. It appears that management would not improve Cisco Academy performance by paying particular attention to cultural diversity.

From the descriptive statistics in section 5.2.6, there is evidence that the students could easily collaborate amongst themselves. About 70.5% of the respondents reported easy collaboration amongst themselves. The mean score for such a perception was 3.99. About 62% of the respondents also reported that cultural differences were handled in a mature manner. General multi-culture questions seemed to be rated much more highly than specific questions which, combined with the ease with which there is collaboration, points to general maturity among course participants. Overall students were satisfied with the handling of multi-culture needs. It appears that management simply needs to uphold the sensitivity with which they are currently handling multi-culture needs without inordinately attending to this matter.

6.2.5 Accessibility

Accessibility has to do with the closeness of academies, the ease with which students enrol for classes at a particular academy and the adequacy of the transport system to their academies. Findings on this variable would have a bearing on Cisco Academy growth strategies in South Africa.

In Chapter Four, section 4.3.4, the multiple linear regression analysis of results established that accessibility is not a significant determinant of Cisco Academy

performance. Management should not expect to increase academy performance with respect to accessibility.

From the descriptive statistics in section 5.2.3, the highest mean score of 4.04 was scored for students who agreed that the academies' timetables made it easy for them to attend classes. The percentage of such participants was 70.5%. It appears that whether part-time students or full-time students are involved, academies are doing well in this regard. Part-time students in particular pay a significantly high fee and academies seem quite responsive in order to tap into this market.

From the descriptive statistics, it is also worrisome that only 50% of the respondents consider their academies easily accessible by public transport. An even lower percentage of 41.6 agree that they travel short distances. It appears that Cisco Academies are too far apart. Cisco and the regional academy support centre need to identify areas where more academies can be opened to increase the convenience of access.

6.2.6 Motivation

According to the literature review in Chapter Two, motivation has a positive influence on student performance. Sansone and Harackiewicz (2000) claim that motivation energizes and directs behaviour towards a particular goal such as educational achievement. A highly motivated student is capable of sustaining interest and effort through the course (Bateman and Snell, 1999).

In Chapter Four, section 4.3.4, the multiple linear regression analysis of results established that motivation is not a significant determinant of Cisco Academy performance. If management were to increase the motivation of students, this would not necessarily improve student performance. This goes against popular research findings. However it is possible that technology tools, standard curriculum and high instructor quality compensate for the need for motivation.

The descriptive statistics in section 5.2.5 show that students are generally motivated. The students generally lacked initial interest as only 41% of the students claimed to

have had relevant knowledge about the courses. This points to the need to also take some of the participants through the introductory networking courses such as Information Technology Essentials which teaches basic networking concepts. It is also important to note that about 84.9% of the respondents reported that the Cisco courses were important for their career development. Such responses gave a mean score of 4.33. It appears that after going through the course, the students become even more convinced of the value of the course and this is further heightened by their experience in industry. Further corroboration of the value of the Cisco course is the observation that 74.7% of the respondents maintained a high interest in the course. Such findings attest to the value of the Cisco Academy programme as well as the quality of the curriculum and instruction which seems to generate the required motivation.

6.2.7 Perceived Academy performance

The perceived academy performance was introduced as a dependent variable to take care of the short-comings of the CCNA exam scores which essentially had one measure. The variable measured the way students perceived their performance.

From the descriptive statistics in section 5.2.7, the highest mean scores of 4.40 were scored in support of the increased knowledge and skills that the respondents possessed after undergoing training in the Cisco Academy. More than 80% of the respondents agreed that they possessed significantly more knowledge and skills after the training. The Cisco Academy programme seems to be imparting useful skills and knowledge to the trainees. Further evidence of the overall value of the Cisco Academy programme is found in the observation that about 72% of the respondents were satisfied with such performance and this was at a high average mean score of 4.03. The government and educational institutions need to adopt the Cisco Academy programme so that they can increase the computer networking skills base. In Uganda, the CCNA programme has been accorded diploma status by the Higher Education ministry.

6.2.8 Other findings

There are a few other findings from Chapter Four which warrant discussion and these are:

- According to section 4.3.9.1, there are no significant differences among gender groups as far as their performance in CCNA written and practical examinations is concerned. This means that it is not necessary to have a differentiated treatment when it comes to the actual teaching of male and female students. Both are equally capable.
- Diploma holders performed better than matric certificate holders. It may be necessary to first give matric students an introductory course in computer networking before CCNA in order to improve their results. Alternatively, they may have to do a preliminary CCNA (CCNA Discovery) course which is designed for students who may not be well-endowed with problem solving and analytical skills but approach networking from an application standpoint. This course is different from CCNA Exploration which is designed for students with advanced problem-solving and analytical skills and knowledge.
- The locations differ with regard to the way they view the independent variables except for motivation. This means that academies are quite different and do not require a one-size-fit-all approach to performance issues. As much as possible each academy should be evaluated as an individual.

6.3 RECOMMENDATIONS

In order to address the main research objective and also the secondary objectives, the following recommendations are made at government level, academy level and at the level of Cisco Systems.

6.3.1 Government level

The recommendations for the South African government are:

- Ensure that the number of teachers in mathematics, science and engineering are increased. These provide the bedrock of training for ICT students. Subject matter experts can easily be trained as trainers.
- Provide more financial support to institutions such as FET colleges and Universities of Technology. FET colleges are vocational in nature but do not attract the best instructors owing to poor financial rewards and working conditions. Funding is also needed to buy and maintain appropriate laboratory equipment.
- The government needs to increase the number of ICT training centres in order to remove the inconvenience being experienced by students in accessing Cisco Academies.
- Promote the adoption of the Cisco Academy programme by universities, colleges and schools. This will increase the ICT skills base.

6.3.2 Cisco Academy

The recommendations for the Cisco Academy management are:

- Invest in instructor training. The Cisco Academy should go beyond the initial training and invest in Professional Instructor Development. Cisco Systems runs workshops for instructors through the internet and also periodically at specific physical locations.
- Provide favourable working conditions for their instructors. Since instructors are marketable even to the non-academic industry, remuneration and general work conditions need to be attractive in order to retain this exceptional talent.
- Adopt employee engagement strategies such as recognition, making the work more stimulating and rendering more management support. This assists in improving morale and staff retention.
- Encourage instructors to make use of technology tools to enhance learning. Technology tools such as packet tracers increase collaboration and explain difficult networking concepts easily. Instructors who cannot use the packet tracer need to be trained.

- Cisco Academies need to invest more in laboratory equipment to improve the student-to-equipment ratio. It is also important to ensure that all laboratory equipment is properly maintained.
- Introduce basic Information Technology courses to prepare students for the CCNA course.
- Provide different CCNA courses depending on the level of problem-solving and analytical skills possessed by the student. CCNA Discovery can be used for matric students while CCNA Exploration should be given to students with advanced analytical and problem-solving skills.

6.3.3. Cisco Systems

The recommendation to Cisco Systems, the owners of the Cisco Academy programme are:

- Increase Instructor Professional Development opportunities. There is a need to increase such opportunities and do this in a flexible manner. More training via web-conferencing platforms would reach out to instructors. This will further enhance instructor quality.
- Pay closer attention to quality management and monitoring. Instructors who do not meet the quality requirements should be obliged to meet such requirements for the sake of ensuring quality.
- Continue to invest in the development of technology tools such as packet tracer and multimedia tools. Packet tracer should be improved continuously in step with technological changes so that it has wide use in the Cisco Academy courses.
- Embed packet tracer in all Cisco Academy courses. Some courses do not make much use of the packet tracer tool.
- There is a need to improve on the quality of accessories like cables since these seem to give students problems. Shorter cables may also need to be used since these are less susceptible to damage.
- Cisco Systems needs to work with the regional Cisco Academy Support Centre and identify areas where new academies can be opened. This will

remove the inconvenience being experienced by students in accessing academies.

- Improve the content of the Information Technology Essentials course to include more basic networking concepts.

6.4 LIMITATIONS OF THE STUDY

The study did not include extensive research in the other types of institutions such as high schools and FET colleges. The South African government views FET colleges as part of a broad solution to fixing the ICT skills shortages in the country. Kiewiets (2005) carried out a study on student performance that focused on FET colleges and made interesting findings. These institutions have a set of their own peculiar challenges which can yield a wealth of information and more significant insights. The study was limited by the decision to use only graduates from the CCNA 4 course. FET colleges and schools may be offering the CCNA curriculum but at the moment they do not have CCNA 4 graduates.

There was little participation by provinces such as Gauteng and Limpopo. In part this happened due to the difficulties experienced in obtaining ethical clearance. A wider participation of South African institutions and a bigger sample would have yielded results of greater statistical significance.

6.5 CONCLUSIONS

The South African government is fully aware of the acute shortage of ICT skills. A flurry of interventions has been made without significantly improving the situation. The Cisco Academy programme complements the efforts that the government has been making.

It was established that the main determinants of Cisco Academy performance are instructor quality and use of technology tools. The Cisco Academy programme is a comprehensive programme with a Learning Management System and comes with ready-made curricula and free technology tools to assist in teaching and learning. It appears that these features contribute greatly to high academy performance and

management needs to ensure that instructor quality and technology tools are employed.

The study established that participant students in the Cisco Academy value the Cisco Academy programme greatly. The South African government and educational institutions could do the nation a favour by adopting the Cisco Academy programme as a tool in fighting the ICT skills shortage which to date has been a perennial problem. This calls for more investment in the establishment of such institutions.

6.6 RECOMMENDATIONS FOR FURTHER STUDIES

The study raised some issues that call for further probing in order to fully understand the performance of the Cisco Academies. It was established that only technology tools and instructor quality are the significant determinants of academy performance. It may be possible that these could be compensating for shortfalls of other variables such as motivation, multi-culture needs and infrastructure. It could be important to reconstruct the conceptual model and establish if there are any relationships amongst these variables.

Academy performance was measured from the perspective of students only. However administrators and management of the Cisco Academies are key stakeholders. The government and employers are equally important. The study could have been broadened to capture the views of such important role-players.

The Cisco Academy programme has a special emphasis on disadvantaged members of the community such as women, the disabled and those in remote areas. These groups were not really addressed. It would be useful to establish if the same factors investigated are applicable and the extent of their impact.

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ANNEXURE 1: THE QUESTIONNAIRE COVERING LETTER



Nelson Mandela
METROPOLITAN UNIVERSITY
Business School
Leaders for tomorrow

Dear Respondent

I am studying towards my MBA (Masters in Business Administration) degree at the Nelson Mandela Metropolitan University Business School. I am conducting research on how to improve the academic performance of Cisco Academies in South Africa. I believe that my study will make an important contribution to the improvement of ICT education in South Africa.

You are part of our selected sample of respondents whose views we seek on the above-mentioned matter and therefore request your consent to participate in this study. We would therefore appreciate it if you could answer a few questions. It should not take more than fifteen minutes of your time and we want to thank you in advance for your co-operation.

There are no correct or incorrect answers. Please answer the questions as accurately as possible. For each statement, tick the number which best describes your experience or perception. For example, if you strongly agree with the statement, tick the number 5. If you strongly disagree with the statement, tick the number 1. **Tick only one answer for each statement and answer all questions please. Please note also that the word “firm” refers to the public institution your work for.** Please also note that your participation is voluntary and you can withdraw from this study at any time if you so wish.

Thank you very much.

Mr Gratitude Kudyachete (Tel. 041-5043175)

The ethics clearance reference number for this research is H12-BES-IOP-016. To verify the authenticity of the study, please contact Prof CA Arnolds at 041-5043825.

ANNEXURE 2: THE MEASURING INSTRUMENTS

INFRASTRUCTURE

In my university/ college, there are/were enough computers in the training laboratory.

In my university/ college, the computers are/ were always in good working condition.

In my university/ college, the speed of the internet access is/was good.

In my university/ college, the Internet is/was always available.

In my university/ college, the number of people sharing networking equipment during laboratory exercises is/ was small.

In my university/ college, the laboratories are/were large enough for the numbers of students in the class.

In my college/ university, the training room is/was properly ventilated / air-conditioned.

In my college the laboratory is/was available after class hours for me to continue working.

In my college/university, the networking equipment and cables are/were always in a good condition.

TECHNOLOGY

In my Cisco Academy courses, the use of tools such as packet tracer increases/ increased student collaboration.

In my Cisco Academy courses, the use of multimedia flash objects /animations helps/ helped to clarify networking concepts.

In my Cisco Academy courses, the use of packet tracer helps/ helped to clarify networking concepts.

In my Cisco courses, the use of video clips helps/ helped me to understand networking concepts.

In my Cisco Academy courses, the use of technology tools like flash objects/animations and packet tracer helps/ helped me to score better marks.

In my Cisco Academy courses, the use of technology tools helps/ helped to improve my overall learning.

In my Cisco Academy courses, the availability of on-line discussion tools helps/ helped me to understand networking concepts.

INSTRUCTOR QUALITY

The instructors of my Cisco Academy courses present/ presented concepts in an understandable way.

The instructors of my Cisco Academy courses have/had good knowledge of their subjects.

The instructors of my Cisco Academy courses answer/ answered student questions in a satisfactory way.

The instructors of my Cisco Academy courses are/were helpful during the conduct of laboratory exercises.

If given a/ another chance, I would take more courses with my Cisco Academy instructors.

My Cisco Academy instructor is/ was available for consultation outside of normal hours.

My Cisco Academy instructor makes/ made the topics interesting.

MULTI-CULTURAL NEEDS

In my Cisco Academy courses, sufficient measures are/were taken to deal with the students' language difficulties/weaknesses.

In my Cisco courses, the cultural differences are/ were handled in a mature manner.

In my Cisco Academy courses, harmony is/was created among people of different cultures.

In my Cisco Academy courses, students of poorer education backgrounds receive/ received the necessary assistance.

I enjoy/enjoyed the cultural diversity in my Cisco Academy classes.

In my Cisco Academy courses, I can/ could collaborate with people of different ethnical backgrounds easily.

MOTIVATION

Before starting the class, my interest in the Cisco Academy courses was very high.

I maintain/maintained a high interest in the Cisco Academy courses.

The Cisco Academy courses are/were very important for my career development.

The skills and knowledge that I had before starting the Cisco Academy courses are/were relevant to these courses.

I enjoy/enjoyed talking about the Cisco Academy courses to other people.

I enjoy/ enjoyed the Cisco Academy course material that challenges/ challenged me.

ACCESSIBILITY

I travelled a short distance to the Cisco Academy.

The Cisco Academy was easily accessible through public and private transport.

It would have been better to have another Cisco Academy closer to where I stay/stayed.

The application process for a place in the Cisco Academy is/ was user-friendly.

The Cisco Academy which I attend/ attended is/ was the only choice available to me.

The timetable for Cisco Academy courses at my university/college makes/made it easy for me to attend classes.

ACADEMY PERFORMANCE

Considering the amount of money and effort I put into achieving good results in my Cisco Academy courses, I believe I am doing well.

I am successful in achieving the results I want in my Cisco Academy courses.

The marks in my Cisco Academy courses are above average.

My results in my Cisco Academy courses make my studies worthwhile.

The computer networking knowledge I now have is more than what I had before studying the Cisco Academy courses.

The computer networking skills I now have are more than what I had before studying the Cisco Academy courses.