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A MODEL TO REDUCE THE DIVIDE BETWEEN SOUTH AFRICAN SECONDARY INSTITUTIONAL SKILLS AND KNOWLEDGE, AND THE ENTRANCE REQUIREMENTS FOR AN INFORMATION TECHNOLOGY DIPLOMA COURSE

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DEDICATION

This dissertation is dedicated to my wife Linda and our family.

ABSTRACT

Historically, access to information technology (IT) in South Africa educational institutions has been socially stratified. As a result, many new learners seeking to enter South African tertiary institutions fail to meet the requirements of their preferred course and institution. In 2003, the Department of Information and Communications Technology at the Vaal University of Technology (VUT), in conjunction with the National Institute for Information Technology (NIIT), an internationally recognised IT organisation, introduced a short course named the Information Technology Boot Camp (ITBC). This course is now known as the Introduction to Information Technology course (Intro-to-IT). The course is targeted at learners who want to study the IT diploma at the VUT but, who as a result of their Matriculation marks, do not meet the VUT's entrance requirements. The aim of the course is to prepare and qualify these learners for possible acceptance into the IT diploma at the VUT. Although the Intro-to-IT course has impacted positively on the VUT, research has found that learners progressing from the Intro-to-IT course into the IT diploma course experience difficulties in solving programming problems in a logical way. Therefore, the failure rate in Development Software 1, a first-semester programming subject, is relatively high.

The model described in this study encompasses alterations (implemented and still to be implemented) to the syllabus and content of the Intro-to-IT course, changes to the learning methods and time frames for subjects, and the measurement of these changes in comparison to previous results. The model also includes a software program, which will assess the Intro-to-IT applicants, store results and provide analytical data on all learners' marks and results for the Intro-to-IT short course at the VUT. This model is designed to provide the necessary skills, knowledge and basic logic required to allow successful Intro-to-IT learners the opportunity of success when they enter the VUT's IT diploma stream.

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LIST OF ACRONYMS

CS&IS	Computer Science and Information Systems
CPUT	Cape Peninsula University of Technology
HG	Higher Grade
ICT	Information and Communication Technology
IT	Information Technology
ITBC	Information Technology Boot Camp
NIIT	National Institute for Information Technology
NMMU	The Nelson Mandela Metropolitan University
RU	Rhodes University
SA	South Africa
SFP	Science Foundation Programme
SG	Standard Grade
TUT	Tshwane University of Technology
UCLA	University of California Los Angeles
UKZN	The University of Kwazulu Natal
UP	University of Pretoria
UPE	University of Port Elizabeth
UPEAP	University of Port Elizabeth Advancement Programme
UWC	University of the Western Cape
VUT	Vaal University of Technology

CHAPTER 1 – PURPOSE OF THE STUDY

1.1 INTRODUCTION

In South Africa, access to information technology (IT), particularly in education, is socially stratified. This has resulted in vast proportions of the population being computer illiterate. Consequently, many new learners entering tertiary institutions have no knowledge or experience in computers (Änderung 2005). Many learners wishing to enter South African tertiary institutions fail to meet the requirements of their preferred course. These requirements are based on secondary school Matriculation or equivalent certificate. In the case of the Vaal University of Technology (VUT), this is determined by the Swedish scale (see Section 2.8), an accepted and proven measuring tool that has been used by the VUT for many years.

The Department of Information and Communications Technology at the VUT embraced the opportunity to address the imbalances in computer-literacy skills, knowledge and problem solving by introducing, in conjunction with the National Institute of Information Technology (NIIT), the Introduction to Information Technology (Intro-to-IT) course, originally named the Information Technology Boot Camp (ITBC). The NIIT is an IT organisation that mainly deals with work in the field of IT education and training (Wikipedia 2007). The NIIT is spread over 30 countries in the Americas, Europe, Asia, Middle East, Africa and Australia/Oceania. The NIIT blends classroom learning with online learning. The NIIT runs the global IT Learning Solutions Corporation, which is known for its pioneering work in the field of IT education and training. The NIIT's strong research orientation has helped it to innovate continuously in the areas of instructional design methodologies and curricula development. The Corporation provides a comprehensive education environment to individuals and enterprises, offering training that is customised to the varied needs of audiences from diverse backgrounds (NIIT 2006).

The VUT and NIIT presented the ITBC course for the first time in 2003. The ITBC course served as an introduction to the IT diploma at the VUT, where successful learners who did not continue with the IT diploma were afforded the opportunity to obtain a recognised certificate from the NIIT.

Entrance requirements for this course originally included a Matriculation or equivalent qualification that was translated into points on the Swedish scale. According to the Swedish scale, a minimum of 22 points were required. In addition, learners had to have attained at least an E symbol for both mathematics and English, either on standard or higher grade.

The course duration is six months, as it was initially, which constitutes one semester. The course consists of three modules (see Section 2.10). The first module (see Section 2.10.1) consists of life skills, numeric skills and communication skills. The life skills component aims to teach the learner time management, basic financial and social skills and to arm them with the ability to adapt to an unfamiliar social environment. The numeric skills component aims to stimulate learners' numerical, logical-thinking and problem-solving skills. The communications skills component aims to stimulate learners' vocabulary, language and reading skills (Van Staden 2004). The second and third modules (see Sections 2.10.2 and 2.10.3) introduce the learner to computers, basic computer skills, operating systems and the Microsoft Office suite.

Tshwane University of Technology (TUT) offers a similar course, which has been classified under Foundation Studies (see Section 2.2). The aim of this course is stated as being to improve the learners' knowledge and application of basic science and mathematical concepts, and to develop their ability to express scientific thought logically and systematically in an appropriate language (Tshwane University of Technology 2006).

Subsequent to the implementation of the Intro-to-IT course, it was found that the aims of NIIT and that of VUT differed. The NIIT format was presented from the

premise that learners entering the Intro-to-IT course were equipped with the fundamental skills, knowledge and problem-solving abilities gained in secondary school, which in the South African context is not always the case. A mutual agreement was reached whereby the VUT decided to present its own short course, designed exclusively to introduce the learners to IT at the Institution, and to prepare them for the VUT's IT diploma. The syllabus for the course was initially adapted to suit the South African context, but was still based largely on the NIIT format.

Learners who have advanced from the Intro-to-IT course to the IT diploma at the VUT have difficulties with subjects in their first semester. The Computer Sciences' Faculty members are not convinced that the course adequately prepares the Intro-to-IT learner for the IT diploma (Mabuza 2006). Assessed applications and results for the Intro-to-IT course are not, at present, captured on any database or application system. When a learner advances to the IT diploma, his/her results are captured on a VUT system. There is no tool or application available to record and assess the learner's entrance qualifications relating to Intro-to-IT, and utilise these for evaluation, data analysis and analytical purposes.

1.2 BACKGROUND TO THE RESEARCH STUDY

This research was conducted to determine whether the Intro-to-IT short course is achieving its purpose, and to identify any gaps between the logical thinking of learners exiting secondary school and the requirements for logical thinking in the VUT's IT diploma course. As part of the research, an investigation was undertaken to determine what other South African universities of technology are doing to address the problem of logical thinking and problem solving, which results in low pass rates in the discipline of computer science.

The study focuses on the development of a model aimed at reducing the gap between existing and required knowledge, skills and problem-solving abilities of Intro-to-IT applicants, in order to adequately prepare and equip them for the IT

diploma course. The other component of this work will involve creating a database using Mysql. The database will be used to assess and record applicants' qualifications, using the VUT's criteria. The database will also track the results of both Intro-to-IT learners and first-semester IT diploma learners. This data will be used to provide historical and statistical information, which will then be used for analytical purposes. In addition, extensive programming will be done using Visual Basic. Visual Basic has key features like ActiveX-based components, Visual C++, Visual FoxPro, Visual InterDev, Visual J++, Visual SourceSafe and a comprehensive MSDN Library. Furthermore, the program will create reports, graphs and other related documents using Crystal Reports. Crystal Reports can be used to save reports in a variety of file formats, including .rpt, .doc, .xls, .rtf, and .txt.

1.2.1 Low pass rates in major information technology subjects

The objectives of the Intro-to-IT course were to improve pass rates, broaden access, improve problem-solving skills through cognitive strategies and overcome the gap between secondary and tertiary education, by improving strategic learning skills. It was expected that the Intro-to-IT course would specifically assist learners with subjects requiring logical thinking and problem-solving skills when these learners entered the diploma stream. This has not materialised. Table 1 shows the pass rate for first-semester Software Studies I prior to the inception of the Intro-to-IT course. This poor pass rate was one of the reasons for the introduction of the course.

Table 1: Pass rates of Software Studies 1 prior to the Introduction to Information Technology course

Year	Software Studies 1 (%)
1997	64
1998	48
1999	44
2000	36
2001	45
2002	47

After the introduction of the Intro-to-IT course in 2003, pass rates for the subject did improve; however, not to the extent hoped for or predicted by the VUT. The following table, Table 2, shows the pass rates for semester-one and semester-two Software Studies 1, 2004. This percentage represents all learners who completed Software Studies 1 as a subject in these semesters, and not only the Intro-to-IT learners who had progressed to the IT diploma. The Intro-to-IT learners who entered this IT diploma subject were exposed to the original syllabus for the Intro-to-IT course.

Table 2: Pass rates for Software Studies 1 2004

Subject	Number of learners entered final examination	Number of learners failed	Average learner mark (%)	Pass rate (%)
Software Studies 1	119	43	54	64

As indicated in Table 3, in 2005 and 2006, after the inception of the Intro-to-IT course, the pass rates for the subject remained on average very similar.

Table 3: Pass rates of Software Studies 1 2005 and 2006

Year	Software Studies 1 pass rate (%)
2005	62
2006	65

1.2.2 Syllabus for the Introduction to Information Technology

The pass rates of the IT diploma's Software Studies 1 may be influenced by the way the syllabus has been designed in the Intro-to-IT course. This syllabus is critical in assessing learners' skills and knowledge, and preparing them for when they enter the VUT's IT diploma course. However, the programming syllabus needs to be balanced. Care should be taken to ensure that it is not over-simplified, as this will limit the learner's ability to adapt to different kinds of problems and problem-solving contexts in the future. Similarly, if the syllabus for programming

is too intensive, learners who have no prior exposure to computers will be overwhelmed and disadvantaged.

1.3 PROBLEM DEFINITION

Learners who have progressed from the Intro-to-IT course to the IT diploma are not performing as was initially expected and predicted, specifically in subjects requiring problem-solving skills and logical thinking. Lecturers in the Department of Software Studies and IT have experienced specific problems with teaching programming to those learners who progressed from the Intro-to-IT course. They indicate that these learners have insufficient knowledge of how to analyse a problem, how to use previous experience and how to use a systematic approach to plan, design and implement a problem solution. There is a discernable gap between what the average learner has, relating to logic and problem-solving skills, and what is required by the learner to succeed in programming subjects. Logic refers to “the science or art of exact reasoning, or of pure and formal thought, or of the laws according to which the processes of pure thinking should be conducted”, and problem solving to “the area of cognitive psychology that studies the processes involved in solving problems” (The Free Dictionary 2008).

No suitable software system is presently available to assess Intro-to-IT applications, record these applications or record the learners’ marks during the Intro-to-IT course. As such, it is not possible to analyse these data and provide statistical information for analytical and decision-making purposes.

1.4 RESEARCH OBJECTIVES

The following objectives have been formulated for this study:

- 1.4.1** Determine the skills and knowledge required to enable a learner to succeed in the IT diploma, first semester.

- 1.4.2** Determine if the content and syllabus of the Intro-to-IT course satisfies the requirements of the IT diploma.
- 1.4.3** Realign the Intro-to-IT syllabus, where necessary, to meet the requirements of the IT diploma.
- 1.4.4** Design, develop and implement a software application that will record and assess applicant's qualifications, according to the University's entrance requirements. In addition, this software package will record the Intro-to-IT course and first-semester IT diploma results, and provide statistical information for historical and analytical purposes.

1.5 RESEARCH METHODOLOGY

The following research methodologies were followed in this study:

1.5.1 Literature study

A comprehensive literature study on extended, introductory, foundation and bridging courses for IT was conducted using sources that included the Internet, correspondence with other tertiary institutions, interviews, journal articles, conference papers, online databases (Nexus, Emerald) and textbooks.

Intro-to-IT courses are offered locally and internationally; however, most of these courses are designed to improve basic computer literacy skills for employees of businesses. The Department of Information Studies, University of California Angeles (UCLA) presents an Intro-to-IT course but the course is not about programming or application-specific skills (see Section 2.2), and does not involve any laboratory work (University of California 2005). In South Africa, the Tshwane University of Technology (TUT) presents a similar course (see Section 2.2). The TUT Foundation Studies programme consists of a suite of fundamental subjects, including English, mathematics, computer literacy and life skills (Tshwane

University of Technology 2006). The Foundation Studies programme of TUT contains no programming content.

1.5.2 Empirical research

Quantitative information was obtained by means of feedback forms completed by learners and members of staff (see Annexure A). The feedback forms endeavoured to elicit respondents' understanding and perceptions of problems and challenges relating to the Intro-to-IT course. Quantitative analysis dealt with numerical measurements of data gathered relating to the learners' performance.

1.5.3 Action research

Action research has been defined as research that is embedded in action. Action research is distinguished by five phases: diagnosing and action planning, taking action, evaluating and specifying learning to be conducted in the research (Van Der Merwe 2006). Data were acquired during the presentation of the Intro-to-IT course over a period of four semesters. Based on these data, decisions were made and alterations implemented in the syllabus, assessments and duration of the modules. Data arising from these changes were then measured against the previous data. Then, through a process of iteration, action research was exercised.

1.5.4 Data analysis

The data were subjected to confidence measures, statistical pattern analysis techniques, variance measures and correlation. The collated data were related to the objectives of this research, within the context of the literature pertaining to IT courses.

1.5.5 Software development

Planning, design, and development and testing: The software planning, design, development and testing were conducted in one phase. A database application was developed as a proposed solution to improve learner assessment and the recording and analysis of data in the Intro-to-IT short course. This has been done using MS Access database, Visual Basic 6.0 and Crystal Reports.

1.6. BENEFICIARIES

The findings emanating from this study are likely to benefit not only the VUT's IT diploma learners, but also the VUT itself.

1.6.1 Benefits to the learners

A well-prepared learner, equipped with the necessary background knowledge, skills and problem-solving abilities required when entering the VUT's IT diploma, has an improved probability of success in his/her first semester. The learner who understands and is proficient in these skills will then be in a position to grasp and master the logic behind programming, as well as other first-semester IT diploma subjects.

1.6.2 Benefits to the Vaal University of Technology

The Intro-to-IT course is at present a valued source of learners for the VUT's IT diploma. Indeed, the majority of learners who enrol in the first-semester IT diploma are those who have progressed through the Intro-to-IT course. The VUT does not only require that there be sufficient learners enrolled for IT, but also that they progress successfully through the IT diploma. The VUT, as is the case with all tertiary institutions, must analyse pass rates and, to a certain extent an institution's performance is measured by these percentages. Adequately preparing learners for

the IT diploma will reflect favourably on the VUT's pass rates, which will improve the perceived image of the Institution.

1.7 CLASSIFICATION OF CHAPTERS

Chapter 2, Introduction to Information Technology, outlines the philosophy, nature, scope and content of the Intro-to-IT course. The teaching and learning styles and the assessment methods used in the Intro-to-IT course are described. The course is then compared with similar ones offered at other tertiary institutions in order to explain its relative advantages and disadvantages. The chapter also describes the selection criteria used at present, the syllabus, the depth of subject coverage and the weight factors allocated to each subject or topic for the course.

In Chapter 3, entitled Research Methodology, the different components of the quantitative research tools that were used to gather the information are discussed.

The fourth chapter, Learner Experiences, analyses the data collected in the questionnaires completed by a sample of learners who have completed both the Intro-to-IT course and at least one semester of the VUT's IT diploma.

Chapter 5, Introduction to Information Technology Software Tool, describes the functions and uses of the software package designed and built for the Intro-to-IT course. The chapter also discusses why this package was deemed necessary.

The objective of the sixth chapter, entitled Results and Recommendations, is to present the conclusions and recommendations arising from the findings of the study, as well as to provide a recapitulation of the study.

1.8 CONCLUSION

In this chapter, the research problem was stated, and the objectives and significance of the research were argued. The reader was introduced to the research

methodology, as well as to the structure that will be followed through the research report.

CHAPTER 2 - INTRODUCTION TO INFORMATION TECHNOLOGY

2.1 INTRODUCTION

This chapter explains the basic concepts involved in the Intro-to-IT course and relates the facts, figures and opinions derived from the literature review. Similar courses presented internationally and in other Universities and Universities of Technology in South Africa will also be discussed. What the VUT presently has and utilises will also be detailed. This will include the present infrastructure relating to the Intro-to-IT course at the Institution.

2.1.1 Introductory, bridging, extended and foundation courses

Many tertiary institutions throughout the world present courses that are aimed at preparing the learner in some way for a formal qualification at their institution. These courses carry various labels, including introductory, foundation, bridging or extended courses:

- Introductory courses are self-explanatory. The aim is to introduce the learner to the specific field for which the course is aimed.
- Bridging courses specialise in 'bridging' the knowledge and skills gap. This means that the aim of the course is to give the learner the specific knowledge and skills that will be required when this learner enters the higher qualification course. A bridging course is designed to equip students to take up a new subject or course by covering the gaps between the students' existing knowledge and skills and the subject or course prerequisites and assumed knowledge (AskOxford.com 2007).
- Foundation courses are courses where the learner is expected to build on the skills and knowledge imparted when entering the recognised qualification course. A foundation course is a preparatory course taken at some colleges and

universities, either in a wide range of subjects or in one subject at a basic level (Compact Oxford English Dictionary 2008).

- Extended courses are courses that have been extended to incorporate some form of introduction or foundation course.

What are the differences between a bridging course and an extended course? A bridging course is a special course designed to prepare the learner for a normal university or college course, usually in specialist areas such as mathematics or science. Foundation or preparatory courses are more general type courses that cover a range of topics and often last up to a year in full-time study. Extended courses are those where the time required to complete the qualification has been extended to accommodate some form of introduction or foundation course.

2.2 INTRODUCTION TO INFORMATION TECHNOLOGY

The VUT presents a semester short course called Intro-to-IT, formerly named ITBC. The term 'introduction to information technology' is broad, and may encompass many short- and long-term courses, covering many and various aspects of IT, including, but not limited to, computer literacy, programming fundamentals, databases, the Internet and electronic mail (e-mail).

The content of an Introduction to IT course may appear to be self-explanatory - prepare learners to enter into the IT field. As can be understood from the references in this chapter, this, however, is not always the case. Many courses available today introduce learners to the basics of IT, for example basic computer literacy; in others, the aim is to introduce learners to more advanced aspects of IT. These courses are usually designed to satisfy a specific need or perceived opportunity in the market place.

The Department of Information Studies at the University of California, Los Angeles, presents a similar course to the VUT's Intro-to-IT. The course is designed

to teach the fundamental concepts of IT in ways relevant to professional practice in the library, archival and informatics fields. It is not about programming or application-specific skills, and the course does not involve any laboratory work. This course, also called Intro-to-IT, does not prepare learners for an IT diploma (University of California 2005).

Western Nevada Community College presents a course titled Introduction to Information Systems and describes the course as follows: “This course introduces the learner to the role of the computer in the modern business environment. Learners will be introduced to the Internet, data base information, management systems, spreadsheets, and word processing. Upon successful completion of this course, the learner will be able to demonstrate survival skills on a computer, have a good understanding of the terminology for computers, and be productive with the use of software for the business setting”(Malkovich 2005).

A project of the Utah State Office of Education determined that all learners entering the IT field needed a basic core of skills. It was also determined that a course that teaches the basic skills IT employees need was not currently available. The Institution developed a course, also known as Intro-to-IT, to meet this need. This course is designed as a one-semester course, geared to learners who have determined that they have an interest in pursuing a career in the IT field, but are, as yet, not sure in which specific area. The course is exploratory in nature, with the goal of exposing learners to the four different programme areas in IT - information support and services, interactive media, networking systems and programming, and software development - to help them determine where their interests lie. Another goal of the course is to teach the foundation skills needed by all IT workers. Learners taking this course should have already obtained keyboarding proficiency, and completed the computer technology computer literacy course and/or possess the required competencies (Laing 2003).

The University of Nottingham offers one-year Foundation Programmes in business, science, engineering and international communications to enable students

who do not have the required qualifications to gain entrance to undergraduate degree programmes in the United Kingdom (UK). The foundation year is not intended for students who have unsuccessfully tried to gain entry according to the normal entry requirements. The foundation year is ideally meant for international students, as it is an opportunity to improve English-language skills whilst adapting to life at one of the UK's top universities. English-language classes are also available before the start of the foundation year for students who need extra support. Students who successfully complete the Science/Engineering Foundation Programme are guaranteed progression in to certain BEng/MEng/BSc degree programmes at the University of Nottingham (University of Nottingham 2006).

The University of Johannesburg offers bridging/foundation courses and states that, "foundation courses are offered to learners who do not qualify for formal undergraduate degree programmes, but might qualify for them under certain conditions. These foundation courses lead to a certificate qualification, which will be integrated with normal mainstream degree programmes, and include some general, credit bearing first year courses" (University of Johannesburg 2006).

The University of Kwazulu Natal has also initiated similar extended courses, named "Alternative Access Programmes". Many prospective students come from school backgrounds that have not equipped them for admission to the University, based on their Matriculation points. The University of Kwazulu Natal has developed innovative alternative access programmes to identify candidates who have the potential to succeed at the University. Students identified by the programmes are recommended to the relevant faculties. The Science Foundation Programme (SFP) is a one-year access programme for applicants from disadvantaged schools who do not have a Matriculation exemption, but who wish to pursue a degree in the sciences. A Senior Certificate is required, with 20 or more points and a standard grade F for mathematics and physical science, and biology or agricultural science. Applicants are required to write a selection test.

Successful completion of the SFP offers entry into a Science degree (University of Kwazulu Natal 2006).

The University of Port Elizabeth (UPE) offers a foundation course for different disciplines and, although not specifically for the IT field, they state that as part of its transformation process, the UPE identified the need to change the traditional routes of access into the University to widen access to the broader community. During a strategic planning seminar of the Joint Planning Group of the University in May 1997, an access task team was established to investigate this. One of the recommendations of the task team was the introduction of a foundation year for under-prepared and unprepared learners. In September 1997, the Executive Management of the UPE approved the introduction of a zero-level programme for the Faculties of Sciences and Economic Sciences and the Department of Pharmacy, in the Faculty of Health Sciences. The UPE intends to research the success of the programme thoroughly before taking a decision to extend it to other faculties (University of Port Elizabeth 1998).

The University of Port Elizabeth's Advancement Programme (UPEAP) bridges the gap between the final year of secondary school and the first year of university studies in order to open up new routes of access into higher education, and to provide students with a solid foundation that will increase their chances of success in their studies. The UPEAP equips students with the life and study skills (for example, critical thinking, problem solving, communication, computer literacy, time management) that they will need to study for a degree. Students also gain basic knowledge and understanding of the subjects that they will study when they enrol for a degree (University of Port Elizabeth 1998).

The University of Pretoria (UP) also recognised this need. UP's Faculty of Natural and Agricultural Sciences state, "In addition to the normal degree programmes, the Faculty also offers a BSc Extended Programme which is a one-year extension of our normal study programmes. This provides an opportunity to students who do not meet the minimum admission requirements for the programmes mentioned in

this prospectus, but who show the potential to learn the necessary skills when given the opportunity” (University of Pretoria 2007b). The overall aim of this programme is to bridge the gap between the final year of secondary school and the first year of studies at the University in order to increase the number of well-prepared learners entering the above-mentioned faculty.

Rhodes University (RU) argues that it is in the interest of all their learners that the standards of their degrees be maintained - nobody wants a degree that is not respected worldwide. The University has set up foundation programmes in commerce, science and the arts, in which under-prepared learners may select a mixture of standard (full) courses and special foundation courses, designed to prepare them thoroughly for other standard courses that will follow. Learners admitted to these three faculties who do not meet the ‘minimum requirements’ are urged to plan for four-year degrees, based on their faculty's foundation programme (Swiltzer 2003).

The University of the Western Cape (UWC) must establish, as soon as possible, its own version of a first-year foundation programme for learners who do not meet the University’s entrance standards. Entrance to the foundation programme will be based on Matriculation-exemption results and on entry-level tests that measure English-language literacy and numerate skills. The purpose of the programme will be to prepare students for university-level education. It is anticipated that most UWC learners will be required to enter the foundation programme, which will effectively extend the undergraduate degree to four years (Swiltzer 2003).

The TUT presents foundation courses for different faculties and states “the purpose of Foundation Studies is to improve the learner’s knowledge and application of basic science and mathematical concepts, and to develop his/her ability to express scientific thought logically and systematically in appropriate language. The programme consists of a suite of fundamental subjects, including English, mathematics, computer literacy and life skills. It also includes core subjects such as physics and chemistry, as well as core and elective subjects that will introduce the

learner to engineering, natural sciences, health sciences, Management and economic sciences or information and communication technology, depending on his/her field of choice. The identified need for a one-year IT Foundation programme at TUT was based on the following observations:

- A large number of learners are unable to grasp or convey what they have learned, logically, systematically and in scientific language.
- The use of English as the medium for teaching and learning means that the majority of learners now enrolled at the Institution have to learn and interpret their learning in a language other than their home or first language, and this is often an obstacle to successful learning. There is a need for communication programmes to develop competence in grasping and conveying concepts of the learning material at a level indicative of higher education thinking and reasoning.
- Mathematical competence (including numeracy) is identified as an area that put learners at risk. A high number of learners cannot manipulate mathematical concepts to solve problems.
- Study skills for most learners are less than adequate. Such skills are considered essential when introducing learners to a particular science's knowledge and conceptual base" (Tshwane University of Technology 2006).

The Nelson Mandela Metropolitan University (NMMU) also presents an extended course named Extended Programme: Information Technology (Software Development). "The course duration is two years and the objectives are to provide students, who do not meet the minimum requirements for admission to the mainstream courses, with an opportunity to do their first year over two years. The requirements for a learner to enter this extended programme are a senior certificate with at least two subjects on the higher grade". They also state "although there are no compulsory subjects, mathematics and computer studies are recommended" (Nelson Mandela Metropolitan University 2006).

Introductory courses are not a new concept. Many tertiary institutions worldwide have introduced their own form of introductory course to fulfil their perceived requirements. The Utah State Office of Education wish to improve on learner's basic core of skills (Laing 2003) before entering the IT stream and the Department of Information Studies at the University of California teach the fundamental concepts of IT in ways relevant to various professions (University of California 2005). Globally and nationally introductory courses have been initiated to fulfil various requirements and needs. In South Africa, one of the main driving forces behind Intro-to-IT courses in most tertiary institutions was to address imbalances in the secondary education structures. An Intro-to-IT course may cover a wide spectrum of knowledge and skills to be learnt, and vary from institution to institution. The content of these courses differ according to the aims of the institution relating to the course, which are sometimes based purely on the market needs in that area.

Universities in South Africa have introduced their own foundation courses, as is the case of the University of Pretoria with their Extended Programme (University of Pretoria 2007b) and the University of Port Elizabeth's Advancement Programme (University of Port Elizabeth 1998). In the case of Universities of Technology in South Africa, Tshwane University of Technology presents foundation courses for different faculties (Tshwane University of Technology 2006). The VUT's the aim of the course is to prepare a learner to enter into the VUT's IT diploma programme. The concept of the course and its aim has changed from its inception to one that should enable the Institution to enrol more learners for the IT diploma programme on its various campuses.

2.3 INTRO-TO-IT AT THE VUT

The aims of the Intro-to-IT Course at the VUT are to:

- improve pass rates in the IT diploma course
- broaden access

- improve problem-solving skills through cognitive strategies
- overcome the gap between secondary and tertiary education, by improving strategic learning skills.

Advantages and Disadvantages

Advantages and Disadvantages

2.3.1 Advantages and disadvantages

2.3.1.1 Advantages

The Intro-to-IT course is not a prerequisite for the diploma/degree in information and communication technology (ICT). Normal entrance criteria still apply to any student wishing to enter directly into the IT diploma stream. Initially the VUT, in conjunction with NIIT, successful Intro-to-IT learners were rewarded with certificate from NIIT, which is an internationally respected global learning solutions corporation (NIIT 2006). Intro-to-IT being no longer presented in partnership with NIIT, issues no certificate to the successful learner (see Section 1.1). Nonetheless, learners who successfully complete the VUT's Intro-to-IT course have the following advantages:

- Learners who previously did not qualify to enter an IT diploma programme are now afforded the opportunity.
- Learners possess skills that are marketable in the work place.
- The majority of the learners accepted into this course come from previously disadvantaged communities. In the long-term, this course assists with the betterment of these respective communities, and addresses imbalances in the employment arena inherited from previous government policies.

The advantages of the Intro-to-IT course to the VUT are as follows:

- The course enables the VUT to register more first-semester IT diploma learners due to successful Intro-to-IT learners advancing to this course.

- The VUT gains financially benefits from the Intro-to-IT course, as it is a means of income for the University.
- Offering the course poses no financial risk to the VUT. According to the fee structure, a learner who has not paid in full for a module prior to commencement of that module is not accepted for the module.

2.3.1.2 Disadvantages

The VUT's Intro-to-IT course also has certain disadvantages:

- The VUT decided to classify their Intro-to-IT course as a short course, and is classified as an Entry-level Certificate as it is not a bridging, foundation or extended course, and, because it is offered over a four-month period, the learners obtain no credits towards the mainstream diploma.
- This course is not covered by state subsidy.
- A learner who successfully completes Intro-to-IT:
 - does not receive a recognised qualification,
 - is only eligible to progress to an IT diploma programme in the ICT department at the VUT, as the course is not recognised by the other faculties of the Institution,
 - cannot enrol in another institution's IT diploma course, as the VUT's Intro-to-IT is not recognised by other tertiary institutions, and
 - has a three-and-a-half-year time period before obtaining a recognised qualification.
- An Intro-to-IT learner is not recognised as a full-time learner by the VUT.
- In comparison to a first-semester IT diploma course, the course fees are relatively high.

The challenge is to improve throughput rates while broadening access without lowering the high quality and standards of the curriculum. Increased access must

not lead to a 'revolving door' syndrome for learners with high failure and drop-out rates.

The IT industry is relying on South African higher education institutions to produce an adequate number of IT students. Although Departments of Computer Science and Information Systems (CS&IS) have experienced an increase in enrolment, this is negated by high first-year failure and attrition rates. Furthermore, the highest failure and attrition rates are experienced among previously disadvantaged students. The attrition rate can be attributed to a number of factors: academic, personal, social or other reasons, including financial difficulties (Greyling & Calitz 2007).

2.3.2 AIMS OF THE VAAL UNIVERSITY OF TECHNOLOGY'S INTRODUCTION TO INFORMATION TECHNOLOGY COURSE

A worldwide shortage of skilled IT professionals is made worse in South Africa because large numbers of qualified people are leaving the country. As companies become more reliant on technology to do business, so the need for suitably qualified technical people grows. Specialist recruitment agencies estimate that South Africa loses between 200 and 1 000 skilled IT professionals a month to overseas markets. In addition, only 7 000 of the 30 000 schools in South Africa are capable of running IT systems, viewing them as a luxury rather than a necessity. With this educational obstacle, it is hardly surprising that South Africa has a shallow IT resource pool (Van Jaarsveldt 1999).

With this in mind, the aim of the VUT's Intro-to-IT course is to allow applicants who do not directly qualify to enter the IT diploma stream the opportunity of entering into the IT diploma stream by means of successfully completing an introductory course. These applicants do not qualify for the IT diploma because of their academic qualifications, which are rated too low according to the criteria used by the Institution (see Section 2.8). Applicants with academic qualifications acceptable according to the rating scale for the Intro-to-IT course are given the

opportunity to enter the VUT's IT diploma programme via the Intro-to-IT course. These learners are then exposed to various skills, theoretical concepts and topics. Providing they can successfully display their competence in these skills and topics through examinations and tests, this course will then assist them to enter the diploma stream.

The VUT's Intro-to-IT course is specifically designed to allow the successful learner to enter the IT diploma programme at the VUT. In the case of Intro-to-IT course, the only diploma programme the successful learner qualifies for is an IT diploma programme at the VUT.

2.3.3 VAAL UNIVERSITY OF TECHNOLOGY'S REQUIREMENTS

Many recognised tertiary institutions present courses designed to prepare learners for the IT field (see Section 2.2). Most of these are exactly that, Intro-to-IT. This entails learning the basics pertaining to personal computers and the applications designed to assist a user, such as the Microsoft Office suite. Upon conception of this course at the VUT, the main aim of the course, agreed upon by both the University and NIIT, was to instil in the learners the basic computer literacy skills required to allow them to enter into an IT diploma course. The assumption was that having these skills would afford the learner the time to concentrate on the more important topics in their syllabus.

The experience of the VUT regarding successful Intro-to-IT learners - those who have progressed to the IT diploma course - indicates areas of concern relating to specific topics and subjects in the IT diploma syllabus. The University's expectations of successfully absorbing these learners into the IT diploma stream are not being met. When the focus changed from instilling basic computer literacy skills to preparing these learners to enter an IT diploma course, it became apparent that the syllabus of the present course is inadequate and needs to be revised and amended.

The VUT has also found that a few of the learners who succeed in the Intro-to-IT course have recognised qualifications in the IT field, which they obtained prior to registering for the Intro-to-IT course. Some of these learners complete the Intro-to-IT course with ease and appear to fair better than their colleagues who do not have these qualifications.

The VUT requires an Intro-to-IT course that fully prepares a learner for the IT diploma programme. It requires a course that will also perform as a selection tool, one that will allow learners with the necessary skills and potential to advance to the IT diploma programme, and one that will identify learners who, based on poor performance, are not allowed to progress to the IT diploma stream.

2.3.4 WHAT THE VAAL UNIVERSITY OF TECHNOLOGY HAS VERSUS WHAT IT NEEDS

The VUT has guidelines, policies and procedures in place regarding various prerequisites and requirements to accept applicants into the Intro-to-IT course. There are also needs arising from accepting learners who would not have normally been accepted into the VUT.

2.3.4.1 What the Vaal University of Technology has

Many aspects covering the acceptance of successful applicants are in place, these include-

2.3.4.2 Applicant assessments

Intro-to-IT applicants are assessed according to their academic qualifications. Points are allocated to applicants according to an accepted rating system, which, in the case of VUT, is the Swedish scale (see Section 2.8). In some cases, the applicant has improved on his/her secondary-school qualifications by attending some form of tertiary educational course to obtain a higher rating. If the

qualification is obtained from a recognised tertiary institution, this is accepted and included to the rating. Recognised computer literacy and computer skills qualifications obtained by the applicant are appraised according to the Intro-to-IT course syllabus. If an applicant has obtained recognised computer training, the applicant may be asked to participate in selection testing. If successful, the applicant may be given accreditation for one of the course modules corresponding to the skills they have successfully demonstrated.

2.3.4.3 Mathematics and English

A minimum of an E symbol in both English and mathematics, either on higher or standard grade, is required along with the minimum requirement of 22 points. Any applicant failing to meet these requirements is not accepted for the course.

2.3.4.4 Basic computer literacy skills

Basic computer literacy skills are not a prerequisite for the Intro-to-IT course. It is neither feasible nor practical to relate or compare South African secondary-school learners with those from first-world countries nor, in some cases, even with those from second-world countries. In South Africa, technology is presently not available to all secondary-school learners. As a result, learners wishing to enter tertiary institutions have little or no exposure to or experience in technology - specifically, in this case, computer-related technology (see Section 1.1).

The South African Department of Education (DoE) is reviewing the secondary-school curriculum with the aim of including basic computer-literacy skills. However, this does not alter the present or short-term aims of VUT. The aim of the DoE is long overdue but, in reality, the implementation of this will take time. It will be a number of years before all secondary school leavers in South Africa are equipped with the necessary basic computer-literacy skills required by our tertiary institutions. This means that, for the near future, tertiary institutions, including the

VUT, need to continue presenting basic computer-literacy skills to potential IT diploma learners.

2.3.4.5 Methods of instruction

Instruction is given through lectures, hands-on instruction, handouts, demonstrations, assignments, and personalised help. Most of the class time is utilised to demonstrate the practical use of the software packages used in the course. Learners are required to work through material in the textbooks during the remaining laboratory time.

2.3.5 What the Vaal University of Technology needs

To integrate Intro-to-IT learners into the IT diploma at the VUT successfully, different aspects off the application process and the syllabus of the course need to be addressed, these include-

2.3.5.1 Accreditation

A system is required which:

- allows recognition for applicants who have obtained relevant recognised computer-related qualifications, and who have obtained the necessary academic requirements to enter the Intro-to-IT course, allowing the applicant to be considered for immediate entrance into the IT diploma programme, and
- awards accreditation and/or exemption for academic achievement in the relevant Intro-to-IT course subjects, in this case mathematics.

2.3.5.2 Programming logic, concepts and skills

Programming logic needs to be a ‘major’ subject in the Intro-to-IT course. Computer programming concepts are quite abstract and difficult for learners who

have no prior exposure to computers. Learners studying computer science as a discipline need-

critical life skills, such as logical thinking, “reasoning: thinking that is coherent and logical” (Wikipedia 2008), mathematical skills, application, and comparing,

contrasting, problem-solving, “The act of defining a problem; determining the cause of the problem; identifying, prioritising and selecting alternatives for a solution; and implementing a solution”(ASQ Basic Concepts 2008),

and strategic-learning skills, “A strategy is a long term plan of action designed to achieve a particular goal, most often winning” (Wikipedia 2007).

The Department of CS&IS has been conducting ongoing research on the selection of first-year students since the early 1980s. This research shows that students’ mathematical and language skills were generally good predictors of success in CS&IS courses. The Matriculation subjects that were identified as relevant predictors are English, mathematics, science, biology and accountancy (Greyling & Calitz 2007).

Not all learners studying at tertiary education institutions have worked with computers. Therefore, South African tertiary institutions enrolling these learners need to accept that the first step in the learning process is to expose and train them in basic computer-literacy skills. The Intro-to-IT course is very successful at achieving this aim. The average successful Intro-to-IT learner exits this course with a solid understanding of basic computer skills. However, a learner progressing to an IT diploma programme at the VUT does not only require some understanding of computer literacy, but also needs to have an understanding of basic computer programming logic and concepts. Computer programming concepts and logic are difficult to understand when first encountered. The syllabus of the Intro-to-IT course does not include basic programming flow and logic in enough depth to prepare the learners sufficiently to understand or practice these concepts and skills. Simple concepts such as pseudo code and flowcharts, which

are relatively fundamental and easy to use and demonstrate, should be utilised to explain programming logic and concepts.

2.3.7 CHALLENGES TO OVERCOME

The VUT faces different challenges, which must be faced and overcome, including-

2.3.7.1 Statutory requirements

The statutory requirement for registering for undergraduate degree studies at a South African university is a Senior Certificate with a Matriculation endorsement; however, senates of universities may approve special exemption from Matriculation requirements, based on a test or successful completion of a bridging programme. Furthermore, individual institutions are granted the right to impose additional entry requirements for particular programmes and qualifications. They must then state their admission policies publicly and transparently (University of Kwazulu Natal 2006).

Altering the entrance requirements to allow broader access gives rise to special problems, requirements and needs, which universities who implement these exemptions need to address. To understand what needs to be overcome, the problem presently being experienced by the VUT needs to be quantified. Towards this aim, the present course admission requirements, admission procedures, content and syllabus need to be explained and clarified. The criteria required for a pass, including the weight factors applicable to the learner's results from the various assessments, will also be explained.

2.4 INTRODUCTION TO INFORMATION TECHNOLOGY APPLICANT APPRAISAL AND APPROVAL PROCESS

Different institutions appraise applications with different tools or scales. The UP for example (University of Pretoria 2007a), calculates applicant's academic qualifications using the M-scale. In the calculation of the M-score, the subject symbols are given values as shown in Table 4.

Table 4: University Of Pretoria's M-Scale

SUBJECT SYMBOL	Higher grade	Standard grade
A-symbol (80 percent or more)	5	3
B-symbol (70 percent to 79 percent)	4	2
C-symbol (60 percent to 69 percent)	3	1
D-symbol (50 percent to 59 percent)	2	0
E-symbol (40 percent to 49 percent)	1	0

Source: University of Pretoria (2007a)

In the VUT, an applicant's documentation is appraised and evaluated according to the Swedish scale as shown in Table 5.

Table 5: The Swedish scale

SUBJECT SYMBOL	POINTS RATING	
	Higher grade	Standard grade
A (80 percent and over)	8	7
B (70 to 79 percent)	7	6
C (60 to 69 percent)	6	5
D (50 to 59 percent)	5	4
E (40 to 49 percent)	4	3
F (33 to 39 percent)	3	2
FF (30 to 32 percent)	2	1

Source: VUT (2007)

At the VUT, the requirements for acceptance into the Intro-to-IT course are a minimum of 22 points, with a minimum of six Matriculation (Grade 12) subjects and a minimum symbol of an E in mathematics and English, on either higher or standard grade. Any relevant recognised computer qualifications the applicant may have relating to the Intro-to-IT syllabus, which may be from other universities or tertiary institutions, are also evaluated. Applicants who have the necessary points on the Swedish scale for direct entrance into the IT diploma stream are assessed for possible direct entrance into the IT diploma by the VUT's ICT department. Applicants are only considered for possible direct entrance into the IT diploma if they attained 28 points, with a minimum of six Matriculation (Grade 12) subjects and a minimum of a D symbol for both mathematics and English, and recognised computer studies, which must include programming. If this applicant is not accepted by this department, his/her documentation is referred back to the Intro-to-IT course.

The UPE states that Matriculation mathematics is not required for admission to the UPEAP, but mathematical abilities will be tested in the UPE Entry Level Placement Test. Their formal requirements are a Senior Certificate (Grade 12) or equivalent school-leaving certificate. All students who apply for admission to the UPEAP write the UPE Entry Level Placement Test, which includes a mathematics component. They state that preference will be given to students from disadvantaged communities (University of Port Elizabeth 2006). Computerised Placement Tests form an integral part of the current placement battery used by the UPE and the Department of CS&IS for evaluating applicants. In November 1998, 230 students who were applying to participate in a university bridging programme were assessed on the placement test battery (Greyling & Calitz 2007).

The TUT admission requirements to their ICT Foundation course are a Senior Certificate or an equivalent qualification with at least an E symbol for mathematics on standard grade or a F symbol on higher grade. Students are required to undergo the potential assessment battery (test) conducted by TUT's Department of Student Counselling. Students with a low score on the reading and mathematical test, will be considered for the extended curriculum (Tshwane University of Technology 2006).

Table 6: Cape Peninsula University of Technology scale

Symbol	MATRICULATION	MATRICULATION
	Higher Grade	Standard Grade
A	8	4
B	7	3
C	6	2
D	5	1
E	4	0
F	3	0

Source: Cape Peninsula University of Technology (2006)

The entrance requirements of the Cape Peninsula University of Technology (CPUT) for their one-year certificate course are as follows. In addition to the minimum admission requirements, mathematics with at least an E symbol on higher grade (or a C symbol on standard grade) is strongly recommended.

Matriculation performance will be evaluated using a points score formula and the performance grid below.

- Points Score = (Double 1st Language Score) + (Double Mathematics Score) + (Best three other scores)
- An applicant must attain a minimum points-score of 25 to be considered for admission (Cape Peninsula University of Technology 2006).

2.5 SELECTION ASSESSMENT

An applicant who does not qualify directly for the IT diploma at the VUT because of insufficient points, but qualifies for the Intro-to-IT course, and has an accepted relevant computer-related qualification, may be asked to write a selection test,

which is based on the syllabus of Module 2 and Module 3 (see Section 2.10) of the Intro-to-IT course. All selection testing is at the discretion of VUT.

The selection testing is a practical and theoretical test that covers the syllabus of Module 2 and Module 3. Depending on the applicant's qualifications, he/she may be invited to write either Module 2 or both Module 2 and Module 3. An applicant may qualify for exemption for Module 2 if he/she obtains 70 percent in Module 2 selection test. If an applicant succeeds in obtaining 70 percent in both the Module 2 and Module 3 selection tests, this applicant may be asked to write further tests to assess his/her mathematical and English proficiency. If this applicant obtains favourable results in these extra tests, the applicant's documentation will be reviewed by the ICT department.

No recognition was awarded to applicants who received high marks in their compulsory mathematics and English Matriculation subjects.

2.6 INTRODUCTION TO INFORMATION TECHNOLOGY SYLLABUS

The Intro-to-IT short course presently consists of three modules.

2.6.7 Module 1

A three-week module, which consist of:

- **Numeric skills** is a refresher course for the learners, consisting of part of the secondary school Grade 12 mathematics syllabuses. The aim of the numeric skills subject is to ascertain the learner's logical proficiency with mathematics. Mathematical competence (including numeracy) is identified as an area that puts learners at risk, given that a high number of learners cannot manipulate mathematical concepts to solve problems.

- **Communication skills** include English reading, writing and comprehension. The use of English as the medium for teaching and learning means that the majority of learners now enrolled at the Institution have to learn and interpret their work in a language other than their home or first language, and this is often an obstacle to successful learning. There is a need for communication programmes to develop competence in grasping and conveying concepts of the learning material at a level indicative of higher education thinking and reasoning.
- **Life skills** are taught to acclimatise the learner to campus life and to demonstrate learning techniques and methods. Study skills for most learners are less than adequate. Such skills are considered essential when introducing learners to a particular science's knowledge and conceptual base.

2.6.7.3 Assessments

- **Numeric and communication skills** assessment consists of class tests during the course. The average mark of these tests is taken as these subjects' final mark. A final average mark of 60 percent is required for a pass in both of these subjects. A learner failing to obtain the required 60 percent in one or both of these subjects is given the opportunity of a rewrite, which covers the complete subject's syllabus. This rewrite mark is then taken as the learner's final subject mark.
- **Life skills** is a compulsory attendance subject with no examinations or tests, which contribute toward any final mark. Learners are given a pass if they have the required minimum attendance of 70 percent.

A learner must obtain a pass in both numeric skills and communication skills. Any subject failed results in a fail for the module. In the event of a learner failing, the learner is not allowed to progress to Module 2. However, such learners are given the opportunity of returning to the University in a future semester, to repeat the

subject or subjects they have failed. If the learner then passes the failed subjects, the learner is allowed to progress to Module 2.

2.6.8 Module 2

A four-week module, which consists of:

- Basic computer concepts and parts:
 - Theoretical knowledge
- Windows Operating System:
 - Theoretical and practical
- Microsoft Word:
 - Theoretical and practical, with more emphasis placed on the practical
- Microsoft Excel
 - Theoretical and practical, with more emphasis placed on the practical
- Microsoft PowerPoint
 - Theoretical and practical, with more emphasis placed on the practical
- A practical group project based on all Microsoft skills learnt, and the compilation of a personal portfolio

2.6.8.3 Assessments

The learners are required to write three class tests and an average of these is taken, which contributes to the learner's final mark. The learners are required to compile a project, which covers practical tasks from all the modules' topics mentioned above. They are also required to compile their own personal portfolios. A module examination is written which covers the complete module syllabus. The learner must obtain a minimum of 60 percent in this examination to be eligible to pass the module. All activities, including the final module examination, contribute to the final module mark.

A learner must obtain a minimum of 60 percent in the final module mark **and** a minimum of 60 percent in the module examination to obtain a pass for the module. Again, if a learner fails to pass the module, the learner is not allowed to progress to Module 3 but is given the opportunity of returning to the University in a future semester to repeat Module 2. If the learner then passes the failed module, the learner is allowed to progress to Module 3.

2.6.9 Module 3

A five-week module consisting of:

- MS Access:
 - Database concepts, theory and practical application
- Internet skills:
 - Basic theory and practical application
- E-Mail:
 - Basic theory and practical application
- MS Front Page:
 - Basic theory and practical application
- HTML:
 - Simple theory
- Basic programming concepts:
 - Pseudo Code
- Flow Charts
- Programming logic and flow

2.6.9.3 Assessments

The learners write three class tests. The average of these tests is taken, which then forms part of the learner's final mark. As in Module 2, the learners compile a

project, which covers practical tasks from all topics mentioned above and they continue with the compilation of their personal portfolios.

A module examination is written, which covers the complete module syllabus. The learner requires a minimum of 60 percent in this examination to be eligible to pass the module. All activities contribute to the final module mark and a learner requires a minimum of 60 percent to pass the module. A learner must obtain a minimum of 60 percent in the final module mark **and** a minimum of 60 percent in the module examination to obtain a pass for the module.

As in Module 2, if a learner fails to pass the module, the learner is not allowed to progress to Module 3 but is given the opportunity of returning to the University in a future semester to repeat Module 3. If the learner then passes the failed subjects, the learner is allowed to progress into the IT diploma stream at the discretion of that department.

2.7 TOPIC DURATION

The duration of each topic within each module is as follows:

2.7.7 Module 1

- Numeric skills - 39 tuition hours per learner
- Communication skills - 27 tuition hours per learner
- Life skills - 12 tuition hours per learner

2.7.8 Module 2

- Computer topics - 80 tuition hours per learner
- Portfolio and project management - 12 tuition hours per learner

2.7.9 Module 3

- Computer topics - 100 tuition hours per learner
- Portfolio and project management - 15 tuition hours per learner

2.8 DEPTH OF TOPIC COVER

The syllabus of Module 1, Module 2 and Module 3 differ, and no subject is repeated in any of the three modules.

2.8.7 Module 1

Module 1 focuses on numeric and communication skills. Numeric skills are a repeat of topics presented in Grade 12 mathematics. Communications covers comprehension and grammar. A learner who successfully completes this module is accepted to be proficient in English and has been tested in their mathematical logic.

2.8.8 Module 2

In Module 2, aspects of basic computer concepts, operating systems and Microsoft Office package elements are presented in a relatively acceptable depth. The computer skills subject, which was presented by the VUT's Computer Sciences Faculty, concentrated on Microsoft Excel, Microsoft Word, basic Microsoft operating system functions and computer concepts, but not to the same extent as in the Intro-to-IT course. A learner who successfully completes Module 2 has a good grasp of both the theoretical concepts and practical skills required when using these elements of the Office Package and Windows Operating System.

2.8.9 Module 3

Module 3 has elements of the remainder of the Office Package and includes some basic programming concepts and logic. The module does not cover basic programming concepts, theory or logic in any great depth.

2.9 WEIGHT FACTORS

Weight factors are used to place more emphasis on specific topics or parts of a subject. Automatically, the larger the weight factor the better the learner has to perform in that topic, as opposed to a topic with a lower weight factor. Both Module 2 and Module 3 have the same weight factors, which apply to the syllabus assessment points. These are:

- Class tests - contribute, on average, 30 percent to final mark
- Project - contributes 20 percent to final mark
- Portfolio - contributes 10 percent to final mark
- Module examination - contributes 40 percent to the final mark
- Module examination - a pass of 60 percent is required

On accumulation of all weighted marks, the learner must obtain a minimum of 60 percent for a final mark to pass the module.

2.10 FAILURE OF A MODULE

If a learner is unsuccessful with a module, the learner is given the opportunity to return at a future semester to repeat the failed module. They are only charged for the tuition and do not need to pay for the course material again, providing that the course material has not changed. This is indicated in Figure 1.

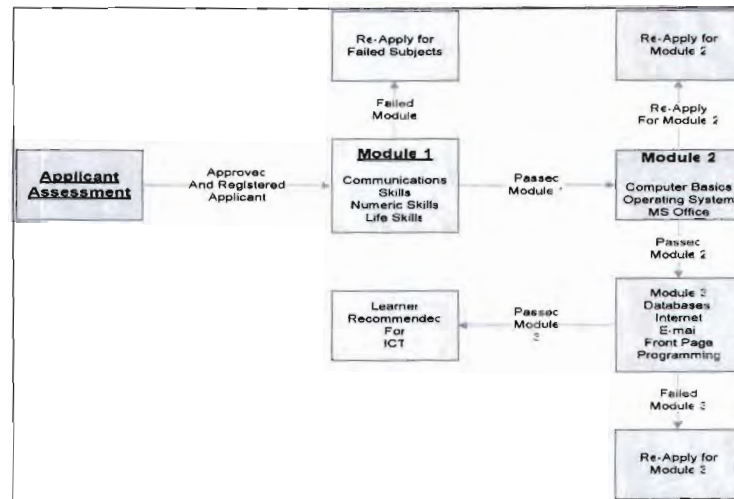


Figure 1: Flow of modules

2.11 CHALLENGE

The challenge is to align the course material and syllabus with the knowledge, needs, requirements and skills the learner will require when entering the IT diploma stream. It is important to apply appropriate weights to the syllabus subjects. This is necessary to ensure that learners have the required skills and knowledge to progress to the IT diploma, rather than simply passing students who gained high marks for less important topics. An example of a topic carrying more weight may be programme flow and logic, which a learner is required to understand and implement when entering the IT diploma.

2.12 CONCLUSION

Many tertiary institutions in South Africa have recognised the need for an Intro-to-IT course in some form or another (see Section 2.2), whether extended, foundation or introduction. There is a great demand for this type of course, both to fill the much needed skills shortages in the business world and to address imbalances in the business world in the medium and long term. Owing to the high demand for IT

personnel worldwide and the consequent emigration of many IT people, the South African IT industry is continuously experiencing a shortage of personnel. The need for the South African society to redress racial imbalances further places a burden on this industry, where only a small contingent of previously disadvantaged personnel is employed (Greyling & Calitz 2007).

Tertiary institutions are broadening access to higher education through the introduction of these types of courses. Access does not simply mean entering university studies. From the student perspective, it implies the opportunity to make use of and develop the skills and abilities necessary to complete an academic qualification successfully. For the university, it involves supporting the aspirations of any person to obtain the highest level of education and training commensurate with his/her potential. Success should also be defined in terms of the mission and values of the new university, whose graduates, in addition to passing their examinations, are to be 'socially responsive' and able to 'serve the country and the region in innovative and effective ways'. Our graduates should be increasingly successful in finding their way in the world of work and of life-long learning (University of Kwazulu Natal 2006).

In order to ensure that an Intro-to-IT VUT learner has the opportunity to succeed in an IT diploma programme at the University, the learner has to be equipped with the required knowledge, skills and understanding. Learners advancing to the diploma programme without these skills will experience difficulties and their performance may be discernibly poorer than those who are equipped with the necessary understanding of the logic, concepts and skills required.

It is the VUT's responsibility to ensure that Intro-to-IT learners are exposed to the correct syllabus, in terms of preparing them for the IT diploma programme. Only learners who have proven that they are capable and competent with the concepts, skills and logic presented and tested in the Intro-to-IT course, should be allowed to advance to the VUT's IT diploma programme. Failure to do so means that learners

who do advance to an IT diploma programme will experience difficulties and the pass/fail rates for first semester IT diploma learners will reflect this.

The aim of this chapter was to clarify the present procedures and syllabus of the VUT's Intro-to-IT course. The procedures and syllabus for this course were initially designed primarily to give a successful learner a recognised qualification in computer skills, and secondarily to give this learner access to the IT diploma stream at the VUT, which previously was not an option for the learner.

Since its inception, the needs and aims of the Intro-to-IT course have evolved and changed. These aims and needs dictate a change in procedures and syllabus to achieve the course's new aim, namely to adequately prepare the successful learner for a diploma in IT at the VUT. The challenge is to ensure that the successful Intro-to-IT learner who enters the IT diploma stream at VUT is equipped with the necessary tools; that is, the skills and knowledge required by a successful IT diploma learner.

A large number of learners cannot grasp or convey what they have learned logically, systematically and in a scientific language. The Intro-to-IT programme needs to be realigned to develop and provide learners with the basic introductory knowledge, cognitive and conceptual tools, and practical techniques to function successfully in continued studies. The approach needs to develop in learners a foundation of academic and generic skills to equip them for academic study and life-long learning and to ensure success at higher levels of the curriculum.

Once learners successfully complete this course, they may be admitted to the formal programme (National Diploma: Information Technology at VUT). Such learners are more likely to succeed in continued studies because of the initial work they did in the Intro-to-IT course.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, existing introductory courses to IT from other institutions in South Africa were discussed, and the VUT's Intro-to-IT course was described in detail. This chapter includes a description of the research methodology used for the empirical portion of the study.

3.2 DATA GATHERING PROCEDURE

3.2.1 Quantitative Survey – the questionnaire

A printable questionnaire was developed (see Annexure A) to record the results of current Intro-to-IT learners and Intro-to-IT learners who had progressed to the IT diploma and to elicit their opinions and views regarding the course. The questionnaire was designed to ascertain how successful Intro-to-IT learners had performed in their first semester of the IT diploma, and to obtain the respondents' overall views and opinions of the value of the Intro-to-IT course. Specifically, with regard to IT diploma learners who had progressed from Intro-to-IT, the aim of the questionnaire was to attempt to ascertain if the course did help to reduce the gap between the skills they had obtained in their secondary institutions and the skills they have experienced are required in the first semester IT diploma. Topics covered in the questionnaire included the following:

Academic record: The first section of the questionnaire covered the respondent's academic record, including when the learner attended the Intro-to-IT course, which semester in the IT diploma the learner is attending and the learner's marks for specific first semester IT diploma subjects.

Skills obtained: In the second section of the questionnaire, the learners were asked to evaluate their basic computer literacy skills obtained in the Intro-to-IT course.

Programming flow and logic: In the third section of the questionnaire, learners was asked to evaluate their knowledge of programming flow and logic, and to indicate whether or not the Intro-to-IT course prepared a learner for the IT diploma. Respondents were also asked whether they believed changes should be made to the syllabus of the Intro-to-IT course.

Intro-to-IT organisation: The last section of the questionnaire requested the learner to evaluate the organisation of the Intro-to-IT course and to evaluate the staff involved in the course.

3.2.2 Interviews

Interviews were conducted with those VUT staff members involved directly or indirectly with the Intro-to-IT course. The Dean of the Faculty, the Head of Department for ICT and the Head of Department for software studies, together with programming lecturers for Software Studies were included. The interviewees were requested to give their opinions and findings on the success or non-success of the Intro-to-IT students who had progressed to the IT diploma.

3.2.3 Learner academic records

Learners' semester academic records were obtained from the VUT's ITS system.

3.3 POPULATION AND SAMPLING

The sample used for the survey portion of this study was small. Around 90 questionnaires were conveniently distributed to the following respondents:

- learners at the VUT, including:
 - existing Intro-to-IT learners
 - learners who had progressed from the Intro-to-IT course into any of the five semesters of the IT diploma stream

The following VUT staff members were interviewed:

- lecturers directly involved in first-semester IT diploma subjects
- concerned parties at the VUT

3.5 DATA ANALYSIS

The responses to the completed questionnaires were marked and collated to allow appropriate statistical analysis. All other data was evaluated and analysed.

3.6 ACTION RESEARCH

Over a period of four semesters of the Intro-to-IT course, based on data acquired during presentation of the course, decisions were made and alterations implemented to the syllabus, assessments and duration of modules. These changes were then measured against the previous data and action research was exercised through a process of iteration.

3.6.1 Action research methodology

Action research is a type of applied social research that differs from other types of research with regard to the closeness of the researcher's involvement in the action process. Action research has been defined as research that is embedded in action. Action research is distinguished by the five phases of diagnosing, and action planning, taking action, evaluating and specifying learning to be conducted in the research cycle, as shown in Figure 2 (Van Der Merwe 2006).

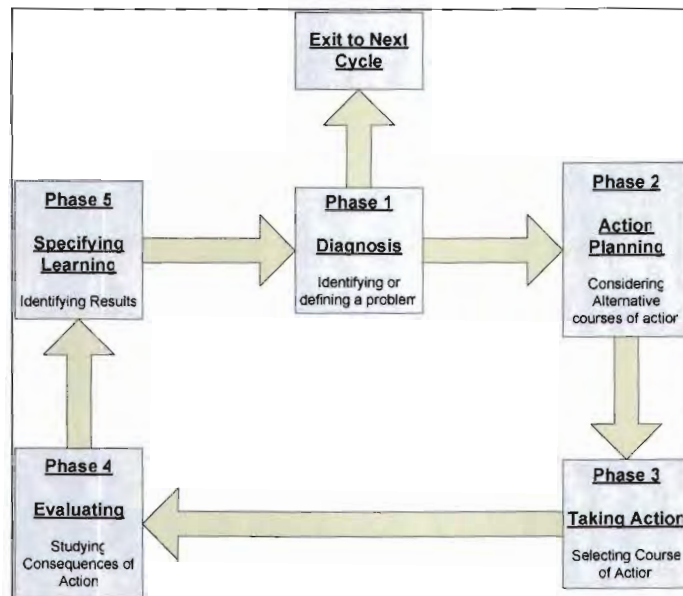


Figure 2 : Action research cycle

3.6.2 Data acquiring process

The data required were obtained from the Intro-to-IT learners' marks for assignments, class tests and examinations. The IT students' results for first-semester subjects were obtained from the VUT's ITS system.

3.6.3 Diagnosing

Data obtained were analysed and interpreted, in conjunction with the information obtained from the interviews with concerned parties, staff members directly or indirectly involved with the Intro-to-IT course.

3.6.4 Action planning

Decisions were taken regarding deficiencies and/or possible and perceived problems with the aim of eliminating or improving these aspects. Plans were then formulated to implement these actions during the following semester of the Intro-to-IT course.

3.6.5 Taking action

The changes and alterations were implemented prior to the commencement of the next semester. All documentation was updated and, where necessary, study guides were adapted. Satellite campuses were also informed of changes.

3.6.6 Specify learning

The general findings from all phases were specified. With each change to the course, measured improvements were seen and, as result, learners who entered the IT diploma were performing better than the previous semester. With each phase the results in the pass rates for problem subjects in IT, for example programming, were slowly improving.

3.6.7 Topics and subjects covered

The topics affected by the action research methodology encompassed many different aspects of the Intro-to-IT course. These included, but were not limited to, the following:

- Entrance criteria relating to points and to subjects required
- The time frames for subjects and topics
- Weight allocation to subjects and assignments
- Software Development Phases:

- Design
- Build
- Test
- Install

3.7 CONCLUSION

This chapter discussed the research design for the empirical study and the area covered by action research. The following chapter will interpret the findings of this study.

CHAPTER 4 – EMPIRICAL RESEARCH

4.1 INTRODUCTION

The previous chapters covered the methodologies used to gather the relevant data relating to the Intro-to-IT course. This chapter details the findings of the empirical portion of the study.

Both quantitative and qualitative research was exercised in this research. Qualitative research was collecting descriptive information, in this case, by means of interviews and a questionnaire, and quantitative by gathering data from the VUT ITS system and by means of the same questionnaire to count and measure occurrences.

A questionnaire was compiled containing seventeen questions covering a broad range of topics, from the respondent's academic record to their personal opinions (see Annexure A). The aim of the exercise was an attempt to ascertain the learner's opinions and experiences relating to Intro-to-IT. Learners currently attending Intro-to-IT and learners who had successfully completed the Intro-to-IT course and progressed to the IT diploma were the respondents to the questionnaire.

4.2 SEMESTER 1 IT DIPLOMA PASS RATES

The sample group for this data was 2004 and 2005 Intro-to-IT learners who had progressed to first-semester IT diploma learners. Data were gathered from the VUT's ITS system. The subjects and pass rates as an average are displayed in Table 7:

Table 7: First-semester Information Technology diploma pass rates for the 2004 and 2005 Introduction to Information Technology learners

Subject	Subject code	Average number of learners entered final examination 2004 and 2005	Number of learners failed	Average learner mark (%)	Failure rate (%)	Pass rate (%)
Development Software 1: Module 1	ASBDX1B	119	33	54.55	27.73	72.27
Information Technology Skills 1: Communications	HKJSY1A	101	11	58.46	10.89	89.11
Information Technology Skills 1: Legal Skills	HLISY1A	110	51	51.40	46.36	53.64
System Software 1: Module 1	ARSYX1A	117	34	55.56	29.06	70.94
Accounting Skills 1: Module 2	BAACY1A	106	7	65.66	6.60	93.40
Information Systems: Module 1	AIISX1A	117	4	66.51	4.68	95.32

The data in Table 7 indicates that although the pass percent is acceptable, the average pass mark is low for some of the subjects.

The 2003 data were not available. From 2002 to 2005, the pass rate increased significantly in Software Studies 1, from 47 percent to 73 percent. In this time, the Intro-to-IT course was introduced and the syllabus for the Intro-to-IT learner had been adapted and altered. This is one of the factors which can be attributed to this improvement in the pass percentage of the first-semester IT learners.

There was a marked improvement in the pass percent of the Intro-to-IT learners in their IT diploma subject Software Studies 1, Semester 1. When the data collected are analysed in depth, it can be seen that there is a tendency of a low pass mark in some of these subjects.

The pass percentages displayed in Table 7 do not include learners who failed the module. These pass percentages are based solely on successful learners.

Table 8: Range of percentages obtained

Subject	Number of learners entered final examination	Learners who obtained between 50 percent and 60 percent (%)	Learner percent above 60 percent (%)	Learner percent distinctions (%)
Development Software 1: Module 1	119	76.00	23.53	4
Information Technology Skills 1: Communications	101	59.00	40.59	2
Information Technology Skills 1: Legal Skills	110	65.00	34.55	2
System Software 1: Module 1	117	83.00	17.09	9
Accounting Skills 1: Module 2	106	31.00	68.87	24
Information Systems: Module 1	117	16.00	83.76	19

As indicated in Table 8, pass percentages and average marks were not as required.

- Development Software 1, Module 1 has an average learner mark of 55 percent. Indeed, only 28 learners from the 119 researched achieved a mark of 60

percent or higher and only 5 of these learners obtained a distinction in this subject.

- Information Technology Skills 1: Communications has an average learner mark of 59 percent, with 41 of these learners obtaining more than 60 percent and only 2 learners obtaining a distinction in the subject.
- Information Technology Skills 1: Legal Skills has an average learner mark of 70 percent, with 38 of these learners obtaining more than 60 percent and only 2 learners obtaining a distinction in the subject.
- System Software 1: Module 1 has an average learner mark of 51 percent, with 20 of these learners obtaining more than 60 percent and 10 learners obtaining a distinction in the subject.
- Accounting Skills 1: Module 2 and Module 1 has an average learner mark of 66 percent, with 73 of these learners obtaining more than 60 percent and 25 learners obtaining a distinction in the subject.
- Information Systems: Module 1 has an average learner mark of 66 percent, with 98 of these learners obtaining more than 60 percent and 22 learners obtaining a distinction in the subject.

Development Software 1, Module 1 is one of an IT diploma learner's major subjects. If learners do not succeed in this subject, they are not allowed to progress to the next level. The average pass mark displayed above indicates a problem in either the understanding or the implementation of the concepts, knowledge and skills required to be successful. The information obtained indicates that learners are not coping satisfactorily with programming in their first semester. The majority of learners are just passing this subject, a subject for which the Intro-to-IT course has 'prepared' the learner. A learner who has just scraped through in this first-semester subject is likely to experience difficulties when progressing to more advanced programming techniques.

4.3 FACULTY MEMBERS INTERVIEWS

Failure rates of Intro-to-IT learners entering the IT diploma first semester was a source of concern to the ICT faculty members. Interviews with concerned faculty members directly involved with the Intro-to-IT learners when they have progressed to the IT diploma stream have provided a more complete picture regarding learners' problems and results.

4.3.1 Faculty staff interviews

- Mabuza, Dean of the VUT's Faculty of Applied and Computer Science, has stated that he is not convinced that the Intro-to-IT course is actually working as expected. He feels that the course attempts to cover too large a syllabus in too short a time, to the detriment of the learner. Mabuza also does not want all potential IT learners to enter directly into the Intro-to-IT course, and has stated that he wishes to have as many learners as possible, those who qualify, based on qualifications and relevant computer experience, to enter directly into the IT diploma stream (Mabuza 2006).
- Jordaan, who at the time of initiating this research was the Acting Head of Department in the Department of Information and Communication Technology at the VUT's Faculty of Applied and Computer Science, has worked closely on this research study, evaluating the syllabus, course content and weight factors for the Intro-to-IT course. Jordaan indicates that she is comfortable with the results of the course relating to the pass percentages of the Intro-to-IT learners, but sees room for improvement in the pass rates of first-semester IT diploma learners coming from the Intro-to-IT course. Jordaan shares Vorster's view that there is room for improvement relating to programming flow, logic and concepts in the syllabus of the Intro-to-IT course (Jordaan 2006).
- Vorster, Head of Department for Computer Studies at the VUT's Faculty for Applied and Computer Sciences, is actively involved with the learners in his programming lectures. Vorster perceives that many of the learners have trouble

understanding the basic concepts of programming and the related logic, and that he, as a lecturer, has to spend valuable time in his class explaining and elaborating on these concepts. He feels the learner should already possess an understanding of these concepts and the necessary skills required to implement these when entering into the IT diploma stream from the Intro-to-IT course.

Based on his experiences and having assessed the Intro-to-IT syllabus, it is Vorster's opinion that the Intro-to-IT course does not sufficiently prepare the learner. He feels that the syllabus and weight system allocated to the course allow learners to enter the IT diploma stream who are either unprepared or should not qualify to enter the stream (Vorster 2006).

Mabuza's and Vorster's views and opinion relating to programming flow and logic are substantiated and supported by the data analysed. The Intro-to-IT course, although a valued source of IT learners, does not totally fulfil the aims of the course, specifically with regard to programming flow and logic. Jordaan also agrees there is room for improvement.

The ability to solve programming problems using logical thinking is a prerequisite for success in the first semester of the IT diploma specifically in programming subjects. Understanding the concept of logical thinking is required to allow the evaluation and assessment of learner's logical processes.

4.3.2 Logical thinking

A programmer is usually given a specific problem to solve by means of programming. Any program that needs to be built involves a series of logical algorithms, which, when followed, will solve the problem presented to the programmer. To enable the programmer to solve the given problem successfully, he/she needs to be able to think logically. Computers use logic in the way they do computations, but that is not quite the same as thinking logically in a computational-thinking sense. Computers themselves have to be programmed

(taught) to do logical reasoning. Computers are not natural logical thinkers (CS4FN 2007)

Education has long emphasised the need to impart cognitive competencies, such as logical-mathematical thinking, problem solving and creativity, along with social and personal competencies. Computerised technological systems can provide a rich learning environment, which can expose the learner to a variety of experiences, such as true modelling, simulations, building models that represent formulas, algorithms, graphics and animation (Barak & Doppelt 2000).

Logical thinking is a very important skill. Like all other skills, it must be taught. There are many everyday life situations in which the ability to think logically is of great importance. If a person stands on a curb and there is a car approaching, that person's life literally depends on whether he/she is able to think logically or not. Logical thinkers understand that they need to wait for the car to pass by to avoid being run over.

This means that logical thinking is thinking in terms of causes and consequences, which, in turn, means that it is sequential thinking. Logical thinking means following a train of thought. It is like looking into and predicting the future: if this happens, then that will happen. However, this has nothing to do with fortune telling. It is based on the interpretation of certain prevalent conditions and then predicting what will happen if the same conditions continue to prevail (Strydom 2007).

Logical thinking is not a magical process or a matter of genetic endowment, but a learned mental process. It is the process of using consistent reasoning to reach a conclusion. Problems or situations that involve logical thinking call for structure, for relationships between facts and for chains of reasoning that 'make sense'. All logical thinking is sequential thought. This process takes on a meaning in and of itself in that it involves taking the important ideas, facts and conclusions involved in a problem and arranging them in a chain-like progression. To think logically is

to think in steps. Logical thinking is also an important foundational skill of mathematics. Learning mathematics is a sequential process. If you do not grasp a certain concept, fact or procedure, you can never hope to grasp others that come later, which depend upon it. For example, to understand fractions you must first understand division. To understand simple equations in algebra requires that you understand fractions. Solving 'word problems' depends on knowing how to set up and manipulate equations, and so on (Learning and Learning Disabilities 2007).

During the first and second semesters of 2006, simple logical questions were included in the final-semester Module 3 Programming examination and rewrites of the Intro-to-IT course as part of the action research methodology. The poor results obtained by the learners for these questions substantiates the staff members' opinions that most of the learners entering the IT diploma through the Intro-to-IT course experience difficulties when they are required to use basic logic to solve a given problem.

4.3.3 Logic Examination Questions

4.3.3.1 Simple logic question

During the second semester 2006 Intro-to-IT Module 3 Programming final examination, a simple logic question was inserted in the examination questions to assess the logical capabilities of the Intro-to-IT learners who had advanced to Module 3. The examination question was:

Enter the Missing Number 3, 6, 12, 15, 30, 33, _.

Of the learners, 35 percent gave the correct answer. This leaves a staggering 65 percent who either did not attempt the question or answered it incorrectly.

4.3.3.2 Logical calculation examination question

In the same examination, 2006 Semester 2 Programming examination, learners were asked to show the calculation, using given variables for a simple algorithm to do the following.

A painter is instructed to paint a wall, the area of the wall is to be calculated to enable the correct amount of paint required to be bought. The wall has a WIDTH, and a HEIGHT, The wall has one door with a height and width, and 2(two) windows of the same size (same height and same width). Using the variables given below show the calculation you would use as a programmer to calculate the area of the wall to be painted. Please note the door and windows are not included in the area to be painted.

<i>Wall Height:</i>	<i>variable</i>	<i>wallHeight</i>
<i>Wall Width:</i>	<i>variable</i>	<i>wallWidth</i>
<i>Door Height:</i>	<i>variable</i>	<i>doorHeight</i>
<i>Door Width:</i>	<i>variable</i>	<i>doorWidth</i>
<i>Window Height:</i>	<i>variable</i>	<i>windowHeight</i>
<i>Window Width:</i>	<i>variable</i>	<i>windowWidth.</i>
<i>Area to Be Painted:</i>	<i>variable</i>	<i>areaTobePainted</i>

Only 42 percent of the learners were able to answer this simple question.

The learners who wrote this examination had all already passed the Module 1 numeric skills subject with 60 percent or more. However, when it came to applying the same type of logic to solve the examples above, most were incapable of doing so successfully.

4.4 LEARNER QUESTIONNAIRES

Learners were given the opportunity to express their opinions, experiences and opinions concerning the Intro-to-IT course by means of completing a

questionnaire. At present, in the VUT's IT diploma stream, there are learners in all semesters from Semester 1 (S1), to Semester 5 (S5) who had attended the Intro-to-IT course from 2004 onwards. A random sample of these students was requested to complete the questionnaire. The learners were asked the following questions and opinions.

The questions were designed to elicit different data or information and can be grouped as follows:

- Questions 1 and 2 were to provide background information regarding which semester the respondent presently attended (see Annexure c).
- Question 3 (see Section 4.4.1) specifically to obtain statistical data regarding pass marks.
- Questions 4, 5, 6 and 7 (see Sections 4.4.3, 4.4.4, 4.4.5 & 4.4.6) were an attempt to obtain the respondent's opinions regarding the syllabus of Intro-to-IT, to attempt to ascertain if the topics are relevant, in enough depth and are the used in the IT diploma first semester.
- Questions 8 and 9 (see Sections 4.4.7, & 4.4.8) attempted to elicit the respondent's opinion of his or her understanding of programming, when entering the IT diploma, and as to how the respondent may have performed without Intro-to-IT. The aim of these questions was ascertain if the Intro-to-IT had indeed imparted logical skills to these respondents.
- Questions 10, 11 and 12 (see Section 4.4.8, 4.4.9 & 4.4.10) were to gather information regarding possible options to improve on the syllabus of Intro-to-IT.
- Questions 13, 14 and 15 (see Sections 4.4.11, 4.4.12 & 4.4.13) were aimed at gathering information concerning the respondent's satisfaction with Intro-to-IT, the administration of the course and the staff involved.
- Questions 16 and 17 (see Sections 4.4.14 & 4.4.15) were aimed at determining if the duration of the Intro-to-IT was appropriate.

4.4.1 Final student mark

- ◇ What was your final mark for the following subjects? If you repeated the subject, please indicate your first mark.

Table 9: Questionnaire rating completed by learner

	Dev. Software 1.1	Dev. Software 1.2	Infos.1.2	Infos. 2.1
Less then 50				
Between 50 and 60				
Between 61 and 70				
Between 71 and 80				
More than 80				

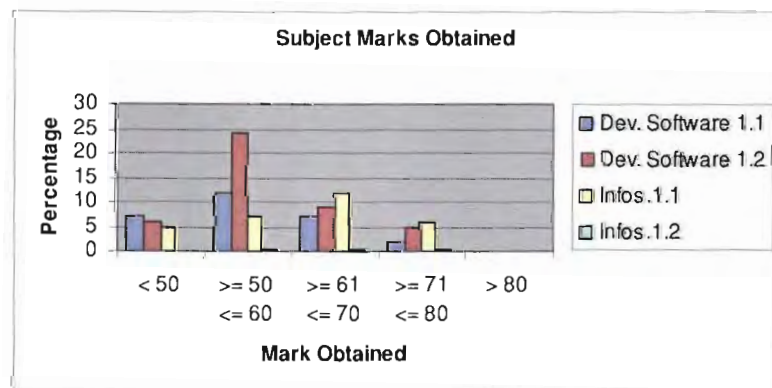


Figure 3: Subject marks percentage obtained by learners

As can be seen from Figure 3, for learners attempting Information systems 1.1, Information Systems 1.2, Development Software 1.1 and Development Software 1.2, the average learner achieved a mark between 50 and 60 percent. For the subjects Development Software 1 and Information Systems 1, no learner who completed the questionnaire achieved a final percentage mark of 80 percent or above.

As can be seen in Figure 4, when the percentages achieved by learners in Information Systems 1.1 and Development Software 1.1 are analysed, on the lower end of the percentage scale, from below 50 percent to 60 percent, the learner appears to cope better with the Development Software 1.1 programming subject than with the theoretical subject of Information Systems 1.1. However, when the higher marks achieved by learners are analysed, a considerably larger percentage of learners achieve higher marks in Information Systems 1.1 than in the other subject, Development Software 1.1

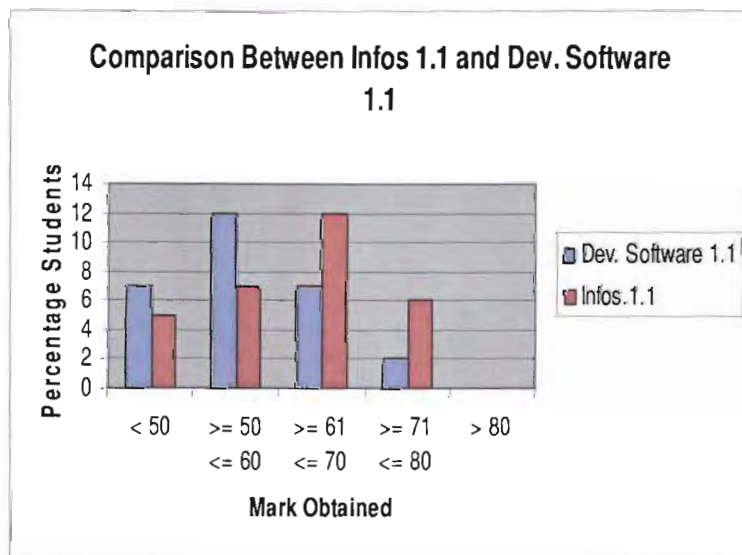


Figure 4: Comparison between Development Software 1 and Information Systems 1 results

4.4.2 Software rating

- ◇ Please rate the following software according to the average frequency you have used them in the IT diploma course up to now:

Table 10: Use of MS Office Package components

MS Word
MS Excel
MS PowerPoint
MS FrontPage
MS Access
Programming Logic

The use of the different aspects of the Microsoft Office Package is part of the syllabus in the Intro-to-IT course. The learners were asked about the frequency with which they utilise these programs. As can be seen from Figure 5, owing to the nature of the diploma, Programming Logic is used daily by most learners; however, programs such as MS FrontPage are used relatively infrequently. Of the learners who responded, 22 percent stated that they never used MS Excel and 33 percent stated that they never used MS PowerPoint.

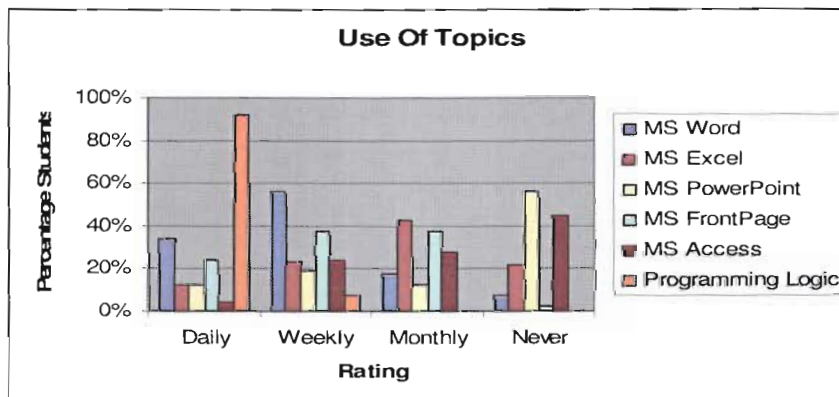


Figure 5: Use of MS Office Package components

4.4.3 Skills required

- ◇ Which of the following software knowledge/skills do you believe to be required to succeed in the IT diploma? If your answer is NO, please indicate a reason. (You are allowed to make more than one selection).

Table 11: Knowledge/Skills required

MS Word
MS Excel
MS PowerPoint
MS FrontPage
MS Access
Programming Logic

Again, Programming Logic was high on the learners' list of required topics. However, as can be seen from Figure 6, other topics, namely MS Word and MS Excel, were also shown to be relevant to the learner. This does not correspond with the previous question, where learners were asked about their frequency of use of these programs. However, the response to this particular question supports the belief that basic computer-literacy skills and a basic knowledge and skill in programming logic are a prerequisite requirement for entry to an IT diploma course at the VUT.

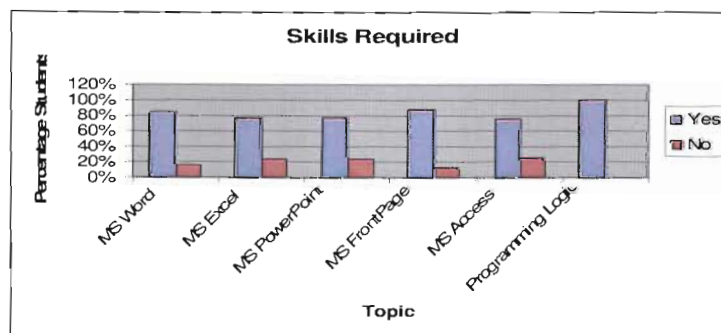


Figure 6: Knowledge/Skills required

4.4.4 Application of skills

- ◇ *How would you rate your ability to apply the skills and knowledge presented in Intro-to-IT with regard to the following subjects in your IT diploma course?*

Table 12: Ability to apply skills after the Introduction to Information Technology course

Programming
Information Systems
Accounting
Entrepreneurship

Learners were asked about their ability to apply the skills and knowledge obtained to specific IT diploma subjects. Their ability to apply these skills to programming, in their opinion, was for the most part positive, as can be seen from Figure 7. Surprisingly, many of the students, 37 percent, indicated that the skills and knowledge they obtained from the Intro-to-IT course were extremely helpful for entrepreneurship. Of the respondents, 40 percent stated that the Intro-to-IT course did not prepare them at all for accounting, while 35 percent stated it was an excellent preparation. Only 40 percent of the respondents were satisfied that they were able to apply the skills and knowledge introduced to them in the Intro-to-IT course and only 30 percent felt they were prepared and capable to apply the skills and knowledge learned in Intro-to-IT. The percentage of respondents believing they were capable of applying the skills and knowledge acquired in the Intro-to-IT course is very low and again supports the belief that the course is not preparing the learner for IT where logic is required in programming.

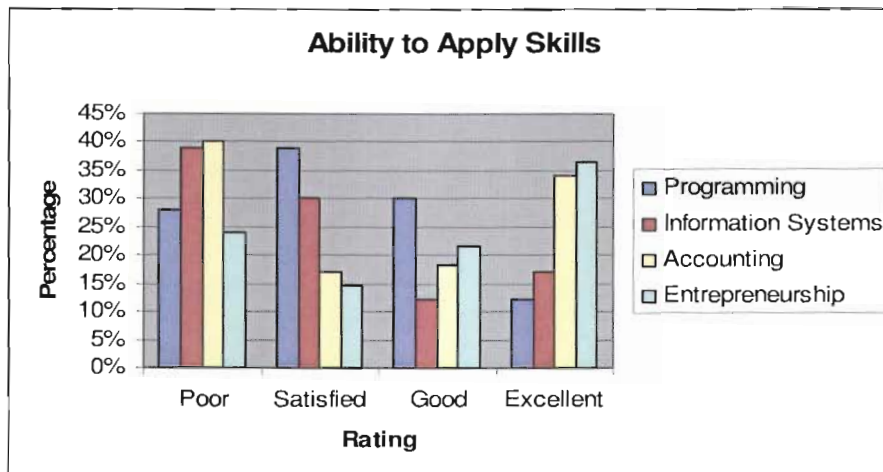


Figure 7: Ability to apply skills after the Introduction to Information Technology course

4.4.5 Programming coverage

◇ In your opinion, the coverage of Programming Flow and Logic in Intro-to-IT was:

Table 13: Coverage of programming

Poor Average Good Excellent

Figure 8 shows that nearly 40 percent of the learners felt that the coverage of programming flow and logic presented in the Intro-to-IT course was either average or excellent. Of the remaining 60 percent, 38 percent felt it was average and 22 percent were not satisfied with the coverage of the topics. Learners who responded are, in some cases, learners who have progressed to the IT diploma and are in a better position to compare what they have learned in the Intro-to-IT course to what they actually need when entering the IT diploma. As can be seen from these results, the Intro-to-IT course is lacking in imparting sufficient skills and knowledge, specifically for programming.

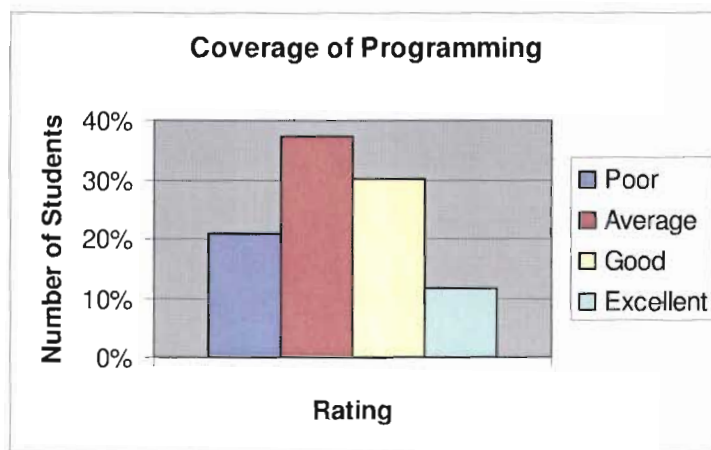


Figure 8: Coverage of programming

4.4.6 Understanding of programming

◇ *How would you rate your understanding of programming flow and logic when you entered the IT diploma?*

Table 14: Understanding of programming

Poor Average Good Excellent

This is perhaps one of the most pertinent questions relating to the learner. The learner's opinion is based on the learner's experience with the subject, whether it was difficult or not. This, to a certain extent, is based on the learner's final mark; that is, whether or not the learner was successful. As can be seen from Figure 9, 80 percent of learners who responded were of the opinion that they had an average-to-good understanding of programming flow and logic. The remaining 20 percent were of the opinion that their understanding was poor. This does not relate to the pass percentages obtained from the VUT's ITS system (see Tables 2 and 3), which averages out to 64 percent.

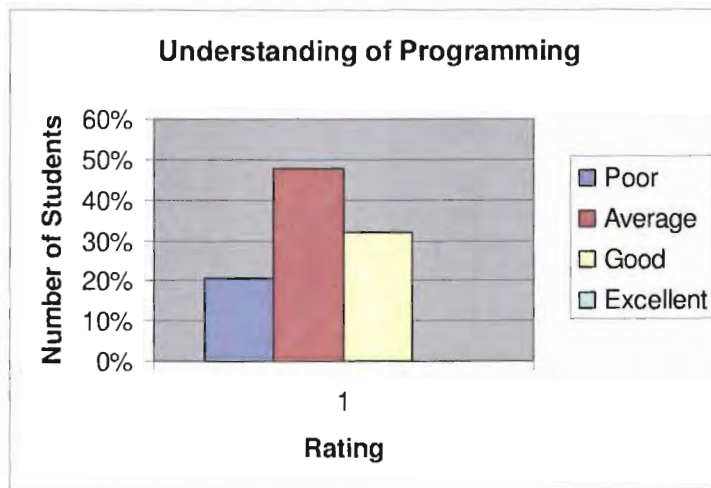


Figure 9: Understanding of programming

4.4.7 Performance without the Introduction to Information Technology course

- ◊ *In your opinion, if you had attended your major subjects (programming and information systems) in the IT diploma without the introduction presented in Intro-to-IT, how do you think your results would have been in comparison the marks you actually obtained?*

Figure 10 shows that most of the respondents, 51 percent, were of the opinion that there would have been no marked difference in their performance in the IT diploma first-semester subjects, programming and information systems, if they had not attended the Intro-to-IT course. Only 13 percent believed that their performance improved because they attended the course and the remainder 36 percent felt that their chances were poorer because they attended. An applicant who is accepted directly into the IT diploma needs a minimum of computer studies on higher grade in their Matriculation or equivalent to qualify, along with other criteria. Taking this into consideration, one interpretation of these learners' opinions would be that programming is not, in their opinion, a prerequisite for the IT diploma, as they feel they would have performed equally well without the

introduction to programming flow and logic presented to them in the Intro-to-IT course. Thus, in their opinion, the Intro-to-IT course is unnecessary. This, however, does not correlate with the marks obtained, where most of the respondents did not perform well in programming (see Table 8).

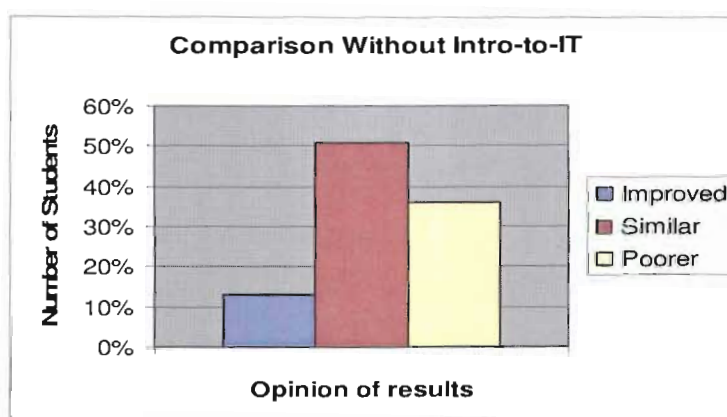


Figure 10: Comparison without the Introduction to Information Technology course

4.4.8 Topics which may assist future learners

- ◇ Which of the following do you think, or believe, would assist future learners in Intro-to-IT, to attempt to ensure each learner enters the IT diploma with sufficient basic knowledge of programming flow and logic (You are allowed to make more than one selection?)

Table 15: Learner selection options to improve the Introduction to Information Technology course

Make use of a programming language, e.g. Visual Basic as a tool.
Extend Module 3 to allow more cover of specific topics in more detail.
Remove some topics to allow more time for specific topics.

What would assist future learners when entering the Intro-to-IT course? As indicated in Figure 11, most were of the opinion that introducing some type of programming language into the Intro-to-IT course would be advantageous to future learners entering the IT diploma. This is understandable and supportable. Theoretical knowledge, without the opportunity to practice that knowledge, does not always result in a good understanding of the knowledge. Programming is about applying the knowledge to solve a problem.

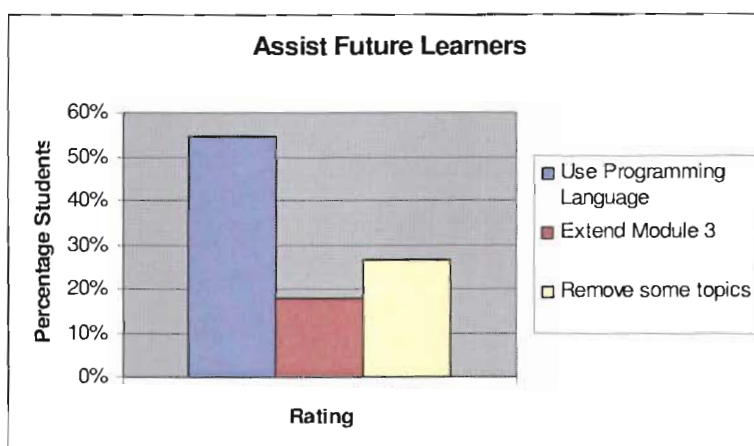


Figure 11: Assist future learners

4.4.9 Topics to be extended

◇ If you indicated you believe Module 3 should be extended to cover more for specific topics, what are these topics? (You are allowed to make more than one selection).

Table 16: Topics to be extended

Programming Flow and Logic	Access	FrontPage	Internet
----------------------------------	--------	-----------	----------

If Intro-to-It was to be extended the learners felt that the coverage of programming flow and logic should be the topic which should be extended, Figure 12. Of the respondents, 80 percent indicated they were in favour of this topic being lengthened.

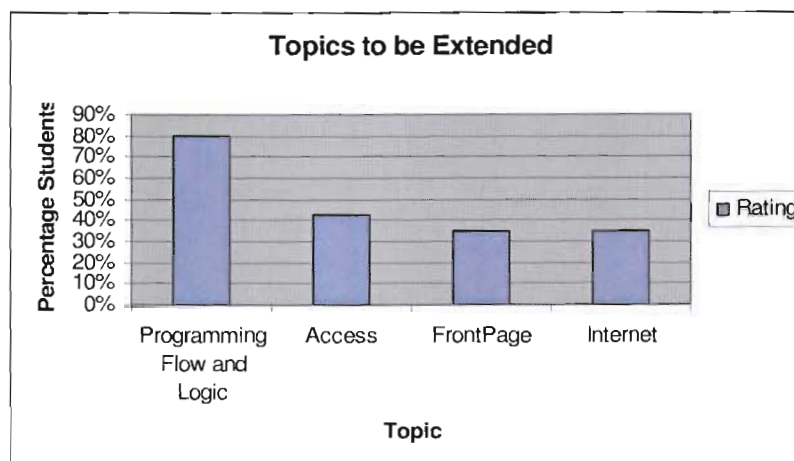


Figure 12: Topics to be extended

4.4.10 Topics which may be excluded

- ◇ If you indicated the removal of some topics to allow for more cover of specific topics in Question 10, which of the following do you feel should be removed?(You are allowed to make more than one selection).

Table 17: Topics to be removed

E-mail	Internet	FrontPage	Access
--------	----------	-----------	--------

Figure 13 shows that Internet and E-mail were found to be the topics most of the learners felt were unnecessary and should be removed from the syllabus of the Intro-to-IT course. This is logical, as most skills and experience learners accumulate with regard to the Internet and E-mail are usually self-taught. There is perhaps a need to explain the basic concepts but not, according to the respondents, to provide detailed lessons on these subjects.

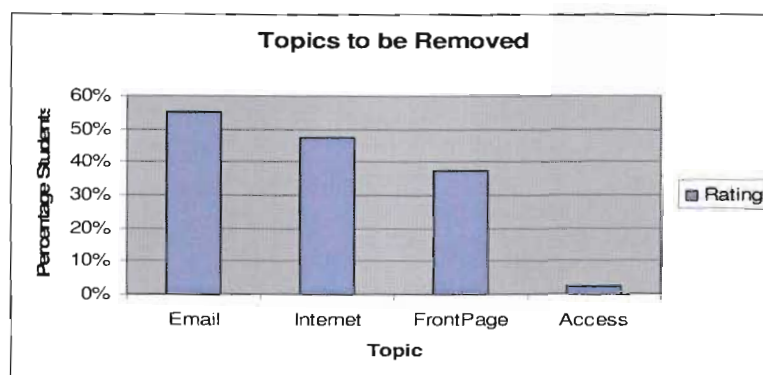


Figure 13: Topics to be removed

4.4.11 Overall satisfaction with the Introduction to Information Technology course

◇ Please rate your overall satisfaction with the Intro-to-IT Course:

Table 18: Satisfaction with the Introduction to Information Technology course

Poor	Average	Good	Excellent
------	---------	------	-----------

As shown in Figure 14, most learners were satisfied with the Intro-to-IT course. Of those respondents who completed this section, 80 percent indicated that they were satisfied with the course. The respondents have also experienced the IT diploma subjects and, therefore, have the experience necessary to be able to compare the Intro-to-IT course to another course.

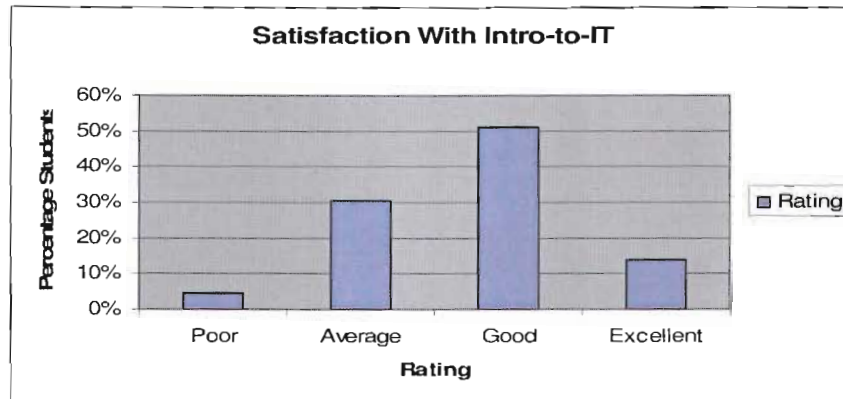


Figure 14: Satisfaction with the Introduction to Information Technology course

4.4.12 Organisation of Intro-to-IT course

◇ The overall organisation and running of Intro-to-IT was in your opinion:

Table 19: Organisation of the Introduction to Information Technology course

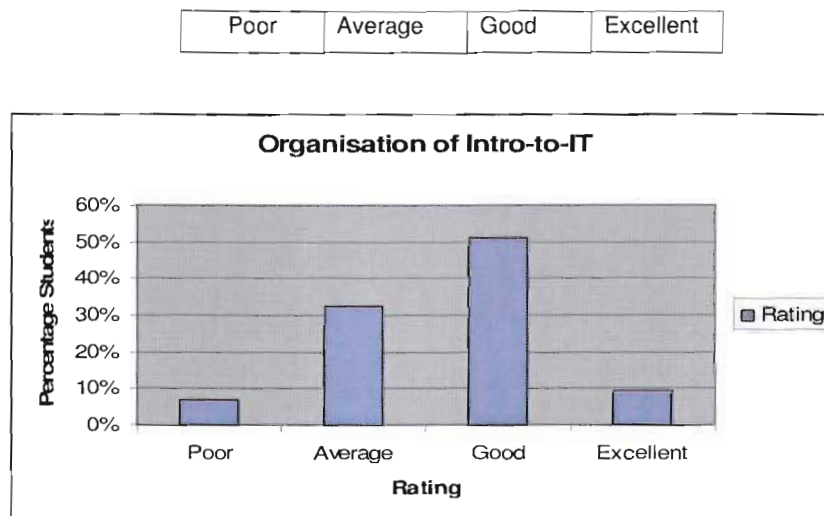


Figure 15: Organisation of the Introduction to Information Technology course

The running of the Intro-to-IT course was described by the students as being, generally, average to good. Again, over 80 percent of the respondents felt that the organisation of the Intro-to-IT course was acceptable.

4.4.13 Lecturer performance

◇ *How would you rate the overall lecturer performance in Intro-to-IT?*

Table 20: Lecturer performance

Poor	Average	Good	Excellent
------	---------	------	-----------

Lecturer performance in the Intro-to-IT course was rated by the respondents as being average to good. This is indicated in Figure 16. Lecturer performance relates directly to the success of the course and the success of the learners. Poor lecturing skills always reflect on the ultimate pass percentage of any subject or course. The respondents can compare the Intro-to-IT lecturers with the IT diploma lecturers.

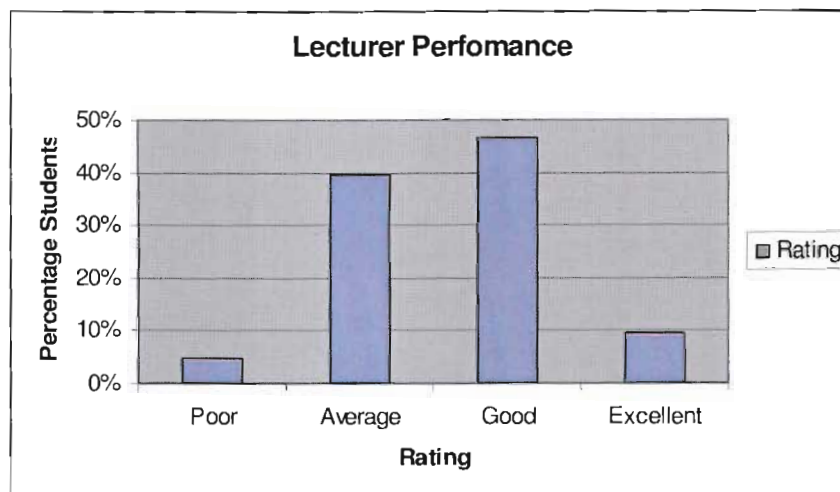


Figure 16: Lecturer performance

4.4.14 Time available in the Introduction to Information Technology course

◇ *Intro-to-IT is completed in one semester; do you believe the time to be sufficient?*

Table 21: Time available in the Introduction to Information Technology course

Yes	No
-----	----

As can be seen from Figure 17, the learners felt that the time available in Intro-to-IT was insufficient. These respondents have completed the Intro-to-IT course and have experienced IT subjects for their diploma course. They are in the position to compare and evaluate the difference between how compact the Intro-to-IT syllabus is in comparison to how they experienced the IT diploma subjects.

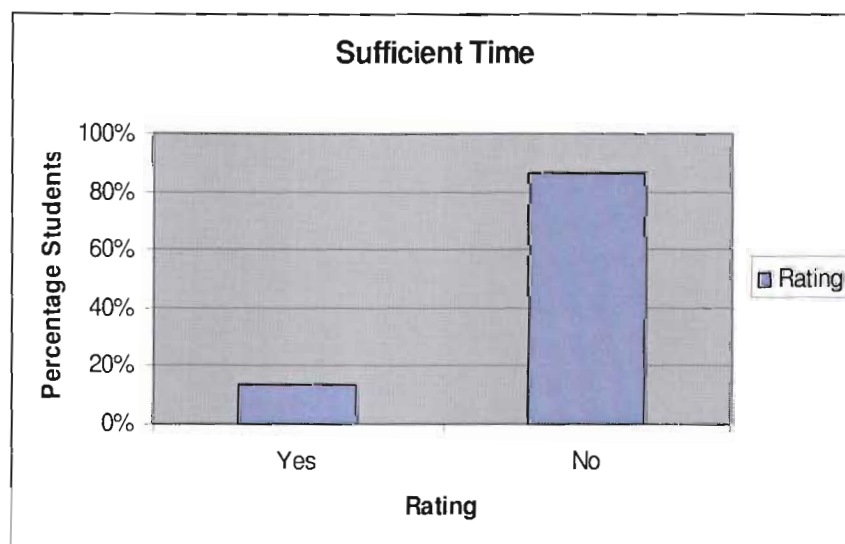


Figure 17: Time available in the Introduction to Information Technology course

4.4.15 Extend the Introduction to Information Technology course to one year

◇ *If your answer to the previous question was no, do you think the Intro-to-IT course should be extended to one year?*

Table 22: Extension of the Introduction to Information Technology course

Yes	No
-----	----

If the Intro-to-IT course was to be extended, the learners felt that it should be extended to a one-year course.

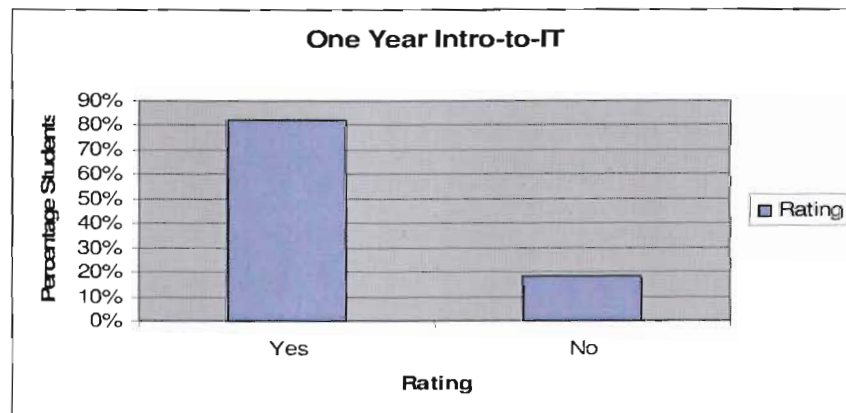


Figure 18: Extension of the Introduction to Information Technology course

4.5 ACTION RESEARCH – REALIGNING THE INTRODUCTION TO INFORMATION TECHNOLOGY COURSE SYLLABUS TO MEET THE INFORMATION TECHNOLOGY DIPLOMA REQUIREMENTS

During the past 24 months, alterations to various aspects of the Intro-to-IT syllabus, prerequisites and Module durations have been implemented, and the results of these alterations have been analysed to assess their impact on the learner and on the Intro-to-IT course.

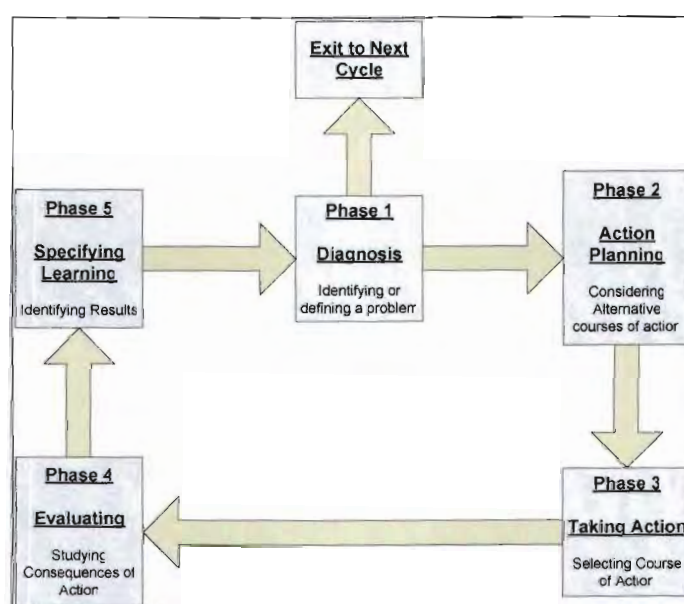


Figure 19: Action research

Action research can be described as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. In most of its forms, it does this by using a cyclic or spiral process, which alternates between action and critical reflection and in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles (Dick 1999).

Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention and reflective learning. In action research, the emphasis is more on what practitioners do than on what they say they do (Avison, Lau, Myers & Nielsen 2004).

Action research is an iterative process, which is accomplished in cycles, and phases, as can be seen from Figure 19, in the case of this research, three cycles of action research were performed.

4.5.1 Cycle one semester 1 2006

4.5.1.1 Phase one diagnosis

Data obtained from the VUT ITS was used in the diagnosis phase, identifying the poor pass rates in the first semester IT diploma as the problem.

4.5.1.2 Phase two action planning

The decision was made to change aspects of the content and entrance requirements of the course during the second semester 2006.

4.5.1.3 Phase three taking action

Prior to the commencement of the second semester in 2006, changes to the entrance requirements, course syllabus and content were introduced in an attempt to improve the pass rates of the Intro-to-IT learners when entering the first-semester IT diploma, and specifically the programming subject these included:

- **Entrance requirements**

When the Intro-to-IT course was initiated, the original accepted prerequisite criteria was 22 points on the Swedish scale, with a minimum of an E symbol in both mathematics and English, either on standard or higher grade. For Semester 1

of 2006, the minimum points accepted on the Swedish scale were increased to 23 and the requirements for mathematics and English stayed the same. Any learner who had achieved an A or B symbol in mathematics and/or English was now credited with numeric skills and/ or communication skills, whichever was the case.

- **Course content**

The topic of flowcharts and pseudo code was introduced into the content of the programming subject in Module 3. Emphasis for this topic was placed on the flow of an algorithm, the declaration and use of variables, and the logic of programming. This was presented as a theoretical addition with no practical training being given to the learners on any programming language.

4.5.2.4 Phase four evaluating

As can be seen from Figure 19, the successful Intro-to-IT learners who progressed to the IT diploma first semester after these changes were implemented obtained a pass percentage of 65 percent in the programming subject; where as the pass percentage for Semester 2 2005 was 62 percent (see Table 3).

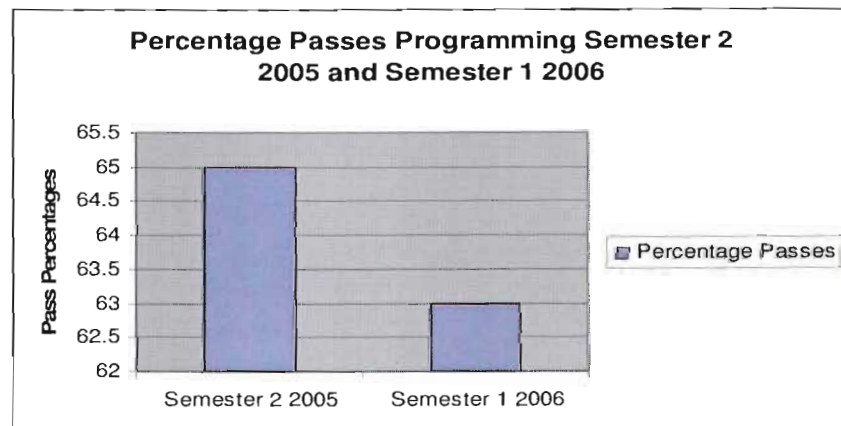


Figure 20: Comparison between Semester 2 2005 and Semester 1 2006 programming passes

4.5.1.5 Phase five specifying learning

As can be seen from Figure 20, the increase in points and alterations to programming content made no real difference to the pass rates for programming in the first semester and had a detrimental effect on the overall pass rate of the Intro-to-IT course. The changes made were not effective enough.

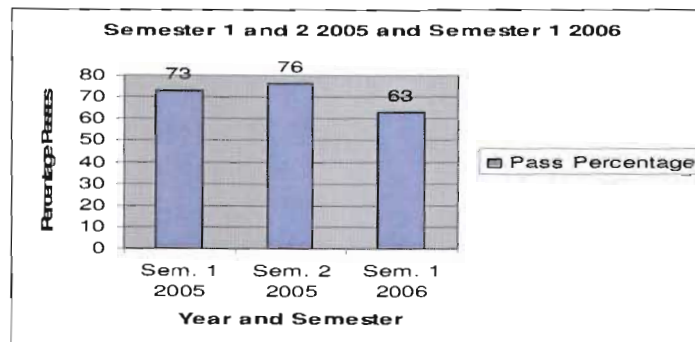


Figure 21: Introduction to Information Technology: Semesters 1 & 2 2005 and Semester 1 2006 passes

4.5.2 Cycle two semester 2 2006

4.5.2.1 Phase one diagnosis

The results obtained from cycle one were used to determine the effectiveness of alterations made to the content and syllabus. The results obtained were not as expected, and did not improve the poor pass rates in any noticeable way.

4.5.2.2 Phase two action planning

Owing to the poor results obtained from the changes implemented in the first the cycle of semester 1 2006 changes to aspects of the content and entrance requirements of the course for semester 2 2006 were implemented.

4.5.2.3 Phase three taking action

Owing to the poor results obtained from the changes implemented in the first semester of 2006, the criteria for the first semester of 2007 were changed.

- **Alterations to weight factors**

This alteration affected the weight factors prescribed for topics in Module 3 alone, again with the aim of improving the pass rate of programming in the learner's first semester IT diploma. The only change to the weights was in the programming and database topics. Previously in the module examination these topics' marks each contributed 50 percent to the Module 3 examination mark and the module class test marks. The alterations were as follows:

- For Test 1, which was MS Access and Databases, the weight factor was adjusted to contribute 35 percent towards the final combined class test mark.
- The programming weight factor was adjusted to contribute 50 percent towards the final combined class test mark.
- The rest of the topics, E-mail, Internet and FrontPage, were adjusted to contribute 15 percent towards the final combined class test mark.
- After completion of the module, a final examination is written covering the complete course work. The final module examination and the module rewrite examination were adjusted as follows:
 - Programming comprised 50 percent of the examination content.
 - Access and databases comprised 35 percent of the examination content.
 - The rest of the topics in Module 3 made up 15 percent the examination content.

4.5.2.4 Phase four evaluating

The Semester 2 2006 Intro-to-IT learners who progressed to the Semester 1 2007 IT diploma performed better than previous learners did with regard to

programming. As can be seen from Figure 21, 79 percent of the learners passed programming in their first semester IT diploma.

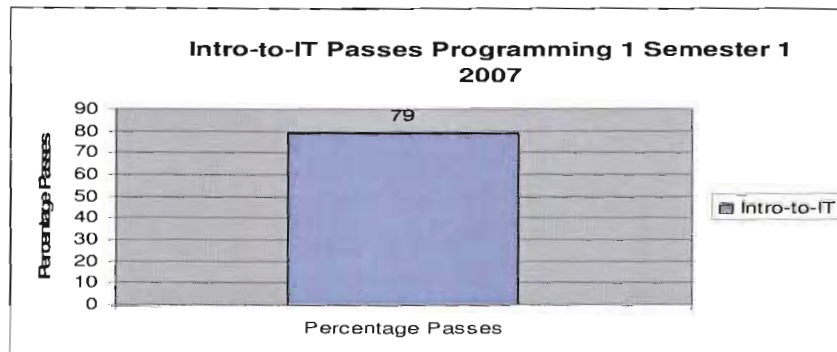


Figure 22: Programming passes for the Introduction to Information Technology students in Semester 1 2007

A comparison was made in this cycle to compare how the Intro-to-IT learner who had advanced to the first-semester IT diploma subjects compared with other faculty learners who were exposed also to programming in their first semester for the first time.

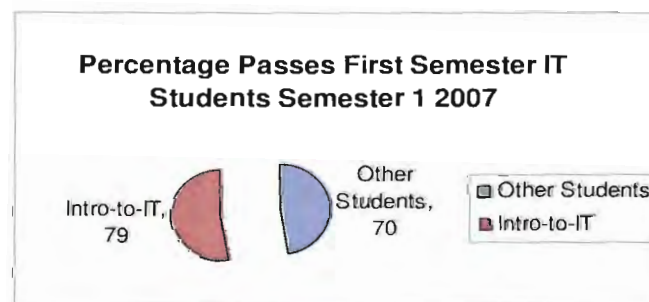


Figure 23: Comparison between the Introduction to Information Technology learners and other faculty learners

4.5.2.5 Phase five specifying learning

There was a discernible difference in pass rates in the programming first-semester subject after the alteration to the weight factors of Module 3 were implemented. Indeed, in comparison to other faculty learners, the average Intro-to-IT learner performed better.

4.5.2 Semester 1 2007

Following the changes in the Semester 1 and 2 of 2006, no changes were made to the syllabus or content in Semester 1 2007, and time was allowed to gather all the relevant information and data.

4.5.3 Cycle three semester 2 2007

4.5.3.1 Phase one diagnosis

In the second semester 2007, the VUT introduced English digital learning (EDL) for all learners at the University. This resulted in the communication skills subject (see Sections 2.10.1 and 2.11.1) becoming redundant. This provided the opportunity to change the time frames for subjects in the Intro-to-IT course. Although Intro-to-IT learners performed better than other faculty first semester learners in the programming subject, the pass rates obtained were still not satisfactory.

4.5.3.2 Phase two action planning

The lecturing times and entrance criteria for semester 2 2007 were altered.

4.5.3.3 Phase three taking action

Changes to the entrance criteria and times for the syllabus were implemented, including:

- **Alterations to subject duration**

Although the actual lecturing hours allocated remained the same (see Section 2.11.1), the number of weeks available to present the subjects was positively affected by the removal of the communication skills subject. The previous time-frame was as follows:

- Module 1: three weeks (see Section 2.10.1)
- Module 2: four weeks (see Section 2.10.2)
- Module 3: five weeks (see Section 2.10.3)
- Between Module 1 and Module 2 was a two-week interval and between Module 2 and Module 3 a two-week interval.

Module 1 and Module 2 were combined into one module. The new Module 1, with six weeks duration, and the old Module 3 became the new Module 2. This gave the learners more time to practice and study the skills and topics they had been presented during this module.

- **Alterations to entrance requirements**

The required points to enter the Intro-to-IT course were increased to 24. In conjunction with this alteration, the subject requirements on an applicant's Matriculation certificate or equivalent were changed as follows:

- English was changed to a minimum D from a previous E (see Section 2.6.1.2)
- Mathematics was changed to a minimum D from a previous E (see Section 2.6.1.2)
- One of the following subjects was also required, again with a minimum of a D symbol:

- Accounting
- Science
- Computer Studies
- Chemistry
- Biology

4.5.3.4 Phase four evaluating

This is an iterative process and the results for Semester 2 2008 are not available at this time to ascertain how the changes have affected the pass rates of programming.

4.5.3.5 Phase five specifying learning

Due to no availability of results phase five was not completed.

4.5.4 Learners who excelled in the Information Technology diploma

A study was made to compare whether learners entering directly into the VUT IT diploma with high marks in mathematics, performed better than the successful Intro-to-IT learners who had also completed their IT diploma (Intro-to-IT learners enter with lower or the minimum mathematic marks). This was considered part of the action research as the outcome of the study may have determined if alterations to the entrance requirements and / or syllabus would have been required. This study considered all IT learners who had completed their IT diploma without failing a subject for 2006.

4.5.4.5 Results of study on learners who excelled in 2006

As can be seen from Figure 23, only 17 percent of the learners who excelled obtained an A symbol in mathematics, 23 percent obtained a B and 30 percent obtained a C. This accumulates to 70 percent of the learners who excelled in the IT

diploma performed well in their Matriculation mathematics subject. The remaining percentage is learners who before the Intro-to-IT course, would not have been in the IT diploma (see Annexure B).

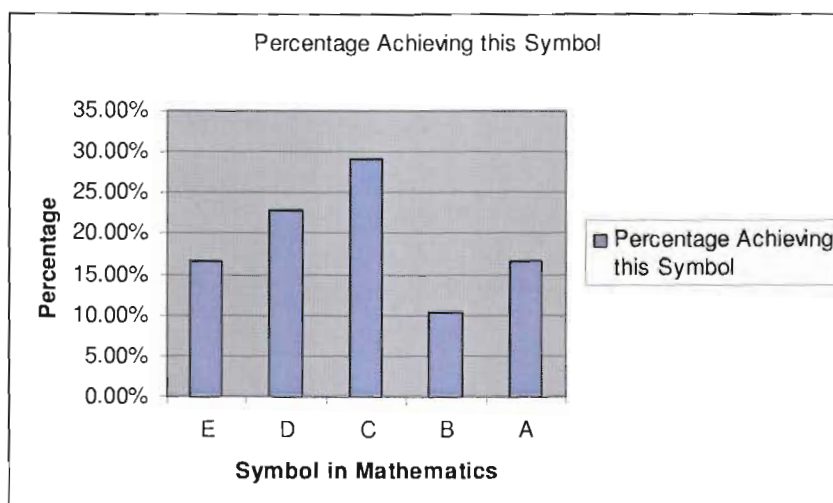


Figure 24: The 2006 Information Technology diploma learners who excelled

4.5.4.2 Conclusion to learners who had excelled

There appears to be a correlation between how well learners perform in mathematics to how well they perform in the IT diploma. Mathematical skills and logical thinking relate to programming. The learners who surprise are those with an E symbol for mathematics who have excelled in the IT diploma. Eight learners with an E symbol in Matriculation mathematics performed just as well as eight learners with an A symbol in Matriculation mathematics.

Table 23: Alterations to entrance requirements and syllabus of the Introduction to Information Technology course

Intro-to-IT Alterations to Entrance Requirements and Other factors					
<i>Time Frame</i>	<i>Required points</i>	<i>Required subjects</i>	<i>Minimum symbol</i>	<i>Other changes to requirements</i>	<i>Changes to syllabus / subject weights</i>
Course Inception	22	Mathematics and English	' E' Either SG or HG	None	None
Semester 1 2006	23	Mathematics and English	' E' Either SG or HG	Credits Given for Mathematics and English with an 'A' or a ' B ' Symbol	Flow Charts and Pseudo Code Introduced
Semester 2 2006	No Change	No Change	No Change	No Change	Weight Factors Module 3 changed to 35% for Databases and 50% for Programming
Semester 1 2007	No Change	No Change	No Change	No Change	No Change
Semester 2 2007	24	Minimum 3 subjects Mathematics and English Compulsory and one Optional Subjects	Compulsory Subjects ad one optional subject ' D'	No Change	No Change

Table 23, is a tabular summary of the alterations made to the entrance requirements and syllabus of Intro-to-IT.

4.6 CONCLUSION

4.6.1 Skills and knowledge requirements for the Information Technology diploma

Basic computer literacy skills appear to be well understood by the respondents, although not all MS Office package components are utilised extensively, which was to be expected. Programming skills are emphasised by their daily use, as a prerequisite when entering the IT diploma stream. Of the learners entering the IT diploma through the Intro-to-IT course, 27 percent rated their ability to apply their skills and knowledge learnt in Intro-to-IT as poor. Around the same percentage, 21 percent, described the coverage of programming in the Intro-to-IT course as poor, the same percentage rated their understanding of programming as poor. Of the respondents, 35 percent stated that they believe that they would have performed equally well in the IT diploma if they had not attended the Intro-to-IT course. These results represent a failure to equip the learners with the necessary skills and inadequately preparation of all the Intro-to-IT learners for the IT diploma.

4.6.2 Content and syllabus of the Introduction to Information Technology course

The coverage of the MS office package is acceptable; the Intro-to-IT course does produce computer literate learners. Although some of the topics are frequently used and others are rarely used, the general content with regard to the MS Office package is acceptable. The syllabus with regard to the programming content does not adequately prepare the learner for the IT diploma programming content. Many learners feel they were unprepared, would have performed equally well without programming in Intro-to-It or did not understand the programming content. Not understanding the programming content would result in learners not being prepared and feeling that they would have performed equally well without attending the Intro-to-IT course. The content and syllabus does not wholly prepare the learner for an IT diploma at VUT, specifically programming subjects. Although

the Intro-to-IT learner compares favourably with other faculty learners, there is still a deficiency in the skills and logical thought processes to allow the Intro-to-IT learner to perform acceptably when attempting programming for the first time.

4.6.3 Realign Introduction to Information Technology syllabus

Respondents feel strongly that the introduction of a suitable programming language into the Intro-to-IT course would be beneficial to future learners. They also indicated that extending the course would also be beneficial. Specifically, they indicate that extending programming in Intro-to-IT is the preferred option. The alignment of the Intro-to-IT course does not presently fulfil the requirements of the VUT.

CHAPTER 5 – INTRODUCTION TO INFORMATION TECHNOLOGY SOFTWARE TOOL

5.1 INTRODUCTION

A Software Program was developed for Intro-to-IT for the following reasons:

- application assessment for entrance to Intro-to-IT was a manual system and assessment evaluations were not recoded,
- Intro-to-IT is classed a short course by the VUT, therefore no student marks are recorded on the VUT ITS system,
- no record was kept of lecturers, part time or full time, available and qualified to present the different subjects in Intro-to-IT,
- Intro-to-IT utilises full time and part time staff members, resulting in difficulties scheduling the lectures, groups and venues, the schedule for full time staff members must accommodate the lecturer's existing scheduled classes from his or her faculty.

5.2 SOFTWARE SPECIFICATIONS

The following tools were used in the development, construction, and implementation and testing of the database system:


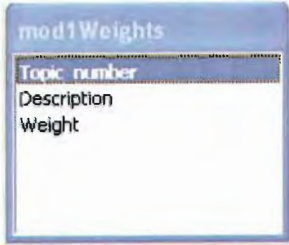



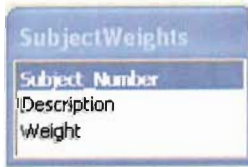
- Microsoft Access in the design and construction of the database,
- Visual Basic 6 to create, read, update and delete entities and instances of those entities, using Structured Query Language. Visual Basic 6 also provided the user interface,
- Crystal Reports to create the necessary reports.

5.3

TECHNICAL SPECIFICATIONS

5.3.1

Entities and attributes

Administrator:		Module 1 and 2 weights (two entities):	
Password:		Group lecturers:	
G007, T122, T115 and Theory Venue (One entity for each venue):		Subject weights:	

Group1, Group 2, Group 3, Group 4, Group 5 and Group 6 (one entity for each group):	<div> Group5 dayNumber Weekday eight nine ten eleven twelve thirteen fourteen fifteen sixteen </div>	Required subjects:	<div> RequiredSubjects Subject Number Description minimumMark Status </div>
Lecturer:	<div> Lecturer_Details Lecturer Number Lecturer_Surname Lecturer_Initials Lecturer_Name Lecturer_Adress Lecturer_Contact_Num Active Numeric_Skills Portfolio_and_Project Life_Skills MS_Office </div>	Marks Module 1 and 2(one entity for each):	<div> MarksModule2 Student Number Surname Initials Semester year Module2_Class_test_Mark Module2_Project_Mark Module2_Portfolio_Mark Module2_Access_Exam_Mark Module2_Access_Rewrite_Mark Module2_Programming_Exam_Mark Module2_Programming_Rewrite_Mark Final_Exam_Mark Final_Module_Mark Comment </div>

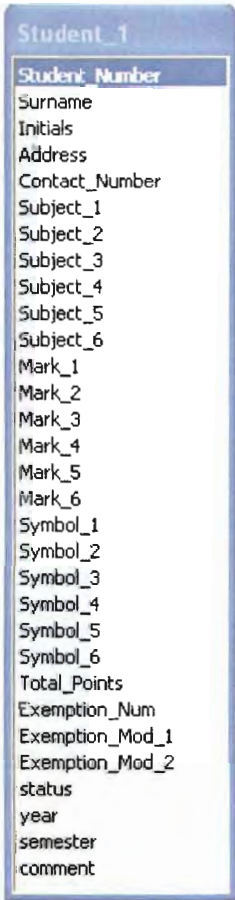
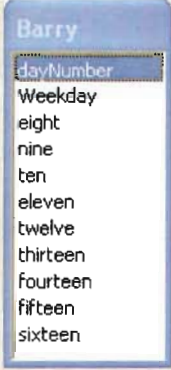
Student application:		Active lecturer:	
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Table 24: Intro-to-IT database entities

5.3.2 Normalisation and relationships

The entities in Table 24 were created in Microsoft Access. This is a non-relational and non-normalised database, which, although not ideal, in this case was very practical and necessary. Some of the main reasons for this were:

- An applicant to Intro-to-IT was not recorded on any system in the VUT, therefore the applicant does not receive a student number. Many successful applicants decide not to enrol in the VUT Intro-to-IT course therefore only when payment is received for registration to the course, are applicants issued with a student number. The student application is therefore a stand-alone entity with no relationships to any other entity either required or necessary.
- The student entity contains many attributes including subjects and marks from the learner's secondary institution. Applicants have many and varied subjects, and many learners have already completed courses from other tertiary institutions. To create an entity to record subjects would have been impractical, it would not have been feasible to attempt to capture all subjects from numerous secondary and tertiary institutions.
- The active lecturer (created using lecturer name) entity, is only created when the user activates an existing lecturer in the database (see Annexure C) the entity created is used to record that lecturers schedule.
- The administrator and password entities are stand-alone entities, utilised to store the necessary data and does not require any relationship with any entity.
- The group and venue entities (6 group entities and 4 venue entities) are again stand-alone entities only utilised to record the schedule for these entities.
- A student is not linked to a group entity in the database, the student is allocated a group manually, due to the first pay the first accepted policy of the Intro-to-IT course. It is not necessary to record to which group a student allocated.
- Students number, the student surname, initials are the only entities recorded for an Intro-to-IT learner. These are recorded in the Module 1 and Module 2 marks.

5.3.3 Procedures

Procedures were widely used in the coding for this application including but not limited to:

- Counting the required number of subjects,
- counting compulsory and optional subjects,
- counting and comparing points obtained to required points,
- evaluating and displaying the assessment result.

5.3.4 Scheduling lecturers, groups and venues

Scheduling of groups and lecturers to venues without any duplication or clashes was also accomplished by coding using procedures.

5.4 REPORTS

Reports were compiled using Crystal Reports including parameter driven reports (see Annexure E), statistical information (see Annexure G), graphical displays (see Annexure G), venue scheduling and timetable reports (see Annexure F).

5.4.4 Coding

Visual Basic was used in the coding with the use of procedures and Structured Query Language to create, read update and delete entities and data.

5.3 CONCLUSION

This unique software was designed specifically to assist the coordinator of the Intro-to-IT course with the scheduling of all learners and VUT assets and resources relevant to the course. This tool may be used to store data for future use, for example, statistical information relating to the course, available and qualified

lecturer details. Required reports may also be generated, including learner reports, pass rates and timetables for lectures, learners and venues.

CHAPTER 6 - THE MODEL

6.1 INTRODUCTION

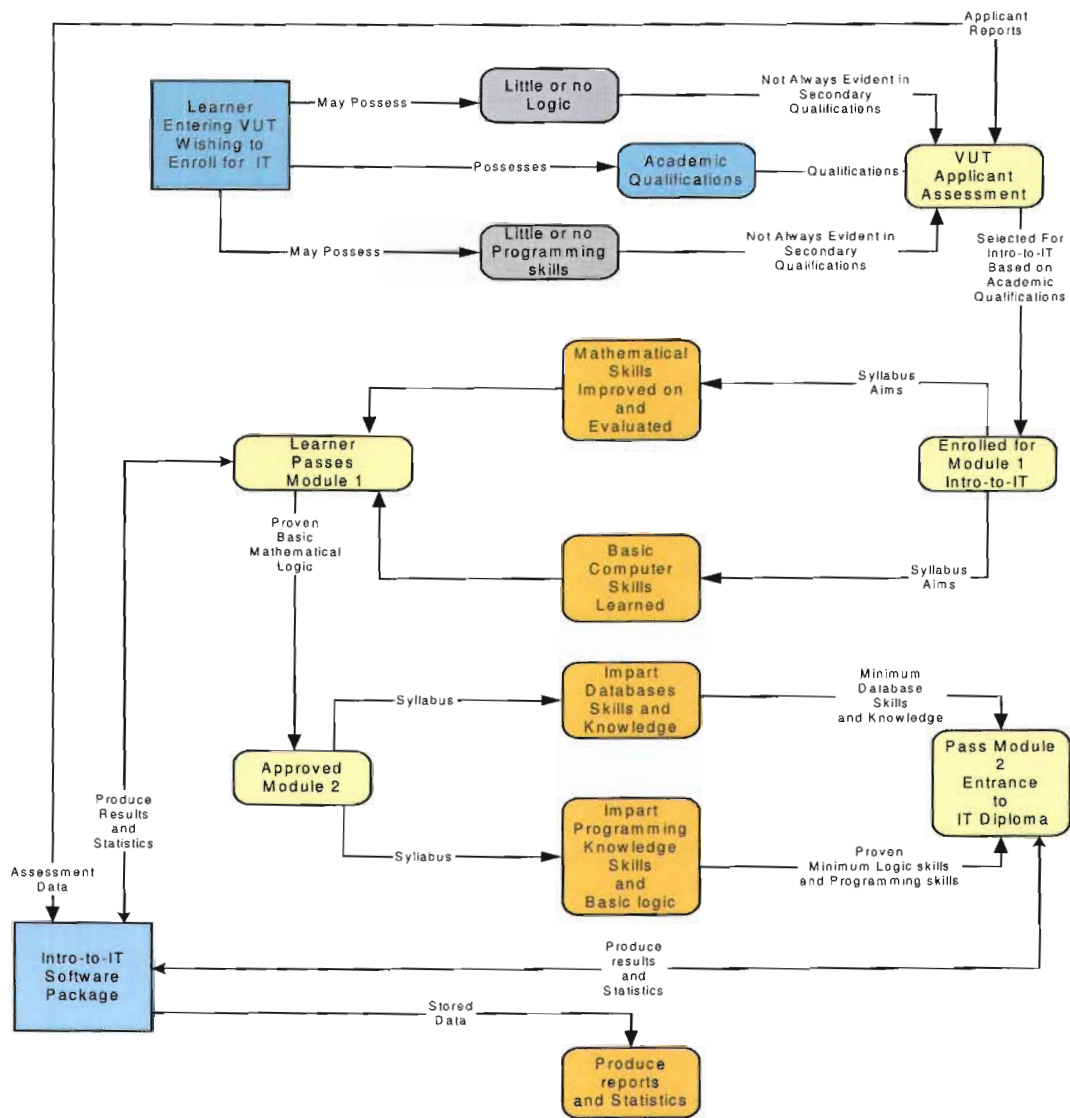


Figure 25: Graphical representation of the model

From previous chapters it can be appreciated that a problem exists between what students are able to do, in comparison with what the tertiary institution, in this case the VUT, expects the learner to be able to do. The title of this research is “A Model To Reduce The Divide Between South African Secondary Institutional Skills And Knowledge, And The Entrance Requirements For An Information Technology Diploma Course” this chapter will explain how this model has assisted in diminishing this divide in the VUT and may help other tertiary institutions to accomplish the same. Figure 25 is a graphical representation of the model:-

6.2 APPLICANT EVALUATION

The initial phase of the model is to assess the academic record of the applicant. The evaluation of the applicant’s qualifications is to ascertain if the applicant has:

- the correct compulsory subjects, English, Mathematics and one of the optional subjects (Science, Computer Studies or Accounting) with the required marks (see Section 4.5.3.3). This is to ascertain if the applicant has minimum logical skills, insufficient to enter directly into the IT diploma, but sufficient to allow the logical skills of the applicant has to be improved and developed by the Intro-to-IT course.
- the necessary points according to the scale used, in the case of the VUT, the Swedish Scale (see Section 4.5.3.3).

In the case of the VUT Intro-to-IT course, approved applicants have no or very little recognised programming experience. The method used to evaluate an applicant’s problem solving and logic skills is to assess their academic record. In this model, applicants who meet the requirements for direct entrance to IT diploma, who possess the necessary compulsory subjects, optional subjects and required points, are recommended for acceptance to IT diploma stream to the relevant faculty.

MODULE 1

The aims of the model in Module 1, the second phase, are to improve and develop the learner's logical thinking skills, to improve the learner's English proficiency, English being the language of tuition in the VUT. In addition, to impart basic computer literacy skills (MS Word, MS Excel, MS PowerPoint etc.), which will be required in the IT diploma course, and to evaluate all skills and knowledge in the duration and at completion of the course.

This is accomplished by presenting the subjects Numeric Literacy, Communications, Life Skills to assist the learner with campus life and studying and Basic Computer Literacy Skills (see 2.10.1, 2.10.2).

Communications and Life Skills are continuous assessment subjects, however, learners are required to qualify for the final Computer Literacy and Numeric Skills Module exams by means of class tests and assignments. All subjects require a sixty percent final mark, and a pass must be obtained in all subjects to qualify for advancement to Module 2.

In this phase, learners are again exposed to sections of secondary institutional grade twelve Mathematics in the Numeric skills subject, the same Mathematics that may have effectively blocked the learner's entrance into the IT diploma. In the content of model the Numeric skills subject is a crucial tool. The rational being Numeric skills require logical processes and thinking, therefore, Numeric skills is used to develop and then assess the learner's logical processes. A learner, who has passed the Numeric Skills subject, has been evaluated on, and has displayed, the required logical thinking which may afford that learner the opportunity of success in Module 2.

The aim of Module 1 in this model is twofold, first, to develop and assess the learner's logical thinking, which is a prerequisite for success in Module 2 of the

model, and second, to ensure only those learners who have successfully displayed acceptable logical skills will advance to Module 2 of the model.

6.3 MODULE 2

The aims of Module 2, phase three in the model, are to impart basic database knowledge and skills to the learner, to expose the learner to programming flow, logical processes and logical skills (see 2.10.3) to develop these skills and then evaluate the learner on these skills and knowledge.

The database syllabus covers Entity Relationship Diagrams (a graphical representation of a database), the creation of databases in Microsoft Access and the theoretical concepts of database systems and database management systems. In this section of Module 1, a learner will need to practice basic logical thinking to succeed, however, the logical skills required for this subject in the model, is to a lesser degree than the logical skills required for the programming content in Module 2. A learner entering the IT diploma will be exposed to databases, database management systems and database concepts. This subject introduces the learner to these concepts, develops the learner's skills in these concepts and then evaluates the learner.

In programming flow and logic, the learner is exposed to Flowcharts, Pseudo code and concepts covering variables, calculations and outputs with the aim of exposing the learner to the required logic and improving that learner in this skill.

Firstly in this phase of the model, Flowcharts are utilised to demonstrate the logical flow of programming and programming processes to the learner. By developing the learner's logical thinking and logical skills, the learner should be in a position to construct logical flowcharts from different scenarios.

Secondly, in this phase of the model, Pseudo code is introduced to the learner. Pseudo code exposes the learner to concepts such as variables, loops, and

procedures. Logical skills are further developed in this phase and again a learner who has developed the required skills should be in a position to construct logical Pseudo code.

Learners are required to qualify for final exams by means of tests and assignments, and once again, a final mark of sixty percent is required to pass the course.

Successful applicants have been evaluated on, and have proven they understand and can demonstrate their proficiency in basic database systems and theory, the flow and logic in programming, and most importantly, have improved their logical thinking skills.

6.4 SOFTWARE TOOL

The Intro-to-IT software tool is used throughout the flow of the model to capture the necessary data (applicant appraisals, module marks etc.), to provide statistical information, to calculate data where necessary and displays the required information in the form of reports (see Section 5.1).

6.5 CONCLUSION

In the VUT, the implementation of this model has reduced the divide between the secondary institutional skills and knowledge and the skills and knowledge required when entering the IT diploma at the VUT. As can be seen from the IT diploma learner results (see Sections 4.6.1, 4.6.2 and 4.6.4), the pass percentages from the implementation of this model has shown a positive increase.

The implementation of this model may also assist other tertiary institutions to improve their pass rates in the first semester of their diploma course.

CHAPTER 7 - CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The concluding chapter of this study provides a summary of the research project and draws conclusions based on the findings of the theoretical and empirical investigation. The first part of the chapter provides a review of the completed study. The aim of the research project is reiterated and the research design, from the literature review to the data analysis, is briefly described. The implications of the findings are discussed and recommendations are made. This chapter presents a discussion of the limitations of this research and, thereafter, makes suggestions for further research. Finally, concluding remarks are made with regard to the value of the research.

7.2 REVIEW OF COMPLETED STUDY

In South Africa today, many learners wishing to enter tertiary institutions do not qualify for entrance because of their academic record. The VUT, as well as many other tertiary institutions, have recognised this and, in the case of the VUT, have initiated an introductory course (Intro-to-IT) to prepare these learners to enter the IT diploma at the VUT. These Intro-to-IT learners have not performed as well as anticipated by the VUT in their first semester IT, specifically in programming.

The first chapter described the need for introductory courses and the entrance requirements of the VUT's Intro-to-IT course. Poor pass rates, specifically for programming, are being experienced by the VUT when successful Intro-to-IT learners advance to the IT diploma, first semester. The research problem that was investigated in this study was formulated as follows:, A model to reduce the divide between South African secondary institutional skills and knowledge and the entrance requirements for an IT diploma course.

The aim of the second chapter, the literature review, was to explain the concepts of introductory courses, to describe the various types of introductory courses available both nationally and internationally, and to explain the present processes and requirements used by the VUT in the Intro-to-IT course. The third chapter explains the research methodology used in this study, the development of the data-collecting instrument, namely a questionnaire was presented. The survey had clearly formulated questions to enable the central research problem to be addressed. The response to the questionnaires were marked and analysed.

The fourth chapter presented the findings of the empirical research. Interpretation of these results was stated with regard to the research problem and the related literature on the topic. The research was evaluated and deemed acceptable. It was found that the changes already made to the content, syllabus and time frames of the VUT's Intro-to-IT course has resulted in an improvement in pass rates in the first-semester programming. The changes made have improved the logical abilities of the Intro-to-IT learners.

The fifth chapter expands on the software package developed specifically for the Intro-to-IT course coordinator. The need for this software, the functions available and technical details of the software package were explained.

The aim of the sixth chapter was to explain the model used in this research. Details on the model phases were explained to demonstrate how an applicant is assessed, the phases the approved applicant needs to successfully complete as a learner in Intro-to-IT, the aims of these different sections with regard to logical skills and the assessment methods used in the different phases of the model were also discussed. The success of this model in the VUT environment was supported by the improvement in the pass percentage of first semester IT diploma learners.

7.3 FINDINGS

7.3.1 Findings for Objective 1

Objective 1: Determine the skills and knowledge required to enable a learner to succeed in the IT diploma, first semester.

With regard to the first objective, the following deduction can be made:

- Information gathered supports the opinion that the Intro-to-IT learners who have progressed to the IT diploma are not performing satisfactorily in the opinion of both the academic staff and the learners. (see Sections 1.2.1, 4.2, 4.3, 4.4.1.2 and 4.5.1).

7.3.2 Findings for Objective 2

Objective 2: Determine if the content and syllabus of the Intro-to-IT course satisfies the requirements of the IT diploma.

With regard to the second objective, the following deduction can be made:

With the introduction of the Intro-to-IT course, the syllabus was designed to prepare the learner for an IT diploma, specifically the first semester in this diploma. The VUT's expectations were to absorb the successful learners into the IT stream and maintain an acceptable pass rate for the first-semester subjects in the IT diploma (see Sections 2.4 and 2.5). This has not been the case (see Section 1.2.1). The syllabus (see Section 2.10) is inadequate and does not fulfil the aims and requirements for a VUT IT diploma.

7.3.3 Findings for Objective 3

Objective 3: Realign the Intro-to-IT syllabus, where necessary, to meet the requirements of the IT diploma.

With regard to the third objective, the following deduction can be made:

The results of Objective 2, to determine if the content and syllabus of the Intro-to-IT course satisfies the requirements of the IT diploma, were that the syllabus did not meet the requirements. During the course of this research action research was exercised in an attempt realign the syllabus with the requirements of an IT diploma. A model was developed and implemented in the VUT using the action research results. The results of this action research and implementation of the model were positive in that the pass rates did improve (see Sections 4.6.1, 4.6.2 and 4.6.4). Intro-to-IT learners entering the IT diploma are performing better than prior to the implementation of the model, therefore the syllabus has been effectively realigned to satisfy the requirements of the IT diploma.

7.3.4 Findings for Objective 4

Objective 4: Design, develop and implement a software application that will record and assess applicant's qualifications according to the University's entrance requirements. In addition, this software package will record the Intro-to-IT course and first-semester IT diploma results, and provide statistical information for historical and analytical purposes.

With regard to the fourth objective, the following deduction can be made:

A software program has been designed and developed to fulfil the requirements of the Intro-to-IT course administrators (see Section 5.1).

7.4 IMPLICATIONS AND RECOMMENDATIONS

Tertiary institutions throughout South Africa are enrolling learners who are ill prepared for the academic demands of these institutions. In the IT field, enrolled learners do not always possess the necessary logical thinking processes required to succeed. There are a number of implications for tertiary institutions.

7.4.1 Implications for tertiary institutions

As a concept, introductory courses for IT in South Africa hold many benefits. Previously disadvantaged learners are afforded opportunities they would not normally qualify for, institutions have a broader base of potential learners and, if these learners are successful, more learners are able to enrol in the formal diploma and degree courses.

The requirements to enter these courses, and the content and syllabus, need to be designed to impart basic logical thought processes and to prepare the learner for the IT field.

7.5 LIMITATION OF THE RESEARCH

This research project has a number of limitations that need to be considered. These limitations must be borne in mind when evaluating the research. Even so, these limitations do not negate the importance of the findings.

Owing to a scarcity of published and printed information available on this research topic, it was necessary to make extensive use of Internet-based secondary data sources. This should not be construed as a salient disadvantage though, as the research topic of introductory courses is suited to being documented on the Internet. The information obtained through the Internet searches for this study was filtered to ensure that only credible and reliable references were used throughout the study.

The research sample used in the research methodology was limited by availability of learners who had progressed from the Intro-to-IT course to the IT diploma at VUT.

A further limitation of this research is associated with the alterations that were implemented in the Intro-to-IT course entrance requirements and syllabus, which have not been evaluated due to time constraints.

7.6 SUGGESTIONS FOR FURTHER RESEARCH

This research has paved the way for an in-depth research project to examine the possible use of software to improve and enhance learner's logical thinking processes. Introducing this type of technology may be advantageous to the learner as it provides a firm base for their future learning.

7.7 CONCLUDING REMARKS

This research has investigated the divide between secondary institutional skills and the knowledge and the entrance requirements for an IT diploma course.

According to the findings of the literature review and the empirical research, a divide does indeed exist. The logical thought processes of many learners entering South African tertiary institutions are limited and result in poor pass rates in the IT diploma course. The content, syllabus and time frame of an introductory course is critical to enable this divide to be reduced.

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Annexure a: *introduction to information technology questionnaire*



Vaal University of Technology

Faculty of Applied and Computer Sciences

Information and Communication Technology

Introduction To Information Technology Questionnaire

I am presently engaged in my Magister Technologiae: Information Technology research, and wish to gather information from students in the Information Technology Diploma stream at VUT (Vaal University of Technology), regarding their experiences with the Introduction to Information Technology (Intro-to-IT) course. This information will be used to determine if the Intro-to-IT course is beneficial to the students and VUT, to ascertain if it is achieving the aims of the course and where any improvements can be made, if any.

This questionnaire will be used to gather information, views and opinions from S1 to S6 learners at VUT, who are currently registered for the IT Diploma and who have progressed from the Intro-to-IT short course, previously known as IT Boot Camp.

Your experiences and opinions as one of the learners who have first hand knowledge and experience of Intro-to-IT are valuable and essential to enable a fair evaluation of the course.

The completion of this questionnaire is voluntary, and you are not obligated in any way to complete this form, however, if you wish to do so, you are requested to complete this questionnaire as honestly and openly as possible.

No personal details are requested or required.

Compiled by: - Roger Baxter.

Contact Number: - 016 950 9848

Office Number: - T216

*Where applicable please mark with an **X** in the box you select.*

1) When did you attend Intro-to-IT?

☐ 2007 Semester 1
Semester 1

☐ 2006 Semester 2

☐ 2006

☐ 2005 Semester 2
Semester 2

☐ 2005 Semester 1

☐ 2004

☐ 2004 Semester 1

☐ Before Semester 1 2004

2) Which semester are you now attending (where the majority of your present subjects are)?

☐ Year 1 Semester 1(S1) ☐ Year 1 Semester 2(S2) ☐ Year 2 Semester 1 (S3)

☐ Year 2 Semester 2(S4) ☐ Year 3 Semester 1(S5)

☐ Year 3 Semester 2(In Service training)

3) What was your final mark for the following subjects? If you repeated the subject please indicate your first mark.

MARK	ASBDX1A	ASBDY1A	AIISX1A	AIISY1D
Less Than 50%				
50% to 60%				
60% to 70%				
70% to 80%				
Greater Than 80%				

4) Please rate the following software according to the average frequency you have used them in the IT Diploma course up to now:-

a) MS Word ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

b) MS Excel ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

c) MS PowerPoint ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

d) MS FrontPage ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

e) MS Access ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

f) Programming Logic ☐ Every day ☐ Once a week ☐ Once a month ☐ Never

5) Which of the following software knowledge / skills do you believe to be required to succeed in the IT Diploma? If your answer is NO, please indicate a reason. (You are allowed to make more than one selection)

a) MS Word ☐ Yes ☐ No

b) MS Excel ☐ Yes ☐ No

c) MS PowerPoint ☐ Yes ☐ No

d) MS FrontPage ☐ Yes ☐ No

e) MS Access ☐ Yes ☐ No

f) Programming Logic ☐ Yes ☐ No

6) How would you rate your ability to apply the skills and knowledge presented in Intro-to-IT with regard to the following subjects in your IT Diploma course?

a) Programming ☐ Poor ☐ Satisfied ☐ Good ☐ Excellent

b) Information Systems ☐ Poor ☐ Satisfied ☐ Good ☐ Excellent

c) Accounting ☐ Poor ☐ Satisfied ☐ Good ☐ Excellent

d) Entrepreneurship ☐ Poor ☐ Satisfied ☐ Good ☐ Excellent

7) In your opinion, the coverage of Programming Flow and Logic in Intro-to-IT was:-

☐ Poor ☐ Average ☐ Good ☐ Excellent

8) How would you rate your understanding of programming flow and logic when you entered the IT Diploma?

☐ Poor ☐ Average ☐ Good ☐ Excellent

9) In your opinion, if you had attended your major subjects (Programming and Information Systems) in the IT Diploma without the introduction presented in Intro-to-IT, how do you think your results would have been in comparison the marks you actually obtained?

☐ Improved ☐ Similar ☐ Poorer

10) Which of the following do you think, or believe, would assist future learners in Intro-to-IT, to attempt to ensure each learner enters the IT Diploma with sufficient basic knowledge of programming flow and logic? (You are allowed to make more than one selection)

- a) ☐ Make use of a programming language e.g. Visual Basic as a tool.
- b) ☐ Extend Module 3 to allow more cover of specific topics in more detail.
- c) ☐ Remove some topics to allow more time for specific topics.

11) If you indicated you believe Module 3 should be extended to cover more for specific topics, what are these topics? (You are allowed to make more than one selection)

☐ Programming Flow and Logic ☐ MS Access ☐ FrontPage
☐ Internet

12) If you indicated the removal of some topics to allow for more cover of specific topics in question 10, which of the following do you feel should be removed? (You are Allowed to make more than one selection)

☐ E-Mail ☐ Internet ☐ FrontPage ☐ Access

13) Please rate your overall satisfaction with the Intro-to-IT Course

☐ Poor ☐ Average ☐ Good ☐ Excellent

14) The overall organisation and running of Intro-to-IT was in your opinion;-

☐ Poor ☐ Average ☐ Good ☐ Excellent

15) How would you rate the overall lecturer performance in Intro-to-IT?

☐ Poor ☐ Average ☐ Good ☐ Excellent

16) Intro-to-IT is completed in one semester; do you believe the time to be sufficient?

☐ Yes ☐ No

17) If your answer to the previous question was no, do you think the intro-to-IT course should be extended to one year?

☐ Yes ☐ No

Comments-----

Thank you for your participation, if you wish to find out more about the topic or results of the findings, please feel free to contact me at the number provided or at my office

Roger Baxter Office Number T216.

Tel 016 950 9848

Annexure b: *Excellers report Intro-to-IT*



Vaal University of Technology
Faculty for Applied and Computer Sciences
Information and Communication Technology
Department
Intro to IT

The following is information gathered and compiled after a discussion with Mrs. A Lombard, Head of Department, Information and Communication Technology, concerning a correlation, if any, between recent students who have excelled when studying the Information Technology Diploma (i.e. passed all their subjects in Information Technology to date, first attempt,) and the results these students obtained for Mathematics in their Matriculation examinations.

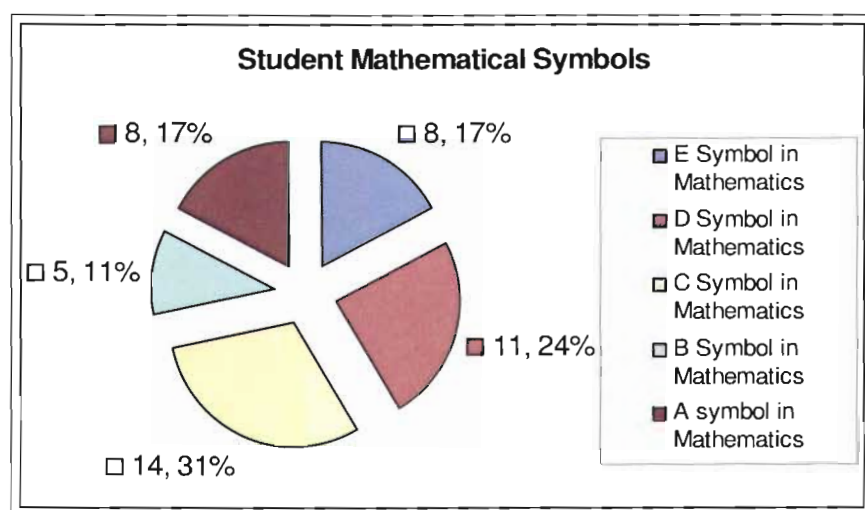
During a recent awards ceremony at the Vaal University of Technology, 63 Information Technology students were recognised for excellence with their academic records to date. These students, and only these students, were the sample population used in this report. From these 63, information relating to their individual Matriculation results was only available for 48 of these students; the information shown reflects the data collected and compiled for these 48 students.

Table 1 shows the tabular representation of results which were recorded by the Universities ITS System and which were grouped in the relevant symbols achieved by the students.

Graph 1 is a graphical representation of the same data.

Symbol	Number of Students achieving this Symbol	Percentage Achieving this Symbol
E Symbol in Mathematics	8	16.67%
D Symbol in Mathematics	11	22.92%
C Symbol in Mathematics	14	29.17%
B Symbol in Mathematics	5	10.42%
A symbol in Mathematics	8	16.67%
Total recordable	48	

Table 1



Graph 1

There appears to be no correlation between results obtained in Matriculation Mathematics and students who have excelled in the Information Technology Diploma stream. Comparison of the group of 8 students who achieved an A symbol in Mathematics to the group of 8 students who achieved an E symbol in Mathematics, does not reflect any difference in performance or results. Both groups performing equally well, illustrating the similarity between the high and low marks obtained in Matriculation and the results obtained in the Information Technology stream.

Roger Baxter

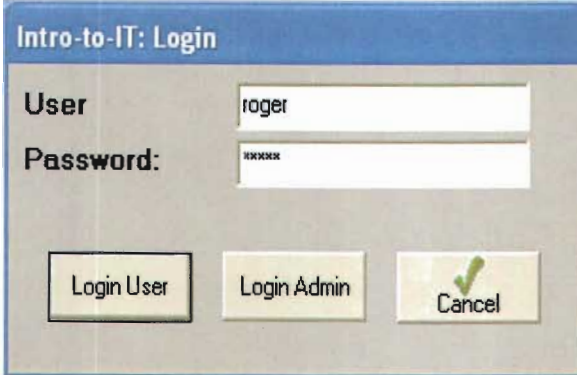
7/2/2006

Annexure c User manual Intro-to-IT software package

The following pages are intended as a user manual for the Intro-to-IT software package, to supplement and augment the online help available in the package.

Login screen

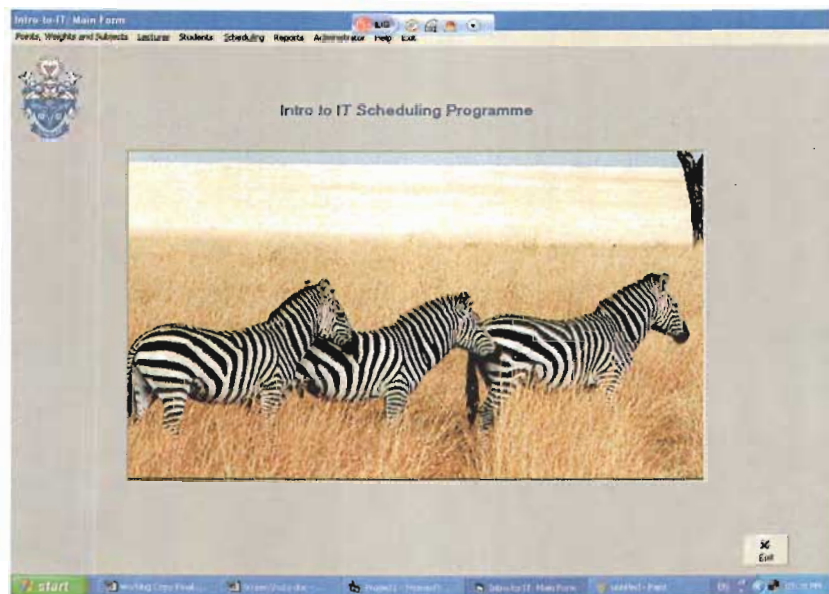
The login Screen allows access to the user and the administrator.



The login screen is titled "Intro-to-IT: Login". It features two input fields: "User" with the text "roger" and "Password:" with masked characters "XXXXXX". Below the fields are three buttons: "Login User", "Login Admin", and "Cancel" (which includes a green checkmark icon).

Main screen

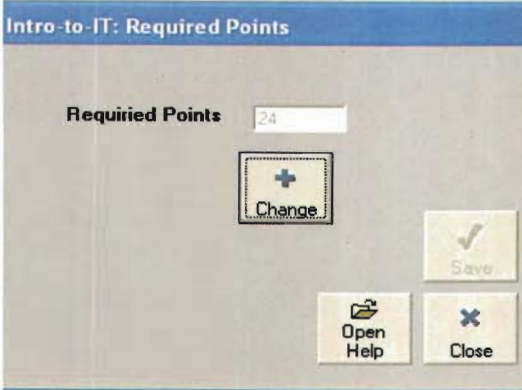
The Main screen allows the user access to all functions by means of menus.



en

Add or edit required points

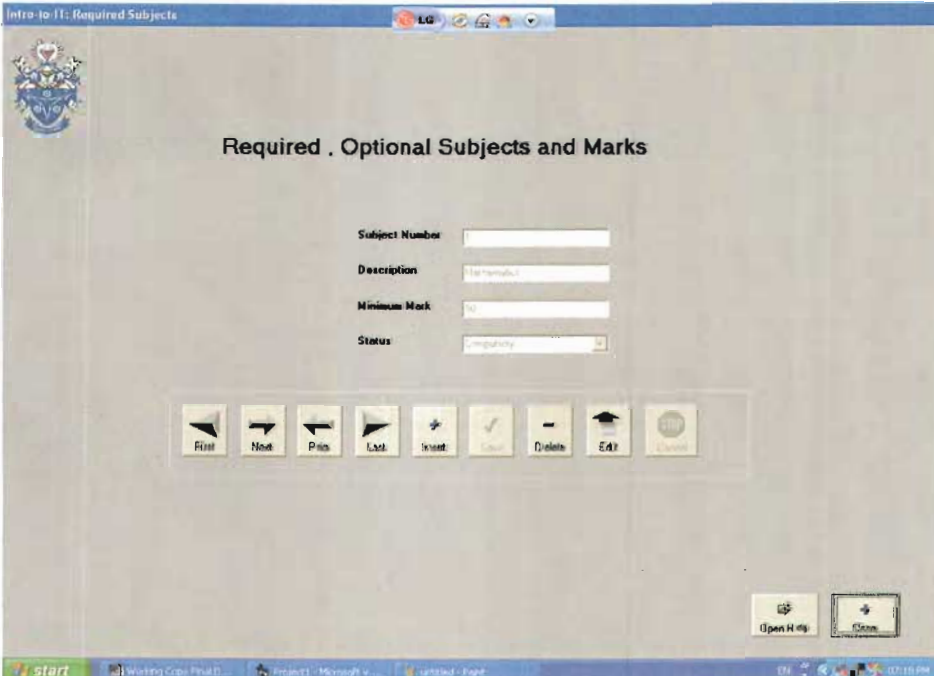
This form is used to adjust the minimum point's requirement.



The screenshot shows a web form titled "Intro-to-IT: Required Points". It features a text input field labeled "Required Points" containing the value "24". Below this field is a button with a plus sign and the word "Change". To the right of the "Change" button is a "Save" button with a checkmark icon. Below the "Change" button are two buttons: "Open Help" with a question mark icon and "Close" with an 'X' icon.

Add or edit required subjects and minimum percentage

This allows the user to add or edit required subjects for the Intro-to-IT course. New compulsory and/or optional subjects may be entered and the minimum percentage required is recorded.



The screenshot shows a web form titled "Intro-to-IT: Required Subjects". It features a university crest logo in the top left. The main heading is "Required . Optional Subjects and Marks". Below this heading are four input fields: "Subject Number", "Description" (containing "Information Systems"), "Minimum Mark" (containing "10"), and "Status" (containing "Compulsory"). Below these fields is a row of ten buttons: "First", "Next", "Prev", "Last", "Insert", "Edit", "Delete", "Save", "Cancel", and "Print". At the bottom right of the form area are two buttons: "Open Help" and "Close". The Windows taskbar is visible at the bottom of the screen.

Add and edit topic weights in Module 1

The topics are locked in this form and only the weight factor may be adjusted. The software ensures that the total weight is exactly one hundred.

Intro-to-IT Module 1 Weights			
	Topic Number	Description	Weight
▶	1	Class	30
	2	Project	20
	3	Portfolio	10
	4	Exam	40

Buttons: Enable, Disable, Save, Open Help, Close

Add and edit topic weights Module 2

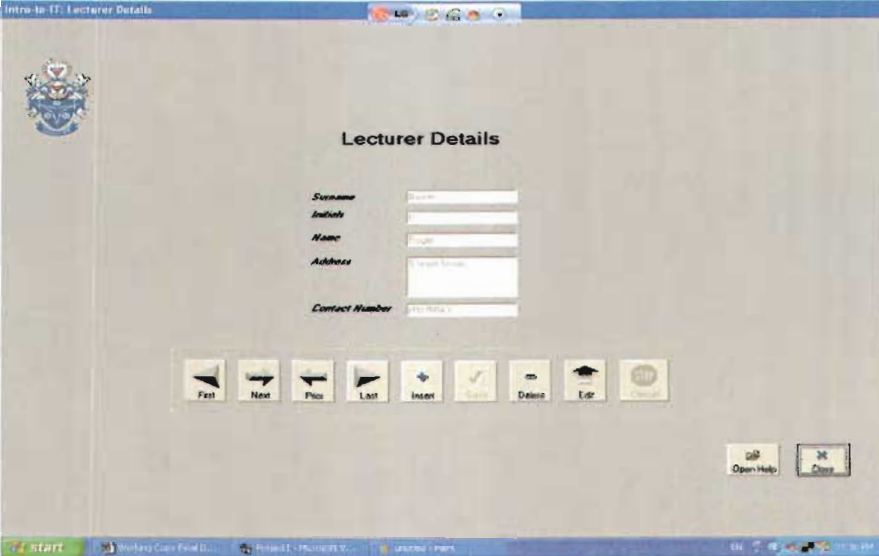
The same functions as indicated in Section 5.2.5 are applicable to this screen for Module 2 weights.

Intro-to-IT Module 1 Weights			
	Topic Number	Description	Weight
▶	1	Class	30
	2	Portfolio	10
	3	Project	10
	4	Exam	50

Buttons: Enable, Disable, Save, Open Help, Close

Insert, edit and delete lecturers

This screen allows the user to create new lecturers and to edit or delete existing lecturers. When a new lecturer is created, the application creates a new MS Access database for that lecturer, which is used to store the lecturer's schedule.



Lecturer details screen

Applicant recording and assessment

This screen is used to record the applicants' personal details and their academic records. Various data types and range checks are built into this screen to ensure that the correct data are entered. After completing the necessary fields, the user may click on the calculate button, which will process the following:

- A calculation is made to accumulate the applicants points
- Procedures check the following:
 - The correct compulsory subjects are present with the minimum points
 - At least one of the optional subjects is present with the minimum points
 - There are six valid subjects

- The correct minimum points is present
- Mathematic percentages are checked for exemption

On completion of these, the status of the application is updated, either approved or not approved, and the Subject Evaluation area will display all criteria showing correct or not correct.

Intro-to-IT: Student Details

Student Details

Identifying Number: 100001004 Year: 2006

Surname: Smith Semester: 1

Initials: S Address: 123 Main Street

Contact Number: 0123456789

Subject Evaluation

Subject	Grade	Mark	Points	Status
MATHEMATICS	C	75	75	Not Approved
SCIENCE	B	85	85	Not Approved
ENGLISH	A	95	95	Not Approved
PHYSICS	C	75	75	Not Approved
STATISTICS	B	85	85	Not Approved

Application Qualifications

Subject	Grade	Mark	Points	Status
Subject 1	A	95	95	Not Approved
Subject 2	B	85	85	Not Approved
Subject 3	C	75	75	Not Approved
Subject 4	D	65	65	Not Approved
Subject 5	E	55	55	Not Approved
Subject 6	F	45	45	Not Approved

Exemptions

Numerics: No

Module 1: No

Module 2: No

Find an Applicant

Enter Identifying Number: [Text Box] [Find] [Reset]

Toolbar: File, Next, Prev, Last, Insert, Find, Delete, Edit, Print, Open Help, Close

Module 1 learner results

This screen allows the user to enter, edit or delete the learners' Module 1 results. Various data types and range checks are incorporated into the screen. The user only needs to enter some of the data and procedures in the application to calculate the final module examination mark and the final module mark using the weights

entered by the user. The user may also search for a learner or learners with various parameters.

Module 1 Marks													
Number	Surname	Initials	Semester	Year	Numerics	Life	Class	Portfolio	Project	Exam	Rewrite	Final	Comment
20056765	Buthlezi	F	1	2008	77	Pass	55	73	54	66	0	61	Pass
20056754	Zulu	BNG	2	2008	66	Fail	77	77	55	66	0	66	Fail
20068976	Brown	R	1	2008	66	pass	55	55	55	55	65	60	Pass
20103000	Baxter	R	2	2008	77	pass	77	77	34	77	77	77	Pass
21345345	Smith	V	1	2008	0	Fail	33	33	33	33	65	45	Fail
200676543	Smith	B	1	2008	44	Fail	44	75	66	45	51	54	Fail

Module 2 learner results

Similar to Module 1, the Module 2 Learner Results Screen has the same functions and checks to allow the user to enter the learner's marks for Module 2. Again, an automatic calculation is carried out to record the final marks for the learner.

Intro-to-IT: Module 2 Marks

Marks for Module 2

The Module Mark, Exam Mark and the Comment Are Calculated Automatically

Module 2 Marks														
Number	Surname	Initials	Sem.	Year	Tests	Project	Portfolio	Acc. Exam	Rewrite	Prog. Exam	Rewrite	Exam	Module	Comment
20075643	Rhodes	TT	1	2008	77	55	66	55	66	77	0	72	71	Pass
200865432	Francis	RR	1	2008	55	55	55	55	44	51	0	53	54	Fail
20104000	Black	DD	1	2008	55	77	66	55	61	55	44	58	60	Fail
20409876	Davidson	OF	2	2008	44	23	25	44	21	44	41	44	40	Fail
30009763	Smith	D	2	2008	77	66	66	33	66	55	0	60	66	Pass

Find a Specific Student

Student Number:

Year and Semester

Semester:

Year:

Enter, Delete or Edit

Enable student data alterations

Disable student data alterations

Display all Students in the database

Display all students

Scheduling of lecturers to groups and subjects

This screen is used to link the lecturer to the group and the subject. The user selects the lecture by double clicking on the name and allocates that lecturer to a group and a subject. A lecturer may present more than one subject to more than one group.

Intra-to-IT: Create Groups

Allocation of Lecturers to groups and subjects

Groups Allocated to Lecturers						
Subject	First	Second	Third	Fourth	Fifth	Sixth
Software	0	0	0	0	0	0
Hardware	1	2	0	0	0	0

Group Lecturers				
Group	Life	Numbers	Computers	Portfolio
1				
2				
3				
4				
5				
6				

Open Help Close

Scheduling of venues and lecturers

The scheduling screen is used to allocate lecturers and their groups to venues, in the case of the Intro-to-IT course, only four venues were being used.

Scheduling of Groups and Lecturers

Week/day	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
Monday	From	From	From	From	From	From	From	From	From
Tuesday	From	From	From	From	From	From	From	From	From
Wednesday	From	From	From	From	From	From	From	From	From
Thursday	From	From	From	From	From	From	From	From	From
Friday	From	From	From	From	From	From	From	From	From

Week/day	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
Monday	From	From	From	From	From	From	From	From	From
Tuesday	From	From	From	From	From	From	From	From	From
Wednesday	From	From	From	From	From	From	From	From	From
Thursday	From	From	From	From	From	From	From	From	From
Friday	From	From	From	From	From	From	From	From	From

Week/day	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
Monday	From	From	From	From	From	From	From	From	From
Tuesday	From	From	From	From	From	From	From	From	From
Wednesday	From	From	From	From	From	From	From	From	From
Thursday	From	From	From	From	From	From	From	From	From
Friday	From	From	From	From	From	From	From	From	From

Week/day	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
Monday	From	From	From	From	From	From	From	From	From
Tuesday	From	From	From	From	From	From	From	From	From
Wednesday	From	From	From	From	From	From	From	From	From
Thursday	From	From	From	From	From	From	From	From	From
Friday	From	From	From	From	From	From	From	From	From

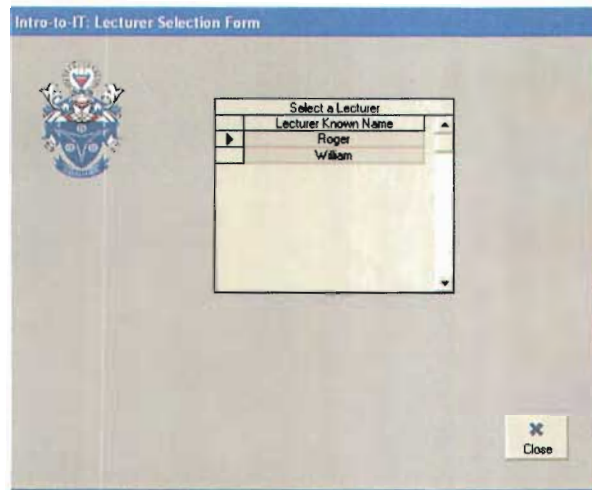
Quit & Exit Select a From Select a From

Open Help Close

- When the Select Lecturer button is activated, the following screen appears where the user may select a lecturer. All lecturers' names appear on the screen;

however, if a lecturer is not allocated to a group, the user will not be able to select that lecturer.

Scheduling groups to lecturers



- After selecting the lecturer, the Venue Selection screen is again presented to the user. The user only needs to double click on the venue, the day and time for which that the lecturer is to be scheduled. If either the group or the lecturer is already scheduled for this day and time, the user will not be allowed to proceed. If this is not the case and both are free, the user is then presented with the following screen. Here the user may select the group the lecturer is teaching, as only groups allocated to this lecturer are active.

Scheduling groups to lecturers


Lecturer	Groups
Roger	1
	2
	3
	4
	5
	6

Open help Close

- As the lecturer may be allocated to more than one subject per group, after selecting the group the user must now select the correct subject. This is accomplished by double clicking on the name of the lecturer at the subject name. When the subject has been selected, the user is again presented with the venue selection screen where a confirmation message will ensure if the data are to be overwritten or not.

Scheduling subjects to lecturers


Intro-to-IT: Select a lecture's subject



Selection of subject for lecturer

The lecturer you are scheduling is: **Roger**

Lecturer and Subject					
	Communication	Life Skills	Numerics	Office	Portfolio
▶				Roger	

 Close

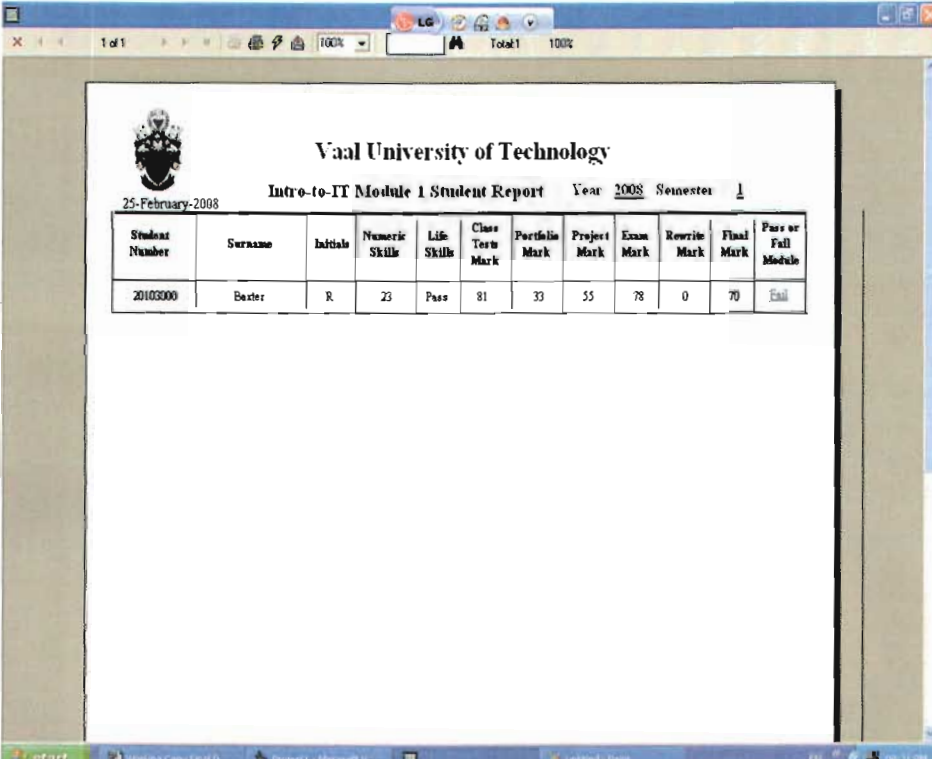
Reports screen

The report screen provides access for the user to various reports, as well as providing a visual display of selected groups and lecturer timetables. Among the reports are:

1. Venue availability
2. Group time tables (see Annexure E)
3. Lecturer timetable

4. Learner results for Module 1 and 2 , which can be filtered for any year and any semester (see Annexure D)
5. All learner results per module and per semester for administrative use to post results
6. Percentage approved applications per semester (see Annexure C)
7. Percentage passes per module and semester (see Annexure F)

All reports have a similar format to the following:



25-February-2008

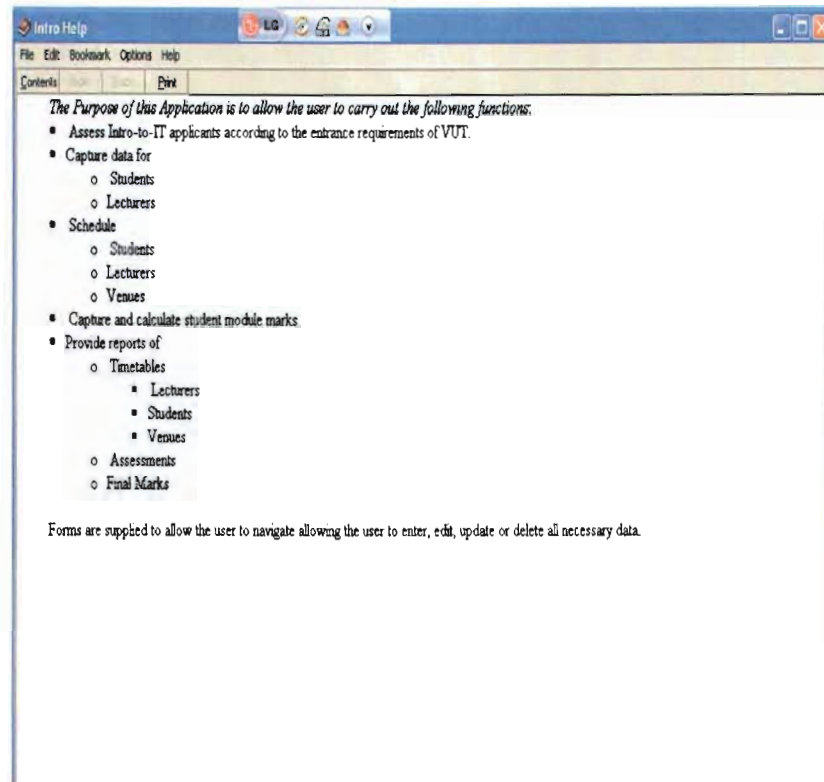
Vaal University of Technology

Intro-to-IT Module 1 Student Report Year 2008 Semester 1

Student Number	Surname	Initials	Numeric Skills	Life Skills	Class Test Mark	Portfolio Mark	Project Mark	Exam Mark	Rewrite Mark	Final Mark	Pass or Fail Module
201033000	Baxter	R	23	Pass	81	33	55	78	0	70	Fail

Help file

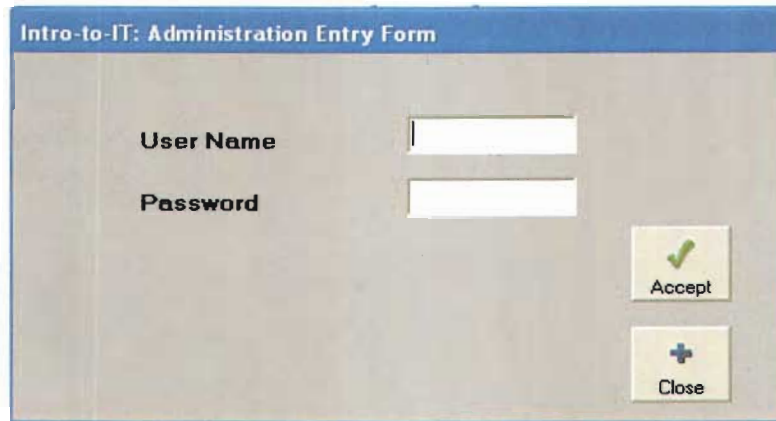
A help file is also available to explain to the user the functions and explain the application.



Administration functions

The administration functions allow the user with administration rights to add, edit or delete user details, and to alter his/her user name and password. On the Login screen, the administrator may enter the administration side of the application. and the administrator may also enter from the main screen where the following screen will ask for user name and password.

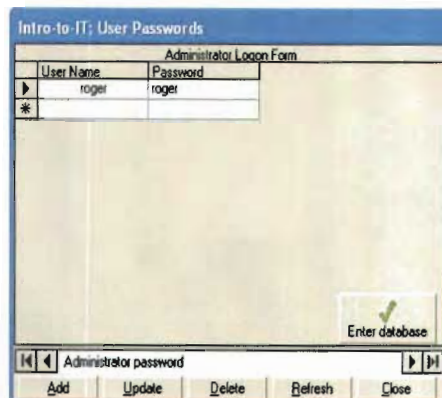
Administrator login



A screenshot of a Windows-style application window titled "Intro-to-IT: Administration Entry Form". The window has a blue title bar. Inside, there are two labels: "User Name" and "Password", each followed by a text input field. To the right of the input fields are two buttons: "Accept" with a green checkmark icon and "Close" with a blue plus icon.

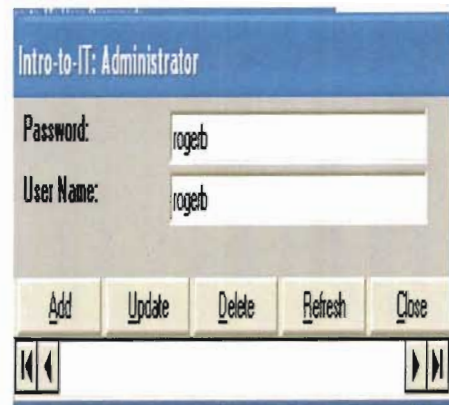
If access is granted, the administrator will have access to the following two screens, which allow the administrator to add, edit or delete users and change the administrator's user name and password.

Administrator access forms




A screenshot of a Windows-style application window titled "Intro-to-IT: User Passwords". It contains a sub-window titled "Administrator Login Form" with a table. The table has two columns: "User Name" and "Password". The first row shows "roger" in both columns. The second row has an asterisk in the "User Name" column and is empty in the "Password" column. Below the table is a button labeled "Enter database" with a green checkmark icon. At the bottom of the window is a status bar with the text "Administrator password" and a set of navigation buttons: "Add", "Update", "Delete", "Refresh", and "Close".

User Name	Password
▶ roger	roger
*	




A screenshot of a Windows-style application window titled "Intro-to-IT: Administrator". It has a blue title bar. Inside, there are two labels: "Password:" and "User Name:", each followed by a text input field. The "Password:" field contains the text "rogerb" and the "User Name:" field also contains "rogerb". Below the input fields are five buttons: "Add", "Update", "Delete", "Refresh", and "Close". At the bottom of the window is a status bar with a set of navigation buttons: "Add", "Update", "Delete", "Refresh", and "Close".


Annexure d: Applicant result report

		Vaal University of Technology Introduction to Information Technology																					
2005/2011																							
<table border="1"> <tr> <td><u>Year</u></td> <td>2008</td> <td><u>Semester</u></td> <td>1</td> </tr> </table>				<u>Year</u>	2008	<u>Semester</u>	1																
<u>Year</u>	2008	<u>Semester</u>	1																				
<table border="1"> <tr> <td><u>Surname</u></td> <td><u>Given</u></td> <td><u>Initial</u></td> <td><u>D</u></td> </tr> <tr> <td colspan="4"> <u>Identifying Number</u> 700407474 </td> </tr> </table>			<u>Surname</u>	<u>Given</u>	<u>Initial</u>	<u>D</u>	<u>Identifying Number</u> 700407474				<u>Address</u> 14 A West End Street												
<u>Surname</u>	<u>Given</u>	<u>Initial</u>	<u>D</u>																				
<u>Identifying Number</u> 700407474																							
<u>Subject 1</u>	<u>Subject 2</u>	<u>Subject 3</u>	<u>Subject 4</u>	<u>Subject 5</u>	<u>Subject 6</u>																		
APPLIED	WELDING	TECHNICAL DRAWING	ENGLISH	MATHEMATICS																			
10	10	10	10	10	10																		
10	10	10	10	10	10																		
<table border="1"> <tr> <td colspan="6"><u>Exemptions</u></td> </tr> <tr> <td><u>Examiner</u></td> <td><u>Module 1</u></td> <td><u>Module 2</u></td> <td colspan="3"></td> </tr> <tr> <td>10</td> <td>10</td> <td>10</td> <td colspan="3"></td> </tr> </table>						<u>Exemptions</u>						<u>Examiner</u>	<u>Module 1</u>	<u>Module 2</u>				10	10	10			
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<u>Examiner</u>	<u>Module 1</u>	<u>Module 2</u>																					
10	10	10																					
<table border="1"> <tr> <td><u>Comments</u></td> </tr> <tr> <td> MATHEMATICS - ENGLISH - Too Low COMMUNICATION - Unacceptable TECHNICAL - Unacceptable PHYSICS - Unacceptable STATUS - Not Applicable </td> </tr> </table>						<u>Comments</u>	MATHEMATICS - ENGLISH - Too Low COMMUNICATION - Unacceptable TECHNICAL - Unacceptable PHYSICS - Unacceptable STATUS - Not Applicable																
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MATHEMATICS - ENGLISH - Too Low COMMUNICATION - Unacceptable TECHNICAL - Unacceptable PHYSICS - Unacceptable STATUS - Not Applicable																							
<table border="1"> <tr> <td><u>Total Points</u></td> <td>12</td> </tr> </table>			<u>Total Points</u>	12	<table border="1"> <tr> <td><u>Signature</u></td> </tr> <tr> <td><u>Date</u></td> </tr> </table>			<u>Signature</u>	<u>Date</u>														
<u>Total Points</u>	12																						
<u>Signature</u>																							
<u>Date</u>																							

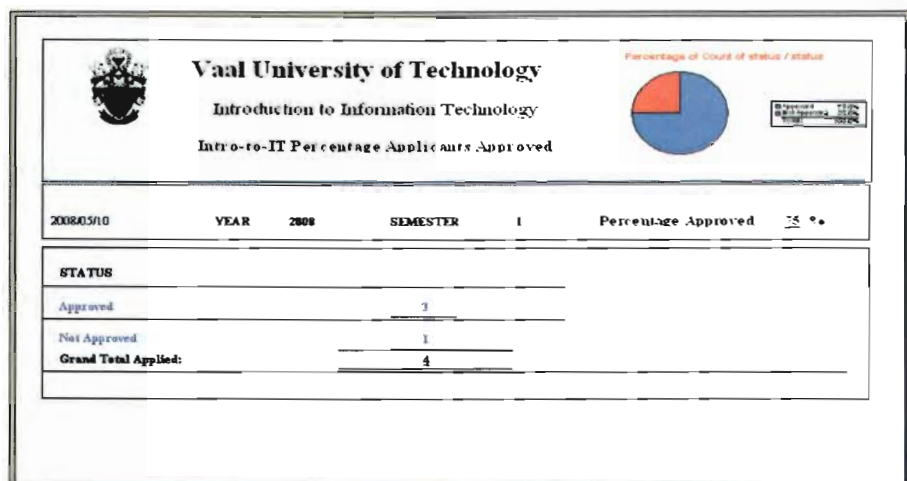
Annexure e: Student reports for Module 1

 Vaal University of Technology Intro-to-IT Module 1 Student Report											
Year		2008		Semester		1					
10-May-2008											
Student Number	Surname	Initials	Numeric Skills	Life Skills	Class Tests Mark	Portfolio Mark	Project Mark	Exam Mark	Rewrite Mark	Final Mark	Pass or Fail Module
20103000	Baxter	R	77	Fail	45	67	77	76	0	66	Fail

Annexure f: Student timetable

 Vaal University of Technology Introduction to Information Technology									
2008/05/10 Group 1									
Weekday	08-00	09-00	10-00	11-00	12-00	13-00	14-00	15-00	16-00
Monday	Roger0007, Office	Roger0007, Office	Roger0007, Office	Roger0007, Office					
Tuesday									
Wednesday									
Thursday									
Friday									

Annexure g: Administrator report for approved percentage



Annexure h: Administrator report on Module pass percentages

