Information Technology (IT) with a Human Face: A collaborative research project to improve higher nutrition training in Southern Africa

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DECLARATION

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

Various enabling factors are required to incorporate technology in teaching and learning, moving towards a more learner-centred approach. Although efforts are being made to address the situation, the effective incorporation of ICT is not yet the norm in African higher education institutions (HEI). Data is available regarding the situation in African HEI, but very little is known about the situation of nutrition training.

This research programme was divided into three phases. Phase I, assessment of the current use, awareness, attitudes and practices of ICT in nutrition training followed a descriptive, cross-sectional approach. A convenience sample of six HEI in South Africa, Malawi, Zambia, Swaziland and Zimbabwe was included. Data were collected from students (N = 591) and lecturing staff (N = 29) in nutrition-related courses using a questionnaire on ICT awareness, attitude and practices. Phase II, development and validation of a purpose-designed e-learning nutrition module followed a descriptive, cross-sectional approach. An e-learning module on Nutrition and HIV/AIDS with eleven sub-modules was developed, using an e-learning platform taking the specific constraints of developing countries into account. It was validated by expert reviewers (N = 27) for content validity and students (N = 175) for face validity. Phase III, to determine the impact of the module on cognitive knowledge followed an experimental before-after approach and used a set of twenty True/False questions for eight of the sub-modules (N = 173).

Although there is widespread accessibility to computers, less so to the internet, in nutrition-related courses at Southern African HEI, respondents still felt that more computers should be made available. Computers are not fast enough and lack of finances is the main barrier to home and internet access. Students rate their ICT skills as average to good. Institutional ICT policies and support seem to be lacking, but their attitude to ICT is positive and supportive. Respondents felt that ICT could add a new dimension to nutrition training and are in favour of application of ICT in different modes. Most indicate that the current use of ICT in nutrition training is inadequate. The *Nutrition in HIV/AIDS module* was validated and found to be useful as an educational tool, being user-friendly, interactive and self-paced. The majority of students reported that their ICT skills were sufficient to complete the e-learning activity. Although generally rated as at least as effective, or more effective than conventional lectures, clearly this mode of e-

learning should not replace traditional teaching. The content was found to be comprehensive and evidence-based. The depth of the content was sufficient, the level correct for undergraduates and the material relevant to the Southern African context. The interactivity was deemed important, helpful and effective. Most students indicated that they would recommend the Nutrition in HIV/AIDS module to other students, that they enjoyed the presentation and learnt something new. There was an improvement in knowledge scores and/or the number of questions being answered correctly in all but one sub-module. The results confirm previous studies indicating that well-designed e-learning modules have the potential to increase the performance of students.

OPSOMMING

Verskeie instaatstellende faktore word benodig vir die insluiting van tegnologie in leer en onderrig om na 'n meer student-gesentreerde benadering te beweeg. Alhoewel daar gepoog word om hierdie situasie aan te spreek, is die effektiewe insluiting van inligting en kommunikasietegnologie (IKT) nog nie die norm in tersiêre onderrigsinstellings (TOI) in Afrika nie. Data ten opsigte van die situasie in Afrika is wel beskikbaar maar daar is min inligting beskikbaar oor voedingsopleiding.

Hierdie navorsingsprogram was in drie fases opgedeel. Fase I, die assessering van huidige IKT-gebruik, houdings en praktyke in voedingsopleiding het 'n beskrywende dwarssnitbenadering gevolg. 'n Geriefliksheidsteekproef van ses TOI in Suid-Afrika, Malawi, Zambia, Swaziland en Zimbabwe is ingesluit. Data is by studente (*N* = 591) en dosente (*N* = 29) in voedinggerigte kursusse ingewin met behulp van 'n kennis-, houding- en praktykevraelys. Fase II, die ontwikkeling en geldigheidstoetsing van 'n doelgerigte e-leer voedingmodule het 'n beskrywende dwarssnitbenadering gevolg. 'n E-leer-module oor voeding en MIV/VIGS met elf submodules is ontwikkel met behulp van 'n e-leerplatform wat die spesifieke behoeftes van ontwikkelende lande in ag geneem het. Die module is deur vakkundige evalueerders (*N* = 27) vir inhoudsgeldigheid en studente (*N* = 175) vir gesigggeldigheid getoets. Fase III, die impak van die module op kennis het 'n eksperimentele voor- na-benadering gevolg met 'n stel van twintig Waar/Onwaar vrae vir agt van die submodules (*N* = 173).

Alhoewel daar wydverspreide toegang tot rekenaars in voedingverwante kursusse in TOI in Suider-Afrika is, minder so vir die internet, was respondente steeds van mening dat meer rekenaars beskikbaar behoort te wees. Rekenaars was nie vinnig genoeg nie en finansies was die hoofstruikelblok vir tuis- internettoegang. Studente het hul eie IKT-vaardighede as gemiddeld tot goed beoordeel. Instellings se IKT-beleid en -onder-steuning blyk onvoldoende te wees, maar houding tot IKT was positief en ondersteunend. Respondente was van mening dat IKT 'n nuwe dimensie tot voedingsopleiding kan lewer en was ten gunste van verskillende aanwendings van IKT. Die meerderheid het aangedui dat die huidige gebruik van IKT in voedingsopleiding onvoldoende is. Die Voeding in MIG/VIGS module was geldig bevind en is beskryf as behulpsaam as onderrigshulpmiddel, gebruikersvriendelik, interaktief en self-tempogedrewe. Die meeste studente het aangedui dat hul IKT-vaardighede voldoende

was om die e-leer aktiwiteit te voltooi. Alhoewel hierdie tipe e-leer oor die algemeen as ten minste effektief of meer effektief as konvensionele onderrig beskou is, behoort dit nie dié tipe onderrig te vervang nie. Die inhoud is omvattend en bewys-gebaseerd. Die dieptegang was voldoende, die vlak geskik vir voorgraadse studente en die materiaal relevant in die Suider-Afrikaanse konteks. Interaktiwiteit was as belangrik, behulpsaam en effektief geag. Die meeste studente het aangedui dat hul die Voeding in MIV/VIGS module aan ander studente sou aanbeveel, dat hul die aanbieding geniet het en iets nuuts geleer het. Daar was 'n verbetering in kennis en/of die aantal vrae wat reg beantwoord is in al die submodules behalwe een. Die resultate bevestig die bevindinge van vorige studies wat bevind het dat goed ontwerpte e-leer materiaal die potensiaal het om studente se prestasie te verbeter.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
BScD	BSc Dietetics
Fanta	Food and Nutrition Technical Assistance
HEI	Higher education institutions
HIV/AIDS	Human immunodeficiency virus / auto-immune deficiency syndrome
HPCSA	Health Professions Council of South Africa
ICT	Information and communication technology
ITANA	IT for the Advancement of Nutrition in Africa
MBTI	Myer-Briggs Type Indicator
MCQs	Multiple choice questions
MDG	Millennium Development Goals
NEPAD	New partnership for Africa's development
NGO	Non-Governmental Organisation
NIM	Nutrition in Medicine
NWU	North West University
PLWHA	People living with HIV/AIDS
SA	South Africa
SAfrITaN	Southern African IT and nutrition research group
SD	Standard Deviation
Sida	Swedish international development agency
SSA	Sub-Saharan Africa
UK	United Kingdom
USA	United States of America
USAID	United States Agency for International Development
VTS	Virtual Training Studio
WSIS	World summit on the information society

LIST OF DEFINITIONS

Constructivism is a learning theory that emphasises explanation and demonstration as a way of knowledge acquisition relative to prior knowledge and learnt concepts utilising integration of relevant, real-world experiences, social negotiation, presenting content in various modes and providing reflection on practice.[1]

Blended learning is defined as a combination of multiple approaches to learning, taking advantage of the best aspects of in-person or face-to-face interaction and e-learning technologies.[2,3]

Pedagogy involves various forms of interaction between the teacher, student/s and the knowledge domain and includes aspects of process, content and context.[4]

Bandwidth is the amount and rate of transmission capability of an electronic device, typically measured in bits per second for digital devices like computers. It is the range of frequencies that can be transmitted by phone line, fibre-optic cable, wireless or T-1 line.[5]

Interactivity presumes some degree of cognition and reflection on the part of the user and active intellectual involvement with the electronic application.[5]

MBTI scores indicate a person's preference on each of the following four dimensions, namely: extraversion/introversion, sensing/intuition, thinking/feeling and judging/perceiving and can also indicate how individuals differ in their learning processes.[6]

ICT is the use of computers for information retrieval, storage & documentation; communication, e-mail, networking; training & development; edutainment; processing & dissemination of information; creating of new knowledge, facilities & information and internet, LAN, WAN.[7]

CHAPTER 1: LITERATURE REVIEW

1.1 Conceptual Framework

The literature has been reviewed specifically within the conceptual framework of this research programme (Figure 1.1) and the findings in this dissertation will report on factors investigated and taken into consideration in this context. The latter by no means covers all aspects of incorporating ICT in higher education.

Global Influences
- Knowledge society
- Millennium Development Goals
- Digital divide

Higher Education Institutions
- Greater competition
- Academic staff
- Changing curriculum

ADVANCES IN HIGHER EDUCATION

**Learner-centred constructivist approach
Use of technology (Blended learning)**

PEDAGOGICALLY SOUND
- Navigation
- Interaction
- Contextualisation
- Consistency
- Operational stability

ENABLING FACTORS
- Environment
  - Access to technology/infrastructure
  - Policy on ICT and ICT support
  - Development time
  - Platform
- Personal
  - Computer readiness
  - Openness to change / positive attitude
  - Learner characteristics
  - User satisfaction and enjoyment

IMPACT ON TEACHING AND LEARNING

CONSTRAINTS
- Lack of human interaction
- Self-discipline required
- Lack of hardware
- Technical problems
- Cost

BENEFITS
- Access to resources
- Interactive
- Flexibility
- Autonomy
- Cost-effectiveness
- Development and diversity
- Variety
- Collaboration

FIGURE 1.1: Conceptual framework for the research programme

1.2 Nutrition Training

Nutrition as a subject crosses many disciplinary borders and is integrated into the teaching of medical, supplementary health sciences, food sciences as well as agricultural sciences, making it an ideal collaborative focus area for research. Nutritional disorders not only continue to be the major cause of morbidity and mortality in many developing countries but are also the main impediment to social and human development.[8] Improving nutrition is therefore not only an important basis for poverty reduction but also a foundation of development as underpinned by the Millennium Development Goals (MDG).[9] Young people in developing countries who are now training as nutritionists, doctors, nurses, agronomists or food scientists at higher education institutions (HEI) face significant challenges as the decision-makers and resource persons of the future.[10-12] Academic staff who are teaching these trainee nutrition/health professionals, face major difficulties in preparing these students for this reality. Barriers faced by these academic staff such as the lack of teaching time to cover an ever-increasing curriculum, inadequate human resources, the difficulty of keeping content current because of the rapidly changing state of science and students' difficulty in appreciating the relevancy of curricula to their future practice, fuel the search for effective and innovative ways to teach nutrition.[13,14]

New approaches are needed to enable knowledgeable, well-trained professionals in the many nutrition-related fields to translate the scientific knowledge that is available today, into practical, locally feasible and sustainable nutrition interventions. The international trend seems to be a move to more flexible delivery of programmes that includes making more effective use of technology for learning. This trend is also an innovative response to the increased access to education/lifelong learning, increased choice in areas of study resulting in greater competition between educational institutions and improving education delivery and access.[15,16] Academic staff, therefore, need to be able to source and share materials, adapt and contextualize them to suit individual needs and use them across a wide variety of educational models.[16,17]

1.3 Advances in Higher Education

Technological and pedagogical advances have occurred in higher education over the past decade with a general trend away from traditional teacher-centred models of didactic

teaching towards alternative learner-centred, constructivist[*] and socio-cultural approaches[18], resulting in a diversification of teaching methodologies particularly those methods requiring less teacher contact and less classroom-based activity without compromising the quality of the teaching experience.[10,19] Moreover, the surfacing of the concept of a global information society has resulted in a new momentum emerging with the enhancement of technology-mediated academic courses.[16,20-25] Various terms are used to characterize this emerging trend such as e-learning, blended, distributed, online, web-based, distance, network or technology-based learning.[24]

It is clear that the current generation of students is embracing technology not only in the area of education, but also for entertainment, personal communication and empowerment.[13,16,26] With these shifts in paradigm, it has become the norm for information and communication technology (ICT) to play an important role in higher education, to such an extent that it is considered a basic academic requirement of the knowledge society for which universities now prepare their students.[4,21,27-29] Cochrane is cited as saying that "in future, there will be two types of teacher, the IT literate and the retired", strengthening the argument that competence in the use of ICT is no longer to be considered an optional extra for teachers.[30]

1.4 Implementation of ICT in Teaching and Learning

There are various terms in the literature that are used for the enhancement of academic courses with technology as well as varying definitions, but most indicate that the acquisition and use of knowledge for learning is facilitated primarily by electronic applications and processes like web-based learning, computer-based learning, virtual classrooms and digital collaboration. The study material content may be delivered via various modes including the internet/intranet/extranet, satellite broadcasts, audio/video tape, DVD or CD-Rom.[5,17,25,31,32]

It is important to realize the difference between "pure" e-learning, where only online technology is utilized and no face-to-face interaction occurs,[25,33] and the incorporation of e-learning material into a course curriculum together with other teaching and learning strategies namely "blended learning".

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[*]Constructivism is a learning theory that emphasises explanation and demonstration as a way of knowledge acquisition relative to prior knowledge and learnt concepts utilising integration of relevant, real-world experiences, social negotiation, presenting content in various modes and providing reflection on practice.[1]

Blended learning is defined as a combination of multiple approaches to learning, taking advantage of the best aspects of in-person or face-to-face interaction and e-learning technologies (Figure 1.2).[2,3]
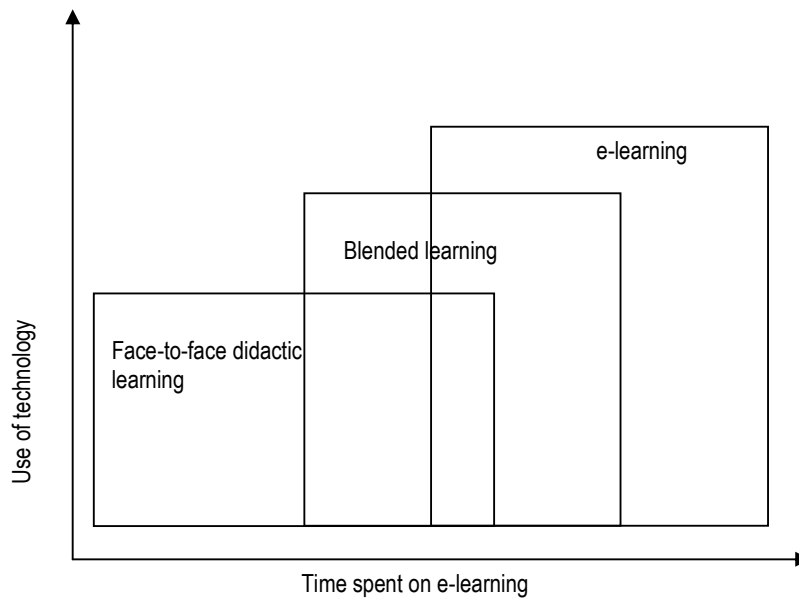
FIGURE 1.2: Conception of blended learning[3]

The literature is generally supportive of the concept that the incorporation of technology is a valuable addition to our pedogogical armory, but it should not necessarily replace traditional methods such as text books, lectures, small-group discussions or problem based learning[34] or become the sole source of instruction.[10,35] There are those that feel that the best use of ICT is in a supplementary role or as blended learning[3,4,23,34-38] and this seems to be the trend being followed by HEI.[39] Several studies have shown that blended learning is preferred by students and affects students' learning positively, but levels of achievement and knowledge retention are not different from traditional teaching methods and it can be argued that the latter are as effective.[37] What should be taken into consideration, however, is that time spent in the classroom and teaching time is reduced.[37]

It is important to realize that, for maximum benefit, the implementation of ICT in teaching and learning is dependent on how enabling the environment is[29] and that it must be pedagogically[†] sound.[4,22,36,40,41]

[†]Pedagogy involves various forms of interaction between the teacher, student/s and the knowledge domain and includes aspects of process, content and context.[4]

1.4.1 Enabling factors for implementation of ICT in HEI

There is a wealth of literature indicating that the implementation of ICT in teaching and learning involves a large number of enabling factors (Figure 1.1), which may differ according to the type of technology being implemented and include both environmental and personal aspects. Probably the most important environmental factor making it a physical possibility is access to technology which includes hardware, software and bandwidth[‡].[21,37,41,42] Furthermore, commitment of the government and institution towards implementing ICT in the form of policy is essential,[37] as well as the availability of support including maintenance and technical expertise within the institution.[21,35,37,41] It is also important to realize that all technologies have specific programmatic limitations or risks which must be weighed up against their benefits.[22] One of the factors given the least attention seems to be that of academic staff having to devote a large amount of time and effort to creating new e-learning material and to being properly trained.[14,19,23,30,36,38]

Various personal aspects are extremely important in enabling the incorporation of ICT in teaching and learning. Having some degree of computer literacy or skill for both students and academic staff is essential.[15,22,26,36,38,42,43] It has been shown that helping students build their confidence in using computers will help to make e-learning more enjoyable and is influenced by their attitude towards computers, computer anxiety and technology self-efficacy.[25]

Openness to change on the part of the designer and student[19,36,38] has also been shown to impact on the success of learning. Yang and Tsai (2008) have warned that putting students with traditional teacher-centred learning experiences, in a student-centred learning environment is bound to cause problems and learners need to adjust to adopting a different learning environment.[44] Similarly it has been shown that when academic staff are committed to e-learning and have positive attitudes, their enthusiasm will be perceived and positively influence student satisfaction.[25,38,43,45] Studies show that although academic staff are positive about the value of ICT for education, many do not include it in their courses which may be as a result of limited rewards and incentives for the incorporation of ICT in their teaching and learning.[38]

[‡]The amount and rate of transmission capability of an electronic device, typically measured in bits per second for digital devices like computers. It is the range of frequencies that can be transmitted by phone line, fibre-optic cable, wireless or T-1 line.[5]

It has further been reported that students are more likely to achieve learning outcomes if they react positively or enjoy the learning event and/or materials.[22,26] The enjoyment or positive perception includes aspects related to user satisfaction. One aspect is the perceived ease of use which is the extent to which a person believes that use of a technology will be relatively straightforward, comprehensible, manageable and free from problems. Another is the perceived usefulness which is the extent to which a person believes that productivity will be enhanced through the use of technology. Enjoyment is further related to confidence or belief in one's capabilities and motivation.[22,38,43] Research has shown that understanding the student's cognitive styles or preferences, learning styles, information processing strategies and personal beliefs is important, as successful learning depends on these learner characteristics.[43]

1.4.2 Pedagogical factors

It is essential to understand the incorporation of technology as integral to pedagogical activity if students are to gain the maximum benefit. Failure to use ICT in an appropriate manner can lead to a compromised learning experience and disillusionment.[4,22,36,40,41] Various factors have been highlighted by investigators that should be taken into consideration in the design of e-learning material to ensure that it reaches its full pedagogical potential:

- **Structure** – learning material should be "chunked" into smaller "bite-size" topics.[40,46]
- **Navigation** – sufficient navigational information is required to enable movement through the learning material and orientation markers to indicate progress.[22,32,40]
- **Interaction** – enabling students to engage with the learning material using internal and/or external links to provide access to important and relevant information and self-assessment.[22,23,40]
- **Contextualisation** - content should be relevant, up-to-date, sufficient and useful[23,32] and locally produced in the required language.[47]
- **Consistency** - a consistent look regarding colours, visual design and naming of key elements is essential as well as legibility and clarity of language. Visual design includes aspects like use of white space, positioning of information on the page, structuring and grouping of information and use of graphics and animation. Legibility covers aspects of font size, readability of fonts, differentiation in text size

and colour contrasts. Clarity of language entails length of sentences, choice of words and expressions.[22]

- **Operational stability** – technical problems have been shown to detract from the learning experience and cause frustration.[32,36,48,49]

There are aspects both in support of and in opposition to the use of e-learning which must be considered before incorporating ICT into a course. A summary of the benefits of e-learning for teaching and learning as suggested by various investigators follows, with some being more relevant to specific technologies than others:

- **Access to resources** – providing increased and more efficient access to resources[1,4,16,37] which may include prescribed or additional reading[46] and are known to be reliable.[50] Obstacles such as poor connectivity, internet costs and access can be overcome if information is imbedded within the learning material. A further benefit is that the reading material can be referred to on more than one occasion.[42]

- **Autonomy** - moves the traditional instruction paradigm to a more student-centred approach of teaching and learning resulting in empowering students to become active participants rather than passive recipients.[15,17,19,24,32,42,51] It also minimises the educational role of the lecturer as the sole source of knowledge and allows him/her to become a collaborator, mediator and facilitator in the learning process.[22,39,43] It may also promote lifelong learning.[22]

- **Flexibility** – learning is independent of time and place, is self-paced and can be repeated/revised.[15,17,19,22,24-26,32,36,40,46,48,49,51,52] Content may be updated[32], re-used for other educational models or learning designs or revised to be provided in a familiar and relevant context.[16] The information can be divided into logical chunks of information.[22,40]

- **Interactivity**[§] - actively navigating through the material engages the learner and closely resembles the cognitive functions in learning,[16,22,24,26,40,50] addressing individual learning styles and preferences.[40] Formative assessment and feedback may be possible.[4,22]

- **Consistency** – able to standardise experiences for all, providing a consistent source of information.[14,50,53]

[§]Interactivity presumes some degree of cognition and reflection on the part of the user and active intellectual involvement with the electronic application.[5]

- **Cost-effectiveness** – in terms of student and lecturer time as this is usually the most expensive component of the education process.[32,53] Depending on the situation and platform used, costs may be reduced as in the case of CDs which are easy to distribute and inexpensive to duplicate in quantity compared with paper-based material[22,42] or as in the case of distance learning which reduces traveling costs.[22]

- **Communication and collaboration** – may enable new forms of communication and collaboration between students and with the lecturer.[22,42,46]

- **Real-world experience** – may enable the use of simulation adding pedagogical value.[22,46]

- **Diversity** - enables individualized instruction[42] and it has been suggested that it may therefore be a more appropriate way of delivering education to groups of learners who come from different ethnic backgrounds and whose needs and expectations, prior education and life experience, personal learning styles and abilities vary considerably.[3,22,44]

- **Development** - new ways of teaching and learning often result in the development of new skills, knowledge and personal qualities.[19,22,52]

- **Variety** – different teaching and learning methods provide diversity which may be stimulating.[1,26,36,48,49,52]

It should however be borne in mind that there are also constraints to e-learning as reported by various investigators which cannot be ignored and are summarized as follows:

- **Lack of human interaction –** the use of technology cannot substitute for face-to-face contact, particularly regarding the inability to ask direct questions and feeling isolated.[3,13,22,23,26,28,36,49,50]

- **Self-discipline required** – good time management is required from the learner as autonomy is increased[19,22,26,49] and motivation of the less independent learner is required (which may be the acquired "culture" of adult learners who have been through a school system of didactic teaching).[3]

- **Technical problems** - like low bandwidth and poor internet access[23,36,54] as well as limitations on system flexibility, access or navigation.[3,23] The lack of a "hardcopy" with students often requesting a printed version, is a further issue which may be partly a legacy of being used to traditional print medium but may also reflect the additional flexibility of "hardcopy" being able to be studied in places where the use

of a computer may be impractical.[40,49] It has also been noted that reading from a screen only, can be tiring and difficult.[22,26,49]

- **Cost** - may include hardware costs, maintenance, software costs (licenses and programme development) and training[36] as well as time to develop material.[23]

- **Risk of information overload** as more resources are made available than may be essential.[30,36]

- **Resource intensive** - in terms of properly trained staff, labour intensity and material resources.[23,24,28,30,43]

- **Social practices** - the introduction of ICT into education has also brought about new challenges in the educational arena such as the rise of open education resources, the increased possibility of plagiarism, the ways that teacher-student relationships are being challenged and reconstituted and disjuncture in assessment.[29]

It is imperative that the designer of e-learning material takes all of the above-mentioned factors into consideration and determines which applications will best meet the course outcomes.[23]

Czerniewicz and Brown (2005) have adapted a framework (Table 1.1), originally developed by Laurillard to classify different types of technology in relation to key teaching and learning strategies, highlighting the message that no one technology or application adequately supports the entire learning process on its own.[4,23] Research has shown that there is no significant difference in the effectiveness of various technologies or applications, when it comes to teaching the same subject matter. Technologies should therefore be selected on the grounds of their appropriateness, convenience and affordability. It is likely that using a combination of media for teaching would be more effective than any single medium.[3,22,23,37,43,55]

TABLE 1.1: Framework classifying technology in relation to teaching and learning

Teaching activity	Teaching and learning event	Learning activity	Media form	Non-computer based examples	Computer supported possibilities
Show, demonstrate, describe, explain	Acquisition	Attending, apprehending, listening	Narrative Linear presentational *Usually same "text" acquired simultaneously by many people*	TV, video, film, lectures, books, other print publications	Lecture notes online, streaming videos of lectures, DVD, Multimedia including digital video, audio clips and animations
Create or set up or find or guide through discovery spaces and resources	Discovery	Investigating, exploring, browsing, searching	Interactive Non-linear presentational *Searchable, filterable etc but no feedback*	Libraries, galleries, museums	CD based, DVD, or Web resources including hypertext, enhanced hypermedia, multimedia resources. Also information gateways
Set up, frame, moderate, lead, facilitate discussions	Dialogue	Discussing, collaborating, reflecting, arguing, analysing, sharing	Communicative Conversation with other students, lecturer or self	Seminar, tutorials, conferences	Email, discussion forums, blogs
Model	Practice	Experimenting, practising, repeating, feedback	Adaptive Feedback, learner control	Laboratory, field trip, simulation, role play	Drill and practice, tutorial programmes, simulations, virtual environments
Facilitating	Creation	Articulating, experimenting, making, synthesising	Productive Learner control	Essay, object, animation, model	Simple existing tools, as well as especially created programmable software

Source: Czerniewicz and Brown 2005[4]

1.4.3 The effectiveness of e-learning

It seems that there is no compelling evidence from studies, reviews and even meta-analyses comparing the effectiveness of e-learning to conventional teaching, to support the notion that technology improves learning, using acquisition of knowledge as the outcome. . However, results do seem to be better for undergraduate courses than for postgraduate courses. It is speculated that this is because undergraduate courses usually require the acquisition of content knowledge and skills while postgraduate courses tend to deal with higher levels of thinking and require more communication.[34,37,43]

In evaluating e-learning material it is also important to determine the student's satisfaction, which according to Shee and Wang (2008), is the "subjective sum of interactive experiences" and may be influenced by many affective components in the interaction. User satisfaction is usually measured in terms of visual appeal, productivity and usability but should also include teaching effectiveness.[32] Various investigators have determined the students' perception of whether e-learning is more effective than more conventional teaching methods, and report that students perceive e-learning as being more effective or at least as effective.[22,49] What existing research suggests is that implementing ICT in teaching and learning has the potential to increase the performance of students and improve the way that they process information if the material is well-designed.[22,40]

Shih *et al* (2008) investigated research and trends in the field of e-learning published in five major educational journals from 2001 to 2005 and found seven categories of research in the 444 identified articles[24], namely

- motivation (attitudes, beliefs and behavioural change and inter-relationships with motivation, the usage of technology and learning outcomes),
- information processing (individual differences, information seeking and management, critical thinking, decision-making and problem-solving),
- instructional approaches (achieving better learning outcomes utilising cooperative, collaborative, contextual, situated and problem-based learning),
- learning environment (innovation, interactive learning and learning communities),
- prior experience (influence of prior knowledge on learning outcomes and processes and students' experience of using the technology),
- metacognition (processes during e-learning including planning, visualization, perception and self-evaluation) and
- cognitive psychological characteristics (schemata, concept maps, mental models, cognitive loads and styles).

Most of the research was descriptive, using questionnaires as their primary data collection technique. The most published research topics covered interactive learning environments (N = 110), followed by collaborative learning (N = 92) supporting the constructivist viewpoint. Perception and awareness (N = 75) and attitude (N = 65) studies followed, supporting student-centred instruction.[24] It has been argued that the current research in this field suffers from poor quality, inappropriate design and lack of social responsibility and it has been suggested that design research may be more appropriate for discovering

what works in practice.[39] Other investigators have also suggested that there is a design weakness in this arena of research, as the design of the e-learning modules may result in an improvement in the instructional design which results in the apparent enhancement of learning abilities, rather than the implementation of the technology.[22,55] Further problems for interpreting the literature regarding the effectiveness of e-learning is that the research is all collated together, without distinguishing between the types of technology utilized.[43]

The following sections in the literature review will concentrate on the situation in Africa and specifically Sub-Saharan Africa (SSA), taking the previous discussion into consideration namely, enabling and pedagogical factors when incorporating ICT in teaching and learning, as well as the reported benefits and constraints of e-learning,.

1.5 Technology Access in Africa
The digital divide is a term used to refer to the disparities between countries, regions and institutions having ICT infrastructure, facilities (hardware, software and bandwidth) and support and using it effectively (influenced by individual, social, cultural, economic and institutional factors) and those not able to. Disparities are usually reported and still exist between North and South or developed and developing countries, urban and rural areas and between class, race or gender.[28,29,39,56,57]

Czerniewicz and Carr (2005) report that the United States of America (USA) has 129 times more landlines, 164 times more computers and 204 times more internet users per 1000 people than Mozambique (lowest infrastructure in the Southern African region) and six times more landlines, eight times more computers and internet users than South Africa (best infrastructure in the Southern African region).[39] Comparisons between various countries in SSA and the United Kingdom (UK) and USA regarding ICT infrastructure (Table 1.2) show the disparities in further detail.

Overall Africa has one of the weakest ICT infrastructures in the world, characterized by limited geographical coverage and bandwidth, poor interconnectivity between countries and low quality of services, high internet access costs and unreliable communication facilities. Africa's participation in global connectivity is less than 20% and internet and international bandwidth access in Africa is very limited, with the majority of African countries having international links of more than 64kbps while a significant number are still operating at 64kbps.[17,56-58]

TABLE 1.2: ICT infrastructure in four Sub-Saharan African countries, United States of America (USA) and the United Kingdom (UK)

	Botswana	Mozambique	South Africa	Zimbabwe	USA	UK
Population (millions)	1.7	18.4	43.6	13	291	59
Landlines /1000 people	87	5	107	25	646	591
Computers /1000 people	38.7	3.5	68.5	12.1	574	460
Internet users /1000 people	29	2.7	68	43	551	423

Source: Czerniewicz and Carr 2005[39]

SSA currently has the lowest data transmission bandwidth in the world and is falling further behind with its capacity growing more slowly than any other region. Only 14 of the 49 SSA countries have any fibre-optic connection to each other or the rest of the world, having to resort to using expensive satellite or radio connections.[58] In addition, the average internet access cost in Africa is above $50 per month resulting in the African consumer paying 50-500 times more than an American for an equivalent connection.[17,57,58] There are also differences between countries in Africa. For example, in South Africa, pricing tariffs for bandwidth are controlled, making them 200% more expensive than a comparable product in Egypt.[59] There are also disparities within countries, with rural areas having fewer resources and costs being much higher.[39,56,57] This limited access to bandwidth, poor connectivity and low quality of services restricts access to information and communication as well as the ability to use new media applications and software.[29]

This disparity of resources raises certain concerns. Firstly, of the ability of developing countries to participate in the emerging world economy, and secondly that the digital divide might grow wider if the African pace of integration within the global information economy does not pick up, thereby reinforcing historical patterns of inequality.[56] The then Minister of Communications in South Africa (Mbeki, 2001)[60], cautioned that "*efforts to bridge the digital divide must be primarily about people, not technology*", echoing various investigators' concern that although ICT can allow developing countries to jump generations of technological change, the new information marketplace may increase the gap between rich and poor countries and rich and poor people.[5,47,61]

The potential benefits of ICT for sustainable development, like using ICT for community development, accessing market information and prices on locally produced goods, stabilizing financial markets and banking systems and using ICT for education purposes are not disputed by either critics or advocates of ICT for development. However these potential benefits can only be realized if ICT is considered as the means and not the end.[57] It is also essential to be realistic and not expect ICT alone to solve all development problems and impact on the economy directly,[28,57] remembering that ICT cannot effect change independently of the broader socio-economic and political context.[23,39,56,62] This is especially important when taking into account that according to the World Bank Report in 2006, "*Africa is the world's biggest development challenge*" having 34 of the world's 48 poorest countries.[31] Another overarching factor to be considered is the economic market, especially in the educational realm, where there has been a rise in ICT-enhanced for-profit institutions, distance education, selling of internet courses, use of learning management software and intellectual property issues, often resulting in further discrepancies for developing countries and institutions. These developments are supported by the World Trade Organization's General Agreement on Trade in Services, which views higher education as a commodity to be traded and supports the deregulation and liberalization of national higher education systems to favour foreign providers, all within the context of reduced state funding. Some investigators have reported this trend resulting in the loss of the academic staff's autonomy, loss of jobs and the erosion of quality teaching.[28]

Furthermore, having the technology and infrastructure in place does not guarantee effective usage. Major barriers to achieving an information society in developing countries have been identified as poverty (not being able to afford a computer or internet access), low literacy levels, poor ICT skills, technical ability, lack of investment in ICT, institutional problems including lack of ICT policy and importantly, poor power generation/electricity supply.[28,31,39,57]

At the recent 2008 Africa Power and Electricity Congress and Exhibition in Johannesburg, South Africa, the Energy Regulation Board (ERB) chairperson Sikota Wina indicated that "given the strong correlation between electricity access and human progress, Africa shall remain in the Third World for another 200 years if access to electricity does not truly become widespread."[62] Despite the abundance of its energy resources, Africa accounts for only about 3% of world commercial energy consumption and these resources are unevenly distributed within and among regions and often located at great distances from

the energy demand areas.[63] It is estimated that no more than 20%, and in some African countries, as little as 5% of the population (excluding South Africa and Egypt) has direct access to electricity. Only 2% of the population in rural areas are connected to national power grids. Although demand is expected to grow by about 5% annually over the next 20 years,[64] even the most optimistic projections show that electricity supplies will continue to be outstripped by demand in this region for the next few years.[62] Electricity supply is erratic, with blackouts and load shedding being routine in most of Africa. The bulk of power plants and transmission facilities were built in the 1950s and 1960s and little investment and maintenance has left the infrastructure lacking. Droughts and civil wars have also had a major impact.[64] The reasons for the poor state of power supply in Africa include the overall policy environment that is perceived to be weak or overly dynamic.[62]

It is therefore critical for Africa to build facilities to provide power to those lacking it, especially in rural areas.[64] Africa is the world's largest consumer of biomass energy (firewood, charcoal, crop residues and animal wastes), which accounts for more than 90% of the energy consumption in many African countries[63] and has far-reaching consequences like associated respiratory diseases and eye problems; land degradation and deforestation; time spent of searching for fuel and limited study hours for scholars and students.[64]

Possible solutions for the erratic and insufficient electricity supply in Africa include governments adopting measures that include re-capitalisation and equity restructuring and regulators encouraging local and foreign investment into the sector.[62,64] With the pressures of the unprecedented rise in cost of primary energy sources and environmental lobby, it is also necessary that diverse energy sources including wind and solar energy sources are developed.[62,64] Hydroelectricity needs to be harnessed as the region possesses some of the largest water courses in the world, but this potential remains largely untapped.[64] Furthermore, efforts should be made to promote inter-country energy cooperation and contribute to the development of energy infrastructure.[63] According to Africa's own development blueprint, the New Partnership for Africa's Development (NEPAD), infrastructure is a pressing priority. Roads, water facilities, airports, seaports, railways, telecommunications networks and energy systems provide the vital underpinnings of any prosperous economy.[64] The creation of the Southern African Power Pool (SAPP) in 1995 and related power-pooling arrangements for intra-regional electricity exchanges provided a model of institutional framework where utilities may be part of

multilateral electricity supply agreements and also benefit from shared capacity reserve, thereby improving reliability and security of electricity supply.[63]

Efforts to improve the technology situation in Africa are also evident, for example in 2003, NEPAD heads of state and the government implementing committee agreed that a fibre optic ring around Africa should be completed to establish connection between all African countries and the rest of the world through submarine cable systems. Currently the number of mobile and internet subscribers tends to increase yearly, but the values remain low when compared to the rest of the world.[17]

A further initiative by the World Summit on the Information Society (WSIS), held in Geneva in 2003, issued a declaration aimed at discovering concrete ways to build an all-inclusive information society that bridges the digital divide and brings benefit to all through opportunities offered by ICT, with the participation of 48 African countries.[17]

Among the key issues identified were the following:
- improve access to information and communication infrastructure and technologies,
- build capacity,
- increase confidence and security in the use of ICT,
- create an enabling environment at all levels,
- develop and widen ICT applications,
- foster and respect cultural diversity,
- recognize the role of the media,
- address the ethical dimensions of the information society, and
- encourage international and regional cooperation.

The WSIS plan of action adopted these objectives to be achieved by 2015 and conducted a survey among the 53 Economic Commission Africa member states to assess their commitment to the implementation of the plan of action at national level, and to measure the current level of implementation of the objectives in the African countries.[17] Since the turn of the millennium, the number of African countries with a policy in place has increased from thirteen in 2000, to twenty-eight in 2005 and thirty-six in 2007 and the number of countries where no development is underway has decreased from thirty in 2000, to ten in 2005 and only five in 2007.[65]

The ICT policies vary in several ways in that they are more likely to focus on telecommunication technologies and their regulation with less emphasis on ICT for development, but some do include this aspect by including ICT in education. Of the forty-eight countries in Africa that either have a national ICT policy in place or are in the process of developing one, thirty-nine of them have education sector ICT policies and plans in one form or another. All policies that were surveyed emphasise the importance of enhancing access to ICT tools and internet connectivity, developing ICT skills among young people and the general population, and the importance of teacher training.[65]

Several efforts are also evident that seem to be enabling factors for the implementation of ICT in national education systems including public-private partnerships, digital content development, open-source software and operating systems, national research and education networks, international connectivity and wireless networks.[65] The South African Minister of Communications (Matsepe-Casaburri, 2004) stated: "*There is no doubt that ICTs can be very effective tools. The question is, tools for what?*" Various investigators share this concern and warn that ICT alone does not enhance learning but must be contextualized as it is the way in which ICT is incorporated into learning activities that is important.[4,17,23,41,47,66]

1.6 ICT in Education in Africa

During the African Ministers of Education meeting at the first African ministerial round table conference on ICT for education, training and development in Nairobi on June 1, 2007, their communiqué stated that: "*ICTs are seen as one key solution that will allow African countries to meet the needs in rural and under-served areas and bring education to their citizens rapidly and cost efficiently.*"[65] Education in Africa today is further required to address challenges of preparing learners to participate in local and global economies[17] and should be relevant to local conditions.[65] The lack of suitable local content has been indicated as a factor contributing to the digital divide with the African continent generating only 0.4% of global online content. If South Africa's contribution is excluded, the figure drops to a mere 0.02%. Publications from African authors are mostly in English despite it being the first language of only 0.007% of the whole African population.[47]

Although the trend of incorporating ICT in teaching and learning is gaining momentum,[31] a survey on the state of ICT infrastructure in African HEI conducted in 2006, summed the situation up as being "*too little, too expensive and poorly managed*". While the process of

adoption and implementation of ICT in education in Africa is in transition, it appears that more attention is being paid to the development of e-learning in the school sector than in higher education, although access to ICT is generally better in HEI.[39] Farrell and Isaacs (2008) suggest that this may be because academic staff at HEI have had far more independent control over content than the teacher in a school classroom. It seems that most of the effort to enhance access in HEI is focused on gaining access to affordable, high-speed internet connectivity rather than on developing materials at the institutional level or through collaboration with other HEI or countries.[65] Paterson (2005) suggested that this may also be because HEI provide academic recognition for research output but not incentives for incorporating technology into teaching.[23] In their editorial on emergent research from Southern Africa, Carr and Czerniewicz (2005) point out that when the use of ICT in HEI becomes an expectation, complex organizational issues emerge such as the development and integration of institutional strategies and policies of ICT for teaching and learning, the need for appropriate technological infrastructure and support and the demand for effective staff development (technologically and pedogically).[39]

Most countries in Africa have embraced policy development for the implementation of ICT in education, but not all countries are able to implement this policy. A country like South Africa, having better infrastructure and a more mature economy, is way ahead in terms of being able to implement ICT in education. Many of the countries of North Africa have also made excellent progress because of their resources and the high bandwidth connectivity they share with Europe. Countries like Cameroon, Ghana, Mauritius and Botswana are moving steadily toward stable economies and placing a higher priority on ICT, but the majority of African countries seem not to be emerging from internal conflict, political instability, poor governance and corruption, making progress on ICT for education impossible.[23,56,65]

Further barriers to the implementation of ICT in HEI in Africa include the formidable cost of connectivity for most educational institutions, especially in rural areas; access to a reliable supply of electricity especially in rural areas; a general lack of human resource capacity in terms of ICT training and equipment servicing, the unavailability of ICT infrastructure and lack of hardware.[57,65,67]

African HEI also lack access to the journals in which essentially all of academic research is published.[58] With the exception of South Africa, Mauritius and most of North Africa,

African HEI are seriously constrained by a lack of computers and poor connectivity. The average African HEI has bandwidth capacity equivalent to a broadband residential connection available in Europe/USA and pays fifty times more for their bandwidth than their educational counterparts in the rest of the world.[58,65]   In a survey of SSA HEI, the most common response by students to the question "*what can international donors do for African universities?*" was "*provide computers*".[58]   A disturbing trend, emerging in students in SSA, who have no internet connection at their universities, is that of resorting to private, fee-charging internet cafes which are expensive in terms of access and traveling costs.[58] In more developing countries, however, the picture is very different with various surveys having found that a very high percentage of students own or have convenient use of a personal computer, for example 85% in the USA[27] and 94% in New Zealand[15] of which the majority had internet access. In a study conducted in the USA to profile the American student in 2002, 79% of students reported that the internet had a positive impact on their academic experience and 74% that they connected to the internet for more than four hours weekly, but used the internet mainly to communicate socially with friends. In comparison, only a third of Venzuelan students studied in 2006, reported connecting to the internet for four or more hours per week and only 37% of them utilized the internet for mostly educational activities.[68]

In a survey among 6577 students and 515 academic staff in five HEI in the Western Cape, South Africa, it was concluded that technology is being used as part of teaching and learning in higher education in the Western Cape. It was found that 81% of students reported using a computer for teaching and learning occasionally or more frequently, yet only 60% of academic staff indicated that they required this of students. The investigators suggest that students are therefore independently using computers as part of their learning strategies even when not required to do so. It also seems that students used computers more readily on a daily basis than academic staff did.[4]   In another survey conducted among 566 academic staff in HEI in the Western Cape, South Africa, 41% indicated that they had access to computers and 53% access to the internet. It must be noted though that 83% of those with access to the internet, indicated that it was unavailable (unreliable, unstable, unpredictable and erratic), inadequate (63%), expensive and slow. Less than half of the academic staff (41%) indicated that they used their computers for teaching.[59]

It seems that the incorporation of technology into teaching and learning is an emerging field in SSA with a rapid growth since the late 1990's, but it is fragmented, limited to

localized pockets of practitioners resulting in everyone working independently and not learning from one another.[39]

1.7 ICT in Nutrition Education

The literature indicates that there are significant differences in the way that different professional disciplines are taught, and it can therefore be assumed that the way in which technology is being incorporated into teaching and learning in specific disciplines will also be different. This was shown in the survey by Czerniewicz and Brown (2005), where it was found that courses in the health sciences used ICT more frequently than other disciplines like business and engineering.[4] This may be because the Health Professions Council of South Africa (HPCSA), which dictates the standards of health professionals' education in South Africa, requires computer usage as one of the generic outcomes for the competence of health professionals.[69] Furthermore, it has been shown that personality typing [using the Myer-Briggs Type Indicator (MBTI[**])] can influence learning styles and that the learning style of concrete active learners is the dominant pattern in the health sector.[70] These learners are described as being "action-oriented realists", the most practical of the four patterns who prefer concrete, practical and immediate learning experiences. It follows then that health-related training should utilize learning systems that follow experiential learning and harness technology as a tool for enhancing learning. It is important to note though that the application of technology does not change how people learn, it changes the way in which they can be taught and should therefore facilitate the learning process by providing more efficient ways of teaching.[22,46]

The previously mentioned advances in higher education have also resulted in the implementation of ICT in nutrition training in various institutions in the North becoming the norm rather than the exception,[10-12,71] but this is not the case in SSA. Technological advances such as the increased availability of a number of nutrition-related web-based or CD-based software;[14,72-74] electronic nutrition journals resulting in new scientific data, methods and concepts being more accessible to HE; nutrition information which can increasingly be found on the web as well as networking, communication and conferencing on the web which can facilitate links between institutions are increasingly available.[13,75] It is important to harness these technological opportunities so that the gap between HEI in the North and South is reduced.[75] An example of an extensively used CD-Rom nutrition

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[**]MBTI scores indicate a person's preference on each of the following four dimensions, namely: extraversion/introversion, sensing/intuition, thinking/feeling and judging/perceiving and can also indicate how individuals differ in their learning processes.[6]

curriculum is the Nutrition in Medicine (NIM) project provided by the University of North Carolina at Chapel Hill, which has been distributed to all 125 USA medical schools, to most USA osteopathic schools, and to 110 international medical schools. Ongoing surveys show that at least 129 medical schools use the modules in some way (92 USA schools, 37 international schools), and an additional 56 medical schools are planning to use it or are evaluating the modules for incorporation.[14] The NIM investigators stress that as nutrition science and guidelines constantly evolve, it is imperative that a comprehensive nutrition curriculum should also be able to do so.[14]

In summary, global influences such as the emergence of the knowledge society and the MDG, as well as changes occurring in HEI over the past decade, have resulted in advances in higher education, and a more learner-centred constructivist approach to teaching and learning which incorporates ICT. Various enabling factors are required to be in place for this to occur, but it seems that Africa and specifically SSA, have not as yet been able to bridge this digital divide. The situation in Africa regarding ICT is poor and although efforts are being made to address and improve the situation, the effective incorporation of ICT is not yet the norm in African HEI as found in many developed countries. Although data is available regarding the situation in African HEI, it is clear that there is very little known about the situation in nutrition training at HEI in Africa, which is the domain of this research programme.

CHAPTER 2: METHODOLOGY

2.1 Aim and Objectives

The aim of the research programme was to determine the current use of Information and Communication Technology (ICT)[††] in selected collaborating countries in Southern Africa as well as to assess the validity and impact on knowledge of an innovative e-learning nutrition module for undergraduate nutrition students in the advancement of nutrition higher training.

Objectives:

i)   To assess the current use of ICT in nutrition training in selected collaborating countries in Southern Africa

ii)   To assess current nutrition training at university level from the viewpoint of ICT awareness, attitudes and practices in collaborating countries in Southern Africa

iii) To develop and validate a purpose-designed e-learning nutrition module, as a platform for training courses in nutrition in collaborating countries in Southern Africa

iv)   To determine the impact on cognitive knowledge of a purpose designed e-learning nutrition module on HIV/AIDS in undergraduate student training in collaborating countries in Southern Africa

2.2 Historical Background

In 1999, the Department of Medical Sciences (Nutrition Unit) at Uppsala University in Sweden started a continuing education programme for teachers in tertiary education, called GlobalNutrITion with financial support from the Swedish international development agency (Sida). By 2004, over 150 academic teachers in nutrition from 50 countries in Africa, Asia and South America had participated in the programme, learning skills in accessing ICT resources, using and producing learning resources. This group continued networking and collaborating via the electronic GlobalNutrITion network. A group of African alumni from the Global NutrITion programme then hosted a very successful PAN-African conference in Nairobi in July 2002, called ITANA (IT for the Advancement of Nutrition in Africa) (www.itana2002.org). The ITANA e-society (www.itananutrition.org) was inaugurated at the congress and one of the strategic objectives was "*the improvement of knowledge, skills and attitudes of target groups in nutrition and modern IT applications*

[††] The term ICT was defined for the purpose of this reseach programme, as the use of computers for information retrieval, storage and documentation; communication, e-mail, networking; training and development; edutainment; processing and dissemination of information; creating of new knowledge, facilities and information and internet, LAN, WAN.[7]

mainly through development, implementation and evaluation of long distance training strategies and/or programmes aimed at individuals or institutions".   This research programme initiated by SAfrITaN (Southern African IT and Nutrition research group), was therefore the initial response to the marked paucity of data in the region regarding the use of technology in higher nutrition training.

The SAfiITaN name and logo was designed for the research group to give it an independent identity (Figure 2.1). The overarching aims of the Group were finalized in a participatory workshop approach involving co-investigators[‡‡] from the Southern African collaborating countries' universities in South Africa (SA), Botswana, Zambia, Malawi, Zimbabwe and Swaziland in conjunction with co-investigators from Sweden (Addendum 1). A closed e-room was developed to enable communication between workshops, hosted on the Global NutrITion website. All investigators involved had access to this platform and were able to utilise the various tools available namely communication forums which were synchronous and asynchronous (chat rooms) and file areas to upload documents for mutual use.

FIGURE 2.1: Logo for the SAfrITaN research group

[‡‡] Co-investigators from Sweden and Botswana and South Africa (except D Marais and R Kennedy) were not specifically involved in collecting data but were involved in authorship of the e-learning module.

2.3 Research Programme Process

The planning of the research programme was jointly defined in a series of participatory workshops held over a two-year period in Stellenbosch (July and Sept 2003, Sept 2005) and Swaziland (Aug 2004) with financial support from Sida. The process and time-line for the research programme followed formative (workshop discussion and planning) and implementation (post-workshop completion of allocated tasks at the various institutions) phases. Feedback was provided at subsequent workshops (Table 2.1).

The research programme was divided into 3 phases and will be reported according to these phases throughout the dissertation:

PHASE I: Assessment of the current use, awareness, attitudes and practices of ICT in nutrition training

PHASE II: Development and validation of a purpose-designed e-learning nutrition module

PHASE III: Impact of the purpose designed e-learning nutrition module on cognitive knowledge

TABLE 2.1: Process and time-line of the SAfrITaN research programme

Year	Activity	PHASE I	PHASE II	PHASE III
2003	**Workshop 1 discussions (July, SA)**	- Target population and sampling - Survey questionnaire developed	- Topic for nutrition module determined - Draft curriculum and assignment of topics	
	Post-workshop institution-based work	- Preparation of pilot questionnaire and coding sheets	- Preparation of manuscripts per topic	
	Workshop 2 discussions (Sept, SA)		- E-learning platform namely VTS[§§] training - Standardised format for manuscripts	
	Post-workshop institution-based work		- Preparation of manuscripts per topic	
2004	**Post-workshop institution-based work**	- Pilot study conducted in SA, Malawi, Swaziland, Zambia	- Preparation of manuscripts per topic	
	Workshop 3 discussions (Aug, Swaziland)	- Report of pilot study results - Standardisation and training for survey	- First draft of manuscripts reviewed - Preamble and VTS guide developed - Target population and sampling determined - Expert reviewers identified - Design of questionnaire	
	Post-workshop institution-based work	- Finalisation of survey questionnaire - Distribution of final questionnaire to all institutions - Surveys conducted in SA, Malawi, Zambia	- Draft manuscripts converted to VTS per topic - Collation of one VTS Nutrition in HIV/AIDS module - CD-Rom distributed to expert reviewers - Face validity conducted in SA ($N = 104$)	
2005	**Workshop 4 discussions (Sept, SA)**	- Report preliminary results for SA, Malawi and Zambia (lecturing staff $N = 26$ and students $N = 461$)	- Report of results expert reviewers ($N = 27$) - Report of preliminary results of student validation in SA	- Planning of methodology for pre- and post-testing of cognitive knowledge
	Post-workshop institution-based work	- Further surveys in Zimbabwe and Swaziland (lecturing staff $N = 3$ and students $N = 130$)		
2006 - 2007	**Post-workshop institution-based work**	- Data analysis of final results of survey	- Further face validity conducted in SA, Malawi and Swaziland ($N = 71$) - Data analysis of composite validity	- Design and content review of pre- and post- knowledge tests - SA testing ($N = 173$)
2008	**Post-workshop institution-based work**	- Writing up report	- Writing up report	- Data analysis knowledge testing - Writing up report

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[§§] The platform used, virtual training studio (VTS), is a free software tool for web-based learning that was developed for the Global NutrITion programme taking the constraints of developing countries into consideration.

2.3.1 PHASE I – Assessment of the current use, awareness, attitudes and practices of ICT in nutrition training

The objectives of this phase of the research programme were to assess current use, awareness, attitudes and practices of ICT among students in collaborating countries. A descriptive, cross-sectional study design approach was adopted for this phase of the research programme.

2.3.1.1 Study population and sampling

As indicated in the historical background, a group of Southern African alumni from the Global NutrITion programme initiated SAfrITaN in response to the ITANA e-society objectives. This resulted in a convenience sample of six HEI, teaching health sciences, in the collaborating countries in Southern Africa (Addendum 1), namely South Africa [Stellenbosch University (US) and MEDUNSA[***]], Malawi, Zambia, Swaziland and Zimbabwe. This convenience sample of HEI, where co-investigators were employed, was selected as it provided research infrastructure from members of SAfrITaN and direct access to students and lecturing staff in nutrition-related courses within the health sciences.

Initially, three target categories of respondents from the participating HEI were identified to be included in the survey:

(i)   Final year students following Medical, Nursing, Food Science, Nutrition, Dietetics, Home Economics/Consumer Sciences, and Agricultural Sciences courses and

(ii)   Lecturing staff providing nutrition training in above-mentioned courses and

(iii)   Administrators (Academic managers, Deans / Assistant Deans, Vice-chairs, Heads of Department / Chairman, Librarians, ICT managers, Support staff and Technicians; see also pilot study outcomes)

[***]As a historically disadvantaged institution, students and staff of MEDUNSA who took part in the research represent a different demographic profile from that of the other South African partner, the University of Stellenbosch. On 1 January 2005 MEDUNSA merged with the University of the North in Polokwane, Limpopo Province. The combined institution will henceforth be known as the University of Limpopo and the name of MEDUNSA will live on as the name of the Pretoria campus of the new multi-campus university.

Inclusion criteria for the students and lecturing staff were all those receiving/providing nutrition training in the specified courses, students in their final year of study for that specific course and those willing to participate in the study, with no gender or age-restrictions. An exclusion criterion was having been included in the pilot study.

Co-investigators at each participating HEI projected the number of respondents who would potentially be available for testing in their respective institutions, depending on the courses provided at that institution (Addendum 2). A total of 279 lecturing staff and 1349 students were indicated for inclusion in the sample. From this projection, an expected sample size of 150 lecturing staff and 1000 students at the six participating HEI was calculated to ensure representivity, based on the formula of Krejcie and Morgan[76] which estimates proportions using a 95% confidence interval and 5% precision. It was expected that not all sub-categories of students and lecturing staff would be represented at each of the participating HEI, but that all sub-categories would be included. It was also anticipated that many of the participating countries would have difficulties, to a varying extent, in implementing data collection depending on factors beyond the control of the investigators e.g. political instability, merging of institutions; that not all of the categories would be reached within the required time period and lastly that not all students would return the completed questionnaire or volunteer to partake in the study, resulting in smaller sample sizes than projected. Measures to address these difficulties included the aim to achieve a sample as representative as possible and the enabling of, by whatever means possible, those institutions/investigators having reversible or facility type difficulties (photocopying, typing, printing, limited finances).

2.3.1.2 Data collection

The data for this phase of the research programme were collected in the form of a awareness, attitude and practices questionnaire. The questionnaire was designed during the first SAfrITaN workshop and included consultation with an educational expert. The draft questionnaire was formatted by the principal investigator (D Marais) after the workshop and sent to all SAfrITaN members for peer review (content validity). A statistician was also consulted regarding data coding and capturing. Changes were made according to the peer review process before pilot testing the questionnaires.

Pilot testing to determine face validity took place after the workshop at five of the participating HEI in four Southern African countries (Swaziland, South Africa, Zambia and

Malawi) and included a total sample of 92 respondents (19 administrators, 17 lecturing staff and 56 students). The results of the pilot study were discussed at the 3rd SAfrITaN workshop held in Swaziland. Standardisation and training of the co-investigators at the HEI involved in data collection and capturing for this phase of the research, were completed during the same workshop. The final changes to the questionnaire were made according to the pilot result discussions and disseminated to all co-investigators for data collection at their home institutions. The collective experience obtained from the pilot testing indicated that the target group of administrators would be best excluded, as it was found that no additional information was obtained from this group as compared to the lecturing staff group. Furthermore, this group was diverse, making representation in the study and analysis of the data difficult. This group was also the least compliant with poor response rates.

The final questionnaire (Addenda 3 and 4) had five sections covering the following areas:

- **Section A** had six closed questions regarding socio-demographics (category, age, gender, years experience/year of study, designation, institution)

- **Section B** had twenty closed questions regarding computer access and usage including access to computer, internet and e-mail (where, when and how often) and utilization as well as the type of computer (hardware, software and support)

- **Section C** had twenty-one statements regarding attitude to various aspects of ICT and nutrition, using a four point Likert scale option of strongly agree, agree, disagree and strongly disagree

- **Section D** had sixteen questions regarding ICT skills and training. The questions in this section were mostly closed but some required supporting information

- **Section E** had nine closed questions regarding ICT skills and training in general and nutrition training in particular

The questionnaire was only available in English as it was the only common language between the six HEI. Questionnaires were handed out during class periods or at a similar opportune time, when all the students were together under the supervision of the relevant

SAfrITaN co-investigator, who was available for any questions. Students were not required to complete an informed consent form as it was clearly indicated on the questionnaire that completing the questionnaire indicated their voluntary participation. No coercion or incentives were offered to the students to complete the questionnaires and no identifying information was required on the questionnaire. Data were collected in South Africa, Malawi and Zambia in 2004 and in Zimbabwe and Swaziland in 2005.

2.3.1.3 Data analysis

A standardized data capturing sheet was prepared and coding pre-determined for all questionnaire items. If a response was not provided, that cell was left blank. The data from all co-investigators were collated into one Excel spreadsheet and checked by the principal investigator to ensure all data had been captured correctly. The principal investigator randomly selected an approximate 10% sample from each set of HEI questionnaires and compared the data sheet for accuracy.

Two types of data were collected, namely continuous data (age and years experience) and nominal or categorical data for all the other closed questions. Descriptive statistical methods, namely means and standard deviations (SD), were used for the continuous data. Descriptive statistical methods used for categorical data included determining frequencies and percentages which were represented in tables and histograms. Analyses were done using StatSoft Inc. (2004) STATISTICA (data analysis software system, version 7. www.statsoft.com).

The mode was determined for the attitude responses on the Likert scale. The scale was also measured on an ordinal scale (4 for *strongly agree*, 3 for *agree*, 2 for *disagree* and 1 for *strongly disagree*) to enable the calculation of means, SD and inferential statistics.

Inferential statistics were conducted to determine statistical significance ($p < 0.05$) and/or correlations between the variables. For comparisons of continuous and nominal/ordinal data, analysis of variance (ANOVA) was used to determine if the means of the continuous data differed between the levels of the nominal variable. If the data were normally distributed, the ANOVA F-test was used to determine the p-value, whereas if the data were not normally distributed, the non-parametric Mann-Whitney test was used to determine the p-value. When more than two levels of the nominal variable were involved, the Kruskal-Wallis test was used to determine the p-value and a Bonferroni multiple

comparison procedure was followed to determine the nature of the differences between the variables. For comparisons between nominal variables, contingency tables were drawn and Pearson's chi-square test was used to determine the p-value. For comparisons between ordinal and nominal variables, the Kruskal-Wallis test or the Mann-Whitney test was used. For comparisons between continuous or ordinal variables, Spearman correlations were calculated with their p-values.

2.3.2 PHASE II – Development and validation of a purpose designed e-learning nutrition module

The objective for the second phase of the research programme involved the development and validation of a purpose designed e-learning nutrition module. A descriptive, cross-sectional study design approach was adopted for this phase of the research programme.

2.3.2.1 Development of a purpose designed e-learning nutrition module in HIV/AIDS

2.3.2.1.1 Topic selection - nutrition in HIV/AIDS

Nutrition and HIV/AIDS was identified as the most relevant topic, as HIV/AIDS was the world's fourth biggest cause of death and 28 million (70%) of the 40 million people with HIV infection were concentrated in Africa at that the time of planning. Life expectancy at birth in SSA was then estimated at 47 years, whereas without the HIV pandemic it had been estimated to be around 62 years.[77]

SSA has since been severely impacted on various levels including health, nutrition, food security and overall socio-economic development by the HIV/AIDS pandemic.[61,78,79] HIV/AIDS is seen as a SSA priority when more recent estimates from 2005 are taken into account, namely that six out of every ten men, five out of every ten women, and nine out of every ten children living with HIV in the world are to be found in SSA.[78]

Although the initial focus on the management of HIV/AIDS was on drugs, the WHO has since highlighted the important role that nutrition plays in the management of HIV/AIDS[61] and emphasized the importance of interventions being based on sound scientific evidence (regarding drugs and nutrition) and local resources and experience.[79]

2.3.2.1.2 E-learning platform selection – virtual training studio

The platform used, virtual training studio (VTS) (http:www.vtshost.com), is a free software tool for web-based learning. It was developed by two Swedish IT specialists, Gabriel Westman and Erik Bergman, as part of the Global NutrITion programme with financial support from the Swedish international development agency (Sida). VTS therefore takes the unique situation and specific constraints of developing countries into account, namely low bandwidth, poor connectivity and limited library resources and/or access to the internet and computers.

It is a two-interface system, in which the designer can enter the course content through a form-based interface, storing the data in a database. The students can then access the database through another interface, which will provide professional design, navigation and graphical presentation of the content. By setting a new, open and freely available standard for creating computerized interactive teaching material, it allows both the designer's and the student's interfaces to be platform- and storage-media independently. This means that teaching material can be created and viewed directly over the Internet as well as from CDs, hard drives and local networks.

The platform further allows for flexible use of the material, including translation into local languages, modification to suit specific target groups, updating or correction of information, as required by the designer. Interactivity is possible by means of various tools including internal links (between pages of the module, between sections of the module and to documents which are uploaded and a part of the material), external links to websites (Figure 2.2), quizzes (Figure 2.3) and the inclusion of multimedia in the form of pictures, sound and video clips (Figure 2.4).
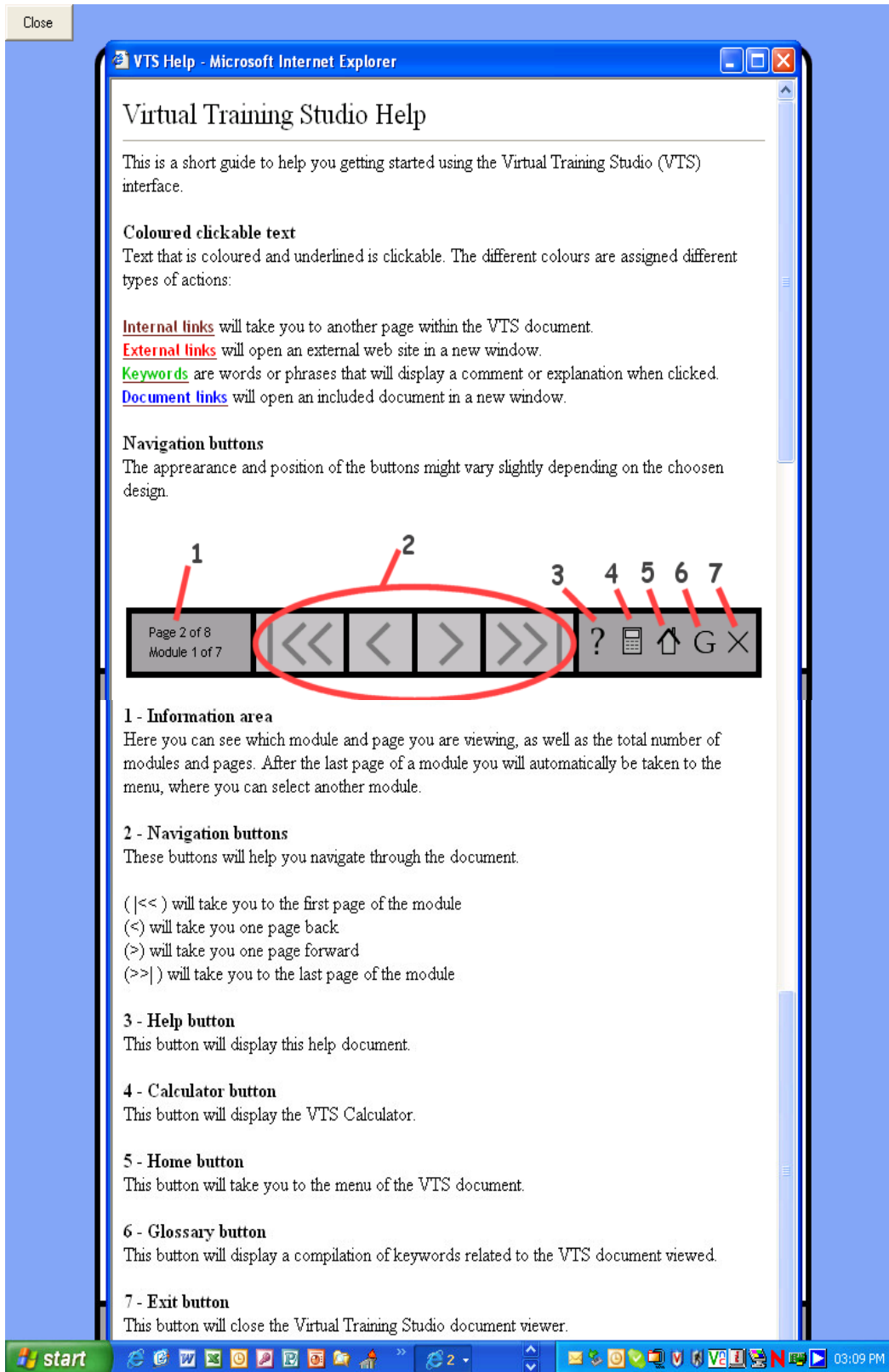
FIGURE 2.2: "Help" window indicating guiding and interactivity tools available in VTS
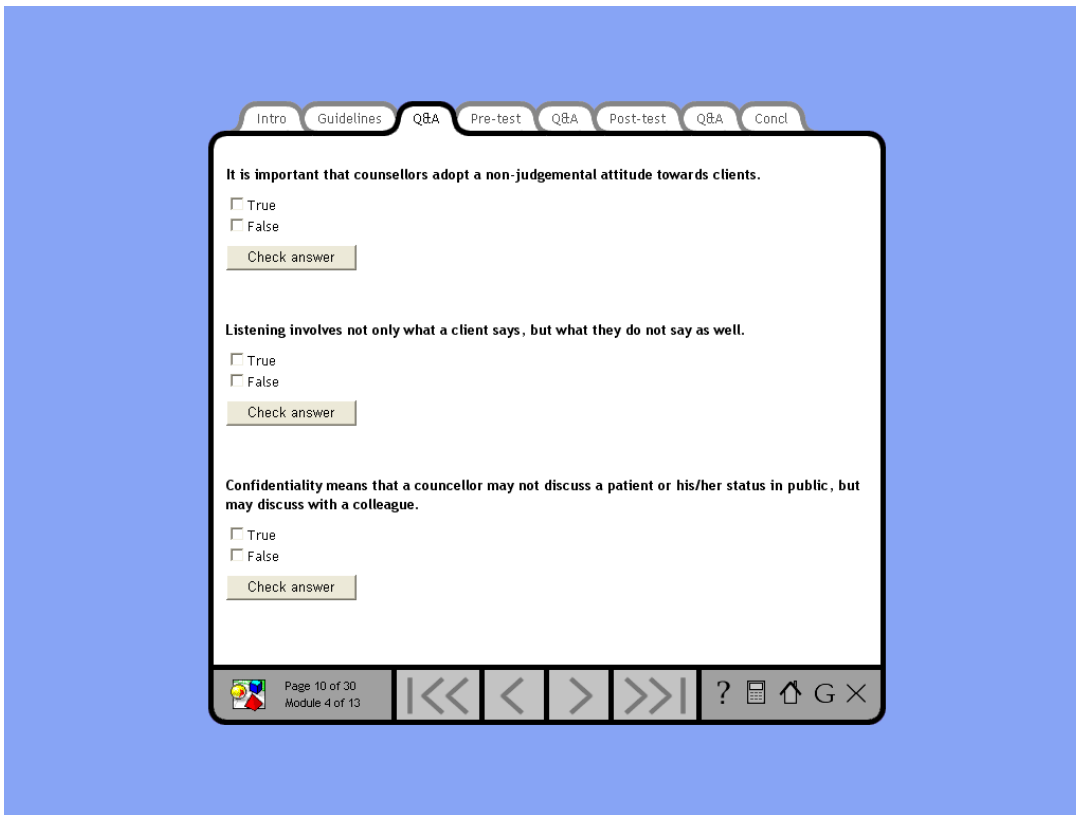
FIGURE 2.3: Example of a quiz in VTS
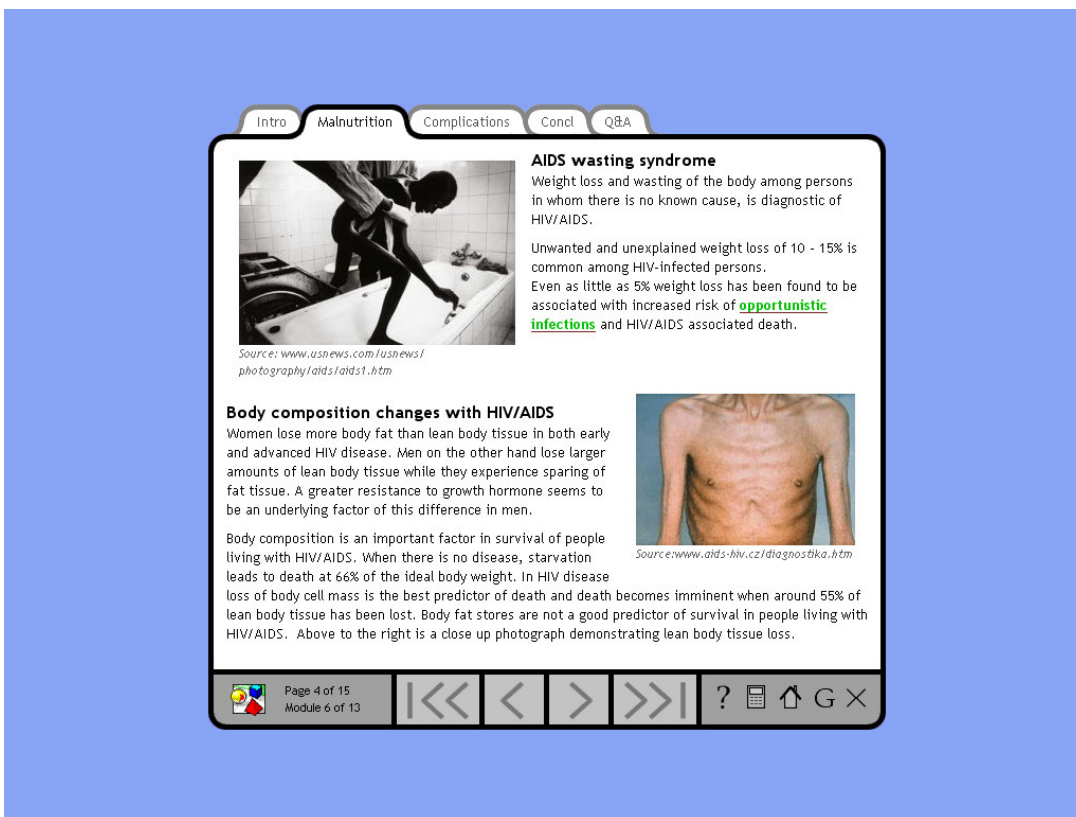
FIGURE 2.4: Example of the inclusion of pictures in VTS

It is important to note that risk-benefit calculations regarding programming issues were taken into consideration by the designers of the programme in limiting its size but still allowing themselves a certain amount of freedom of design.

These restrictions include the following:
- A limited number of standardized "skins" which influence the visual layout of the student interface and include background colour, font size and font type
- The size of the window of the student interface not being full-screen size
- Quiz responses only indicating whether the selected response is correct or incorrect (not providing the correct answer)
- Not providing a "back" option which means that users must do this manually using arrows or menu tabs (within sub-modules) or the content home page (between sub-modules)
- Not being able to work on other applications without closing the VTS module

Regarding software requirements for the computer: windows media player and depending on the resources provided, either Windows, Excel or Adobe acrobat for PDF files would be required. Free software, like the windows media player and Adobe acrobat, can be provided on the same CD-Rom as the learning material in VTS format.

2.3.2.1.3 Design process for the Nutrition in HIV/AIDS e-learning module
Members of the SAFrITaN research group (Addendum 1) jointly decided, designed and developed the Nutrition in HIV/AIDS e-learning module. Draft educational material for trainers on HIV and Nutrition from the United States Agency for International Development (USAID) and Food and Nutrition Technical Assistance (Fanta), provided by Dr Robert Mwadime (Regional Centre of Health Care, Medical School, Mulago, Uganda), was used together with various teaching materials provided by collaborators from their own countries, for the development of a draft curriculum.

A draft curriculum was developed for the module during the 1st SAfrITaN workshop covering the following topics:
- An introduction to HIV/AIDS
- HIV/AIDS Voluntary Testing and Counselling
- Nutrition and infection complex
- Vicious cycle between nutrition and HIV/AIDS

- Nutritional status assessment of People living with HIV/AIDS (PLWHA)
- Nutritional care and management of PLWHA
- Caring for HIV/AIDS through the lifecycle
- Food hygiene and food safety in the context of HIV/AIDS
- Treatment and care practices of HIV/AIDS
- Food Security and Socio-economic Impact of HIV/AIDS
- Food and Drug Interactions in the context of HIV/AIDS

Each topic was discussed during the workshop and the content outline of each sub-module within the greater Nutrition and HIV/AIDS module was determined (Addendum 5). Members of the SAfrITaN research Group were assigned specific sub-modules to be authored, either on their own or as a group, according to their expertise within that field. In some fields, where expertise within the Group was minimal, outside expertise was requested as in the case of the sub-module regarding *"HIV/AIDS Voluntary Testing and Counselling"*, where a South African non-governmental organisation (NGO), namely the Triangle Project, was requested to provide the manuscript.

Guidelines regarding sub-module layout were provided to all authors during the 2nd SAfrITaN workshop to ensure uniformity of the material. These guidelines specified the length/duration of each sub-module in that the number of pages should be limited to 20-30 per sub-module to enable students to complete the material within an hour. Furthermore, that specific aims, objectives and outcomes per sub-module should be included to standardize all sub-modules. The pedagogical aim of the module was specified that it should be evidence-based, a self-study activity to be used for blended learning and interactive. Applications for interactivity, used in the Nutrition in HIV/AIDS module to ensure interaction or engagement of the student with the study material, included:
- quizzes as formative evaluation (True or False questions);
- keyword links providing the definition of terms;
- links to further information internally (documents, pages within the module, graphics or publications) or externally (websites);
- relevant pictures were included throughout to break the text;
- culturally and country-specific tasks, assignments and case studies. These tasks were not compulsory and did not need to be handed in for marking or discussion for the purposes of this research, but could be used for summative/formative evaluation purposes by lecturing staff.

The 2nd SAfrITaN workshop was held primarily to train the investigators in the use of VTS technology. This training included:

- an introduction to VTS,
- the concept of e-learning,
- the use of multimedia (digital pictures, sound and video clips),
- tools and programmes for object creation (Paint Shop Pro, Windows Media Encoder, Easy Audio Converter), and
- using VTS-specific tools (text objects, keywords, links and quizzes).

Once the draft manuscript for each sub-module was finalized, it was converted into the VTS format by the authors themselves in most cases or by the principal investigator. During a 3rd SAfrITaN workshop held in Swaziland, the modules were peer-reviewed by the other SAfrITaN members and changes were made accordingly. A single *Nutrition and HIV/AIDS module* in VTS, combining all the sub-modules provided by the various authors, was compiled by the principal investigator in the form of a CD-Rom for testing and validation purposes. The CD-Rom also included a preamble (Addendum 6) which outlined a motivation regarding the need for nutrition and HIV/AIDS training material, acknowledgement of the efforts being undertaken in Africa regarding HIV/AIDS and Nutrition, the uniqueness of the product and the need for VTS. The fact that this module will not be sold for financial gain, was highlighted. Justification for inclusion of the collaborating universities/countries as well as a brief background of all the sub-module authors were included. A brief guide to VTS was provided as an additional sub-module. Windows media player and Adobe acrobat were also included on the CD-Rom.

2.3.2.2 *Validation of the e-learning nutrition module*

2.3.2.2.1 Study population and sampling

During the 3rd SAfrITaN workshop, two study populations were targeted for the validation of the Nutrition in HIV/AIDS module. These included expert reviewers for content validity and students following specific nutrition-related courses (Dietetics, Nutrition, Home Economics/Consumer Sciences, Medical, Nursing, Agricultural Sciences and Food Science) at the collaborating HEI in Southern Africa for face validity.

Expert reviewer sample: A purposive non-random sample of expert reviewers included internal and external reviewers. The internal reviewers were the 15 collaborators in the SAfrITaN research Group (Addendum 1). The twenty external reviewers from South Africa

(N = 7), Sweden (N = 5), Zimbabwe (N = 1), Zambia (N = 3), USA (N = 3) and Swaziland (N = 1) were identified by SafrITaN members according to their expertise in a specific area(s) of HIV/AIDS or the nutritional aspects involved, as well as educational and technological expertise (Addendum 7). Fourteen attendees of a workshop regarding Nutrition in HIV/AIDS at the 2004 ITANA conference held in South Africa (utilizing the e-learning module as basis for the workshop material), were invited to review the module as well since they were colleagues working in the field of nutrition, with a special interest in HIV/AIDS as indicated by their attendance at the workshop. Expert reviewers were invited to review sub-module(s) according to their areas of expertise. It was expected that not all of the 49 invited expert reviewers would complete all of the sub-modules, but that all sub-modules would be evaluated for content validity.

Student sample: Co-investigators (members of the SAfrITaN Research Group) identified specific courses/modules, relevant to the course curriculum of the students in the relevant courses, in which the sub-module(s) of the Nutrition in HIV/AIDS module could be incorporated as self-study activities (Addendum 8). This provided a projected purposive sample of 194 students. Inclusion criteria stipulated that all students should be studying the identified nutrition courses and consent to partake in the evaluation. No gender or age-restrictions were included.

The relevant sub-module(s) to be evaluated by specific student groups was identified by the lecturing staff. It was not expected that all sub-categories of students would complete all of the sub-modules, but that all sub-modules would be evaluated for face validity. It was anticipated that many of the participating countries might have difficulties, to a varying extent, in implementing data collection depending on factors beyond the control of the investigators, e.g. political instability and merging of institutions. It was also understood that not all of the categories would be completed within the required time period and lastly that not all students would return the completed questionnaire or volunteer to partake in the study, which could result in smaller samples than projected. Measures to address these difficulties included the aim to achieve a sample as representative as possible and the enabling of those institutions/investigators who had reversible or facility type difficulties (photocopying, typing, printing, limited finances) by whatever means possible.

2.3.2.2.2 Data collection

Expert reviewers: A letter of invitation was sent to the expert reviewers requesting them to evaluate those sub-modules to which their expertise was most relevant, and to submit comment (thus open-ended questions) on the following regarding the sub-module(s) (Addendum 9):

- scientific correctness/relevance,
- usefulness,
- interactivity,
- based on the latest information, and
- level of presentation.

Students: Students were requested to evaluate the sub-modules concurrently for face validity. A draft evaluation questionnaire was designed during the 3rd SAfrITaN workshop for evaluation of the Nutrition and HIV/AIDS module. This draft questionnaire was sent to an educational expert for comments, and changes were made accordingly. Questions were mostly closed questions with a limited number of open-ended questions, particularly for recommendations and suggestions. Attitude to statements was tested using a four point Likert scale (strongly agree, agree, disagree and strongly disagree).

The questionnaire had four Sections regarding the following (Addendum 10):

- **Section A**: Personal Information (age, gender, country and category)
- **Section B**: Administrative (module(s) completed and order of completion, mode of delivery, assistance provided, clarity of instructions and information, place and situation of module completion, effectiveness of learning and adequacy of IT skills)
- **Section C**: Content (level, adequacy, skills acquired, relevancy and applicability of interactive tools and culturally specific)
- **Section D**: Mode of Delivery (familiarity of icons and menu, functionality and usefulness of links and other visuals and colour scheme)

The finalised questionnaire was sent to all collaborators electronically. Where collaborators were unable to make their own copies of the questionnaire or CD-Rom, the necessary number of copies was provided on request. The questionnaire was only available in English, being the only common language between the six collaborating HEI.

Investigators (members of the SAfrITaN research Group) identified specific courses/modules (relevant to the course curriculum of the students in the relevant courses), in which the sub-module(s) of the Nutrition in HIV/AIDS module could be incorporated as self-study activities and used in the evaluation of the e-learning module. Each student was provided with a CD-Rom of the entire Nutrition in HIV/AIDS module and it was clearly indicated which sub-module(s) should be completed during the self-study time allocated, as identified by the co-investigators. It was made clear to students that this material was part of their course curriculum. Students were also provided with the relevant evaluation questionnaires and requested to complete them for the specific sub-module(s) on the understanding that they were free to complete any of the other sub-modules should they be interested. Students were able to retain possession of the CD-Rom for later reference. They were not required to complete an informed consent form as it was clearly indicated on the questionnaire that completing the questionnaire indicated their voluntary participation. No coercion or incentives were offered to the students to complete the questionnaires and no identifying information was required.

2.3.2.2.3 Data analysis

Expert reviewers: As the questions in the expert review questionnaire were open-ended questions, data were analysed as qualitative data. No transcription or triangulation was required as reviewers provided written responses in their own words. Content analysis was conducted using the editing method utilising the description as provided by the reviewers, which was classified according to common themes or patterns and connections made between these themes. The number of similar responses within a theme was quantified for each section. Reflexivity (effect of investigator's perspective, values and beliefs) was minimized as theming of responses was conducted by an independent research assistant. Including a large number and variety of reviewers in terms of area of expertise and geographical areas improved the transferability, dependability and confirmability of the data.

Students: A standardized data capturing sheet was prepared and coding determined for all student evaluation questionnaire items. If a response was not provided, that cell was left blank. The data from all co-investigators was collated into one Excel spreadsheet and cleaned by the principal investigator to ensure that all data had been captured. Spot checks were done using hard copies of the questionnaire.

Only nominal or categorical data were collected from students. Analyses were done using StatSoft Inc. (2004) STATISTICA (data analysis software system, version 7. www.statsoft.com). Descriptive statistical methods used for categorical data included determining frequencies and percentages which were represented in tables and histograms. The mode was determined for the attitude responses on the Likert scale. The scale was also measured on an ordinal scale (4 for *strongly agree*, 3 for *agree*, 2 for *disagree* and 1 for *strongly disagree*) to enable the calculation of means, SD and inferential statistics. The mean scores for attitude statements utilizing the ordinal scale were calculated to indicate the student's self-rated ICT skill, level of enjoyment of the e-learning activity and how effective they scored the e-learning module as compared to conventional teaching methods.

Inferential statistics were conducted to determine statistical significance ($p < 0.05$) and/or correlations between the variables. For comparisons of continuous and nominal/ordinal data, analysis of variance was used (ANOVA) to establish whether the means of the continuous data differed between the levels of the nominal variable. If the data were normally distributed, the ANOVA F-test was used to determine the p-value, whereas if the data was not normally distributed, the non-parametric Mann-Whitney test was used to determine the p-value. When more than two levels of the nominal variable were involved, the Kruskal-Wallis test was used to determine the p-value and a Bonferroni multiple comparison procedure was followed to determine the nature of the differences between the variables. For comparisons between nominal variables, contingency tables were drawn and Pearson's chi-square test was used to determine the p-value. For comparisons between ordinal and nominal variables, the Kruskal-Wallis test or the Mann-Whitney test was used. For comparisons between continuous or ordinal variables, Spearman correlations were calculated with their p-values.

2.3.3 PHASE III – Impact of the purpose designed e-learning nutrition module on cognitive knowledge

The objective for the third phase of the research programme involved pre- and post-testing of knowledge to determine the impact of the Nutrition in HIV/AIDS module on cognitive knowledge. An experimental before-after study design approach was adopted for this phase of the research programme.

2.3.3.1 Study population and sampling

For this phase of the research, it was necessary to identify specific nutrition-related courses that were able to incorporate a sub-module(s) of the Nutrition and HIV/AIDS module into the course curriculum as a stand-alone teaching method and not part of blended learning. This was to ensure that the impact on cognitive knowledge was as a result of the e-learning material only and not from other teaching and learning activities. Due to time and practical constraints, such as political unrest and relocation of co-investigators to other institutions, testing for this phase of the research only took place in South Africa at the Faculty of Health Sciences, Stellenbosch University.

Even in South Africa, it proved to be extremely difficult to find suitable testing groups, as lecturing staff tend to combine different teaching and learning activities for a particular topic and did not feel comfortable utilizing the CD-Rom only. To ensure that the pre- and post-testing of knowledge tested only the impact of the e-learning material, it was essential that only this material be utilized, although the intention of the investigators/designers was not that this e-learning module be used as a stand-alone module specifically. Testing opportunities were therefore very limited and were only possible for eight of the eleven sub-modules.

Nutrition-related courses that were investigated for participation included dietetics and medical courses. Other nutrition-related courses included in the previous phases of research were either no longer available as undergraduate programmes at Stellenbosch University (nursing and consumer science courses) or not easily accessible to the investigator, as they were based at another campus (food and agricultural sciences). The medical programme coordinators were not accommodating for this phase of the research as it was felt that time was extremely limited within the course curricula. Lecturing staff were not agreeable to providing self-study activities only on a topic or they felt that the timing for the teaching of the topic was not practical for testing purposes.

Graduate students from the North Western University (NWU) in Canada were attending a 3-month elective course in Public Health in South Africa. The organizers had contacted the Division of Human Nutrition requesting lectures on HIV/AIDS amongst other nutrition-related topics. Negotiations with the organizers resulted in the inclusion of some of the relevant sub-modules of the Nutrition in HIV/AIDS module as self-study activities within their programme and the assurance that no other teaching and learning activities would be

utilized for these topics. The sub-modules (Food security and socio-economic impact of HIV/AIDS; Overview-introduction to HIV/AIDS; HIV/AIDS voluntary testing and counseling) were not tested as no opportunities arose for testing either as a result of time constraints (each topic only covered once in a period of a year) or the inability to find a suitable course in which they could be incorporated without another teaching activity in this regard.

In summary, therefore, twenty-five second year BSc Dietetics (BScD) students were requested to complete the *Food hygiene and food safety in the context of HIV/AIDS module* during the HACCP module in their Foods course. Fifteen third year BScD students were requested to complete only the *Food and drug interactions in the context of HIV/AIDS module* during the HIV/AIDS theme of their Therapeutic Nutrition course. Thirty graduate students from NWU were requested to complete the following sub-modules: *Nutrition and infection complex; Vicious cycle between nutrition and HIV/AIDS; Nutritional status assessment of PLWHA; Nutritional care and management of PLWHA; Caring for HIV/AIDS through the lifecycle and Treatment and care practices of HIV/AIDS*.

2.3.3.2 Data collection

The principle investigator, together with the relevant lecturing staff involved identified the specific topics relevant to the course curriculum of the students in the courses where the sub-module(s) could be incorporated as self-study activities and would be the only teaching and learning activity for that topic. Each student was provided with a CD-Rom of the entire Nutrition in HIV/AIDS module and it was indicated which sub-module(s) should be completed during the self-study time allocated. It was made clear to students that this material was part of their course curriculum. Students were able to retain possession of the CD-Rom for later reference. Students were not required to complete an informed consent form as it was explained that completing the pre- and post knowledge questionnaires was voluntary. No coercion or incentives were offered to the students to complete the questionnaires. Students were asked to provide their student numbers on the questionnaires so that pre- and post-tests could be linked, but were assured that this information would not be linked to their names.

In the case of the BScD students (second and third years), pre-testing took place under the supervision of the principle investigator before the CD-Rom was provided to the students and they were allowed self-study time of 45 minutes to complete the required

sub-module. The post-testing was conducted the following day under the supervision of the principle investigator. The NWU students completed their pre-test under the supervision of the principle investigator before the CD-Rom was provided to them and they were given self-study time over a two-month period to complete the six sub-modules. The post-testing was conducted under the supervision of one of the SAfrITaN research members after the two-month period.

Multiple choice questions (MCQs) are popular for evaluation purposes to assess knowledge, as cognitive knowledge is best assessed using written test forms.[80] MCQs are defined as a form of assessment item for which respondents are asked to select one or more of the choices from a list. Although referred to as questions, items are phrased as statements (stem) with a correct answer (key) and one or more incorrect answers (distractors).[79] A fair and defensible MCQ test should be closely aligned with the syllabus, sample broadly from important content and be free from construction errors.[81] The stem must involve one issue only and be easy to understand. Confusion may be caused by using negatives and imprecise terms like *frequently* or by ambiguity, which invalidates the question and discriminates against students for whom English is not their first language. Distractors should be brief, homogenous, plausible (based on common errors made by students) and the inclusion of at least three distractors can reduce guessing. It is also important to not to provide clues to the answer or to form a pattern of responses.[80]

Various advantages and disadvantages have been identified regarding the use of MCQs. Advantages reported are, being able to test large numbers of candidates with minimal human intervention;[80,82] handwriting and language skills are not a discriminating factor;[82] minimization of writing allows for a range of topics/knowledge to be tested in a short period of time;[80,82,83] objective assessment and easy and accurate marking,[82,83] efficient as it takes less time to complete[83] and questions can be banked and shared or reused.[80] A longstanding criticism of MCQs is that they test knowledge only, which does not guarantee competence (which integrates knowledge, skills, attitudes and communication skills). However, the literature unequivocally shows that knowledge of a domain is the single best determinant of expertise, therefore they continue to be a valid method of competence testing of cognitive knowledge.[80,83] MCQs cannot test written or oral skills such as discussing or arguing[83] and have a reputation of being easy or promoting factual regurgitation but it has been noted that MCQs can be designed for a particular level of

difficulty depending on the nature of the questions and how the MCQs fit into the overall assessment plan.[80,83]

The True/False format of MCQs inadvertently provides cues resulting in less discriminatory questions, but it remains the most common format of MCQs. This format has two major drawbacks of guessing and cueing.[80] Discouragement of guessing (randomly selecting an answer if unsure of the correct answer and still having a chance of receiving a mark) is often necessary and usually achieved by negative marking but can in turn lead to negative psychometric effects.[80,83] Other strategies, such as adopting mathematical strategies to normalize marks achieved or raising the pass mark have also been suggested and Higgins and Tatham (2003) raise the question of whether this guessing is any worse than a student who adopts a "write all you can about a subject" approach for a five mark question.[83] Cueing can be difficult to disentangle from guessing, but has been estimated to play a role in approximately 20% of answers.[80] It has been shown that these True/False MCQs are difficult to write well and in order to avoid ambiguity, it is necessary to assess the recall of an isolated fact.[80]

A set of 20 True or False MCQs was designed for each of the eight modules (Addendum 11), using the learning outcomes in the e-learning module for each of the sub-modules as source. The 160 questions were sent to two reviewers (Prof D Labadarios, module co-ordinator of the postgraduate HIV and Nutrition module of the Masters of Nutrition programme and Mrs J Visser, undergraduate lecturer for HIV and Nutrition for BScD third year students) for verification of content validity. For the BScD students, the pre- and post-tests contained 20 questions each as they completed only one module per group, whereas the pre- and post-tests for the NWU students consisted of 120 questions, as six modules were to be completed. The pre- and post-tests contained the same questions but the order of the questions was randomized for each questionnaire using Excel's random number generation tool. The questionnaires were in English only as the learning material was also only available in English.

2.3.3.3 Data analysis

Pre- and post-test scores were determined for each student for each of the eight sub-modules as the number of correct answers out of a total of 20. In the case of the NWU students, the 120 questions were first divided into the six sub-modules. The post-test score was subtracted from the pre-test score to determine the change in knowledge score.

Analyses were done using StatSoft Inc. (2004) STATISTICA (data analysis software system, version 7. www.statsoft.com). Descriptive statistical methods used were the calculation of means and SD for pre- and post-tests as well as the change in knowledge score. Inferential statistics were conducted to determine statistical significance ($p<0.05$) between the pre- and post-test scores using repeated measures ANOVA with confirmation using non-parametric Wilcoxon signed rank tests, if the residuals were not normally distributed. The number of students correctly answering each question for the pre- and post-test was categorized according to quartiles indicating questions correctly answered by 25% or less, 26 to 50%, 51 to 74% and 75% or more respectively. Each of the quartiles of students answering pre- and post-test questions correctly was given an ordinal value ($1=\leq25\%$, $2=26-50\%$, $3=51-74\%$, $4=\geq75\%$). Means and SD were calculated for the pre- and post-test quartile scores. Non-parametric comparisons of the pre- and post-test quartile means were calculated to determine statistical significance ($p<0.05$) using the Wilcoxon Matched Pairs Test and Spearman correlations.

2.4 Ethics and Legal Aspects

The study was submitted to the Human Research Committee of Stellenbosch University for Ethics approval and a project number was provided: N04/09/159 (Addendum 12). No informed consent forms were required for any questionnaires as it was explained that completing questionnaires was voluntary. No coercion or incentives were offered for completion of the questionnaires. Students were asked to provide their student numbers during the last phase of the research programme only so that pre- and post-tests could be linked, but confidentiality was assured.

CHAPTER 3: RESULTS

3.1 PHASE I – Assessment of the Current Use, Awareness, Attitudes and Practices of ICT in Nutrition Training

3.1.1 Socio-demographics of the sample

Data was collected from 591 students at all six collaborating universities in five Southern African countries (Figure 3.1).
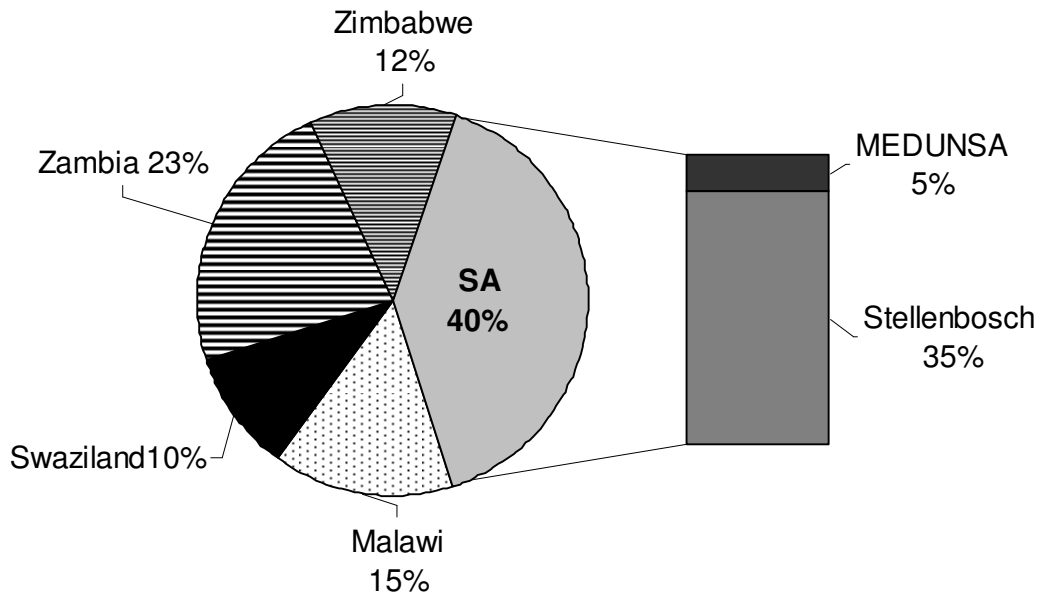
FIGURE 3.1: Distribution of students in the various collaborating countries involved in Phase I of the research programme (N = 591)

For the student sample (N = 591), two-thirds (67%) were female and the majority of students were either in their 3rd (25%), 4th (32%) or 5th (31%) year of study. Most (75%) of the students were in the age range of 20-25 years, varying between 17 and 49 years, with a mean age of 23.5 [Standard Deviation (SD) 3.6] years. Although the response rate was only 59% of the expected sample, the intention to obtain information from all categories of nutrition training was reached. The majority of students followed nutrition (25%), medical (20%) and nursing (16%) courses, but agricultural sciences (10%), home economics (9%) and dietetics (6%) were also represented (Table 3.1).

The lecturing staff sample (N = 29) with a 19% response rate included lecturing staff from only four of the collaborating universities. Malawi and Swaziland were not able to collect this data as the lecturing staff had all taken part in the pilot study. The majority (86%) of lecturing staff were female, ranging from 21 to 62 years with a mean age of 42.5 (10.9) years. Lecturing staff's experience ranged from 1 to 37 years with a mean of 18.1 (10.5)

years. All seniority levels i.e. junior lecturer (19%), lecturer (51%), senior lecturer (19%) and associate professor (11%) were represented in the sample. The intention to obtain information from all categories of nutrition training was reached (Table 3.1).

TABLE 3.1: Distribution of nutrition training courses followed by students (*N* = 591) and provided by lecturing staff (*N* = 29) at the collaborating universities in Phase I of the research programme

HEI	Agric Science		Food Science		Nutrition		Nursing		Medicine		Dietetics		Home Econ		Other	
Students	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Malawi	1	1	12	13	36	40	13	15	-	0	1	1	20	22	6	7
Medunsa	-	0	-	0	-	0	19	61	-	0	12	39	-	0	-	0
Stellenbosch	-	0	21	1	25	12	25	12	89	44	22	11	22	11	-	0
Swaziland	27	46	-	0	2	3	16	27	-	0	-	0	14	24	-	0
Zambia	29	21	14	10	50	37	-	0	16	12	-	0	-	0	27	20
Zimbabwe	-	0	-	0	35	49	21	29	16	22	-	0	-	0	-	0
Total	**57**	**10**	**47**	**8**	**148**	**25**	**94**	**16**	**121**	**20**	**35**	**6**	**56**	**9**	**33**	**6**
Lecturing staff	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
	3	**10**	**4**	**14**	**5**	**17**	**2**	**7**	**2**	**7**	**10**	**34**	**2**	**7**	**1**	**3**

3.1.2 Computer access

Overall, 96% of the students indicated having access to a computer, with Zambian students indicating a significantly lower (Chi-square test p=0.0002) accessibility (Figure 3.2). All lecturing staff indicated having access to a computer. Additionally, the majority of students and lecturing staff reported having access to a personal e-mail address (86% of students and 93% of lecturing staff) and the internet (82% of students and 85% of lecturing staff).

Students were asked to indicate the location of the access they had to computers (more than one point of access was allowed to be reported) (Figure 3.3). Fewer students reported access at home (39%) than at their place of study. Access at their place of study was either in the university library (60%) or computer lab (76%). Home computers were available to almost two-thirds of South African students, but to less than a quarter of students in Zimbabwe (17%), Malawi (19%) and Zambia (24%). Students seemed to be able to access computers at friends and relatives more easily, especially in Swaziland

(80%) and South Africa (85%). Fewer than half of the students in Zimbabwe (40%) and Malawi (48%) though had this access available. In contrast, internet cafes were utilized by more than two-thirds of students in Zimbabwe (65%) and Zambia (74%), by almost a third of students in Malawi (31%) and by less than a quarter of students in Swaziland (22%) and South Africa (37%).
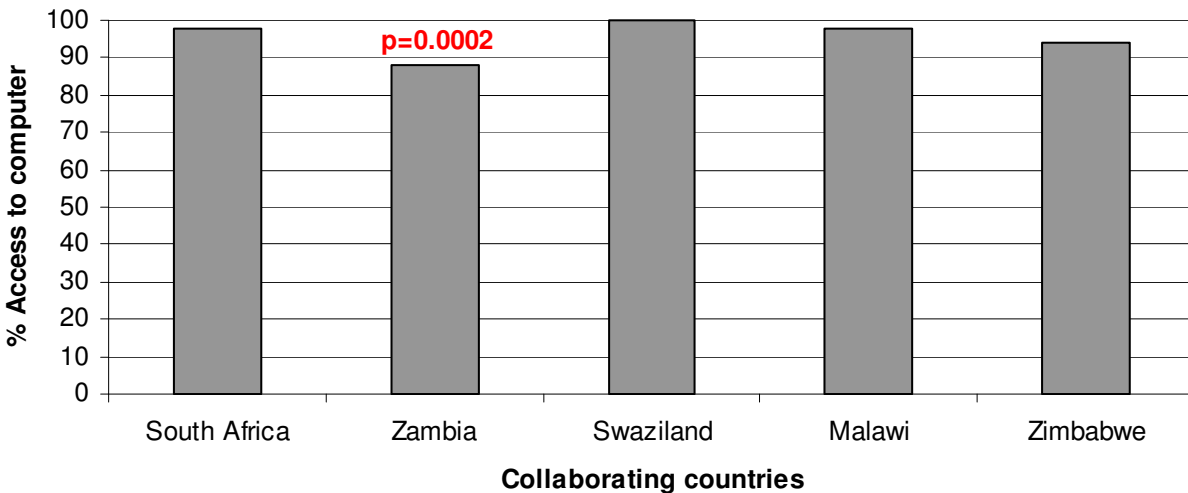
FIGURE 3.2: Percentage of students reporting having access to a computer in the various collaborating countries (_N_ = 591) in Phase I of the research programme
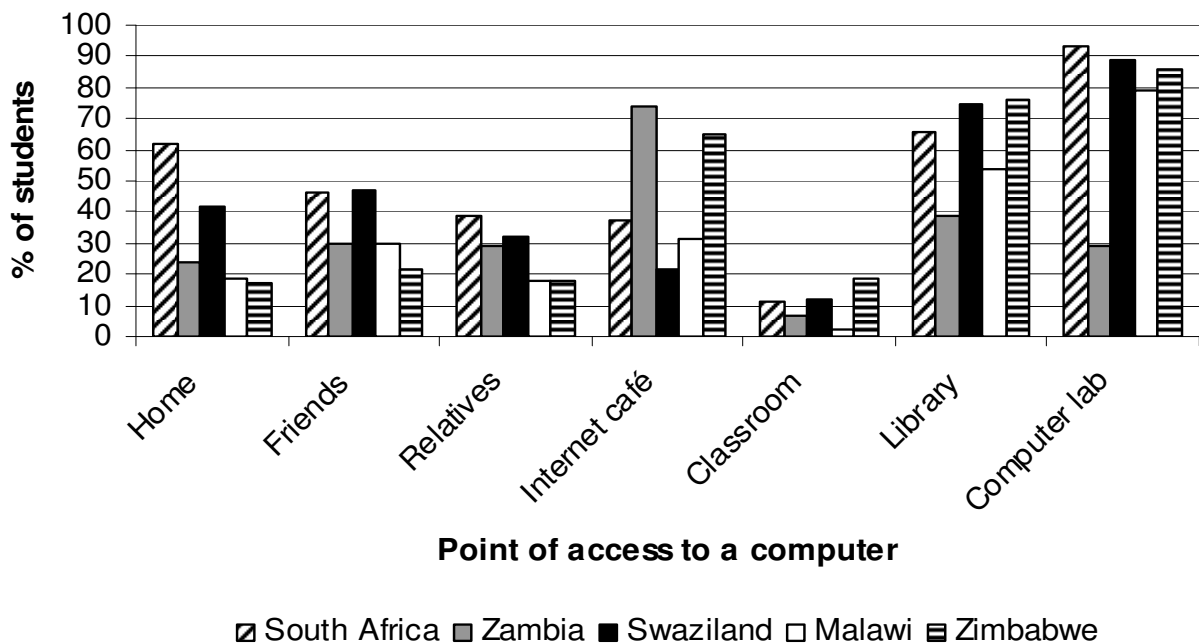
FIGURE 3.3: Percentage of students reporting having access to a computer at different sites in the various collaborating countries (_N_ = 591) in Phase I of the research programme

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When asked to indicate the location of the computer used most often, overall 64% of students indicated that it was at the university, with Zambia being significantly lower than the other countries (Chi-square test p=0.0000). Only 21% of students overall reported using computers at home more frequently than at their place of study and only 14% reported using computers at an internet café more frequently than at their place of study. Once again there were significant differences between countries, with significantly more South African students (Chi-square test p=0.0000) using computers at home more frequently and significantly more Zambian and Zimbabwian students (Chi-square test p=0.0000) using internet cafes more frequently. Lecturing staff on the other hand, reported having most access at home (83%) and did not rely much on friends, relatives or internet cafes. All lecturing staff had access at university, in either their own offices (62%) or a shared office or the computer laboratory and reported using their computers in the office more often than at home.

The main barrier to easy access to a computer outside the place of study, reported by those responding to this question (N = 220), was financial (80%) (Figure 3.4). Connectivity was also reported as a problem in 17% of the respondents and significant differences were found between countries (Chi square test p=0.0049). South African, Zambian, Malawian and Zimbabwian students indicated finances and connectivity as the main barriers, whereas students in Swaziland indicated electricity (12.5%) as an additional barrier.
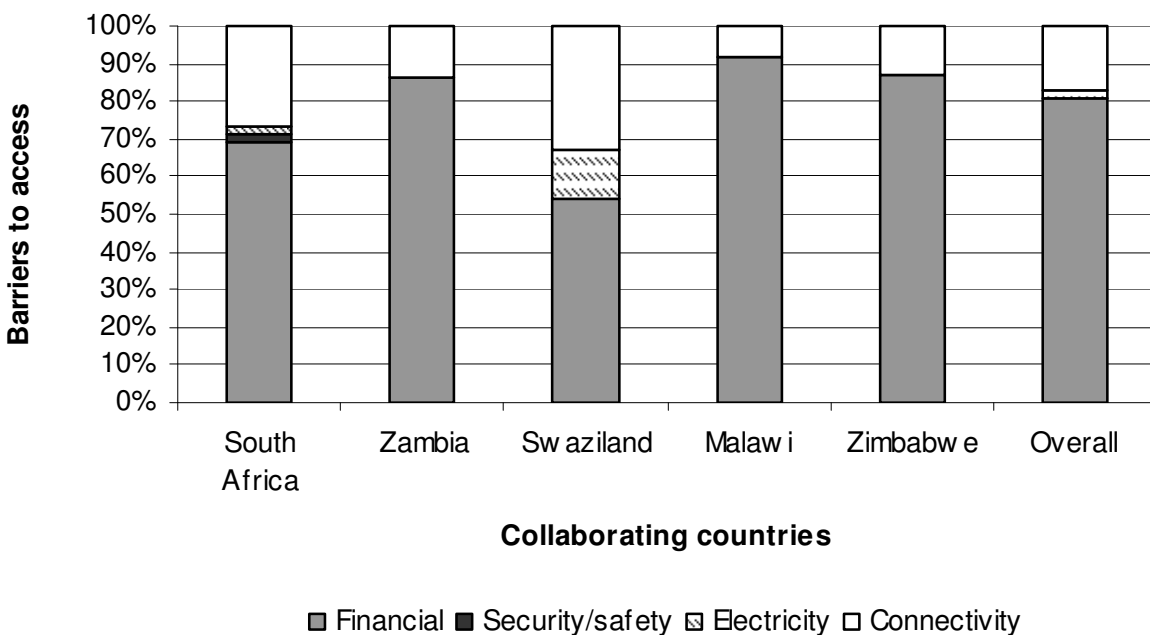
FIGURE 3.4: Percentage of students reporting barriers to access to a computer in the various collaborating countries (N = 220) in Phase I of the research programme

Students reported their computers at home were mostly (56%) one to two years old, whereas 40% of computers at the university were reportedly less than a year old and a further 39%, two to three years old. South African computers at the place of study, were significantly newer than those in other countries (Bonferroni test p=0.0000) (Figure 3.5). Seventy percent of students and 88% of lecturing staff indicated that they had access to reliable printing facilities.

Vertical bars denote 0.95 confidence intervals
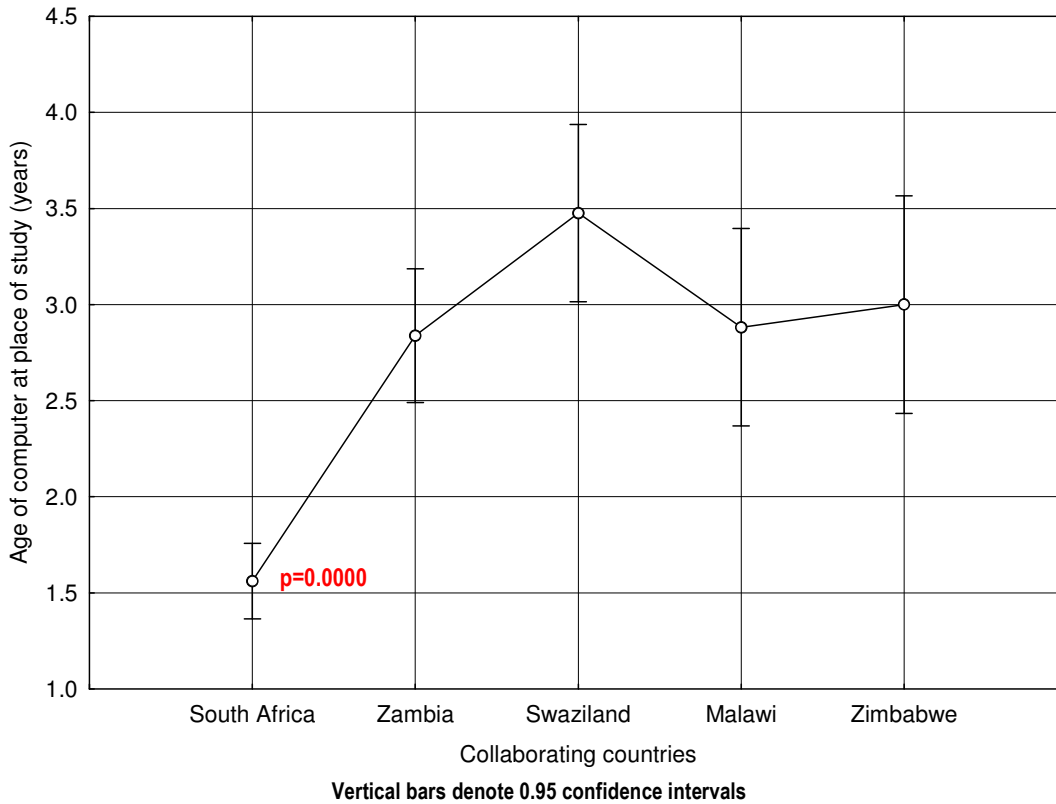
FIGURE 3.5: Reported age of computers at student's place of study in years in the various collaborating countries (*N* = 205) in Phase I of the research programme

3.1.3 Computer usage

Overall students reported using computers mostly on a weekly (45%) or daily (30%) basis, but significant country differences were found (Chi square test p=0.0000). Students in Swaziland reported mostly using computers on a daily basis (62%), whereas in South Africa they reported daily use (41%) and weekly use (50%). Students in Zimbabwe reported using computers mostly on a weekly basis (60%). Students in Malawi and Zambia reported less frequent use of their computers with only 43% and 40% of students respectively using computers on a weekly basis and 34% and 27% respectively, reported using computers rarely. Lecturing staff on the other hand, mostly used their computers on a daily basis (89%) with only two of the lecturing staff from Zambia and one from

Zimbabwe indicating that they only used their computers weekly (all three of the lecturing staff did not have their own computers in their offices).

When asked which software programmes were installed and available on their computers at home or at the university, students and lecturing staff indicated that MS Office, internet browsers and e-mail were most available (especially at university), whereas statistical and dietary assessment packages were least available. Students and lecturing staff reported using their computers at home mostly for word processing, however, lecturing staff also reported using their computers at home for PowerPoint presentations, spreadsheets, internet and e-mail. At university however, students mostly reported using computers for e-mail, internet searches and word processing, whereas lecturing staff used them mostly for e-mail, word processing, internet, PowerPoint presentations and spreadsheets.

The internet was reportedly used most frequently to access electronic journals (43% for students and 64% for lecturing staff), to link to association or organizational web-sites (41% for students and 32% for lecturing staff) and less frequently for accessing databases (15% for students and 5% for lecturing staff). Students using the internet for accessing databases were significantly older [24.8 (0.48)] years, Bonferroni test p=0.0275] than students linking to web-sites [23.2 (0.29) years]. The majority of students (87%) reported that they used the internet for learning purposes; whereas only 58% of lecturing staff reported using the internet for learning purposes. Students indicating that they used the internet for learning purposes were significantly younger (23.4 (3.31) years, Bonferroni test p=0.0310) than those indicating they did not [24.6 (5.09) years].

3.1.4 ICT support
The majority of lecturing staff (82%) and students (66%) indicated that a policy supporting and/or promoting ICT in academic programs was available in their institutions, but significant differences were found between countries (Chi square test p=0.000) with the majority of students in South Africa (89%), Zimbabwe (68%) and Swaziland (60%) indicating the availability of a policy, but only 51% of students in Zambia and 30% in Malawi indicated the same.

When asked to self-rate the security and safety precautions concerning ICT within their department or institution relating to firewalls, anti-virus programmes and theft, 34% of students and 11% of lecturing staff responded that they did not know. Ratings provided

ranged from poor (9% of students; 11% of lecturing staff), to average (20% of students; 18% of lecturing staff), to good (27% of students; 36% of lecturing staff) and excellent (9% of students; 21% of lecturing staff).

Most of the lecturing staff (93%) compared to 61% of students overall indicated that the university had technical support services available related to the use of computers, ranging from only 30% and 34% in Zambia and Malawi respectively to 53% in Zimbabwe and 71% and 80% in Swaziland and South Africa respectively. Most students reported that this support was from the institution/department (65%), but 24% reported being unsure of where the support came from and only 1% solicited support privately or informally. Technical support provided seemed to be fairly equal between software and hardware with 41% and 42% respectively indicating reliable support for software and hardware and support sometimes in 40% and 37% for software and hardware respectively, following a similar trend for responses from lecturing staff.

3.1.5 Attitude regarding ICT and nutrition

Students and lecturing staff were asked to respond to attitude statements according to a Likert scale by indicating whether they *strongly agreed*, *agreed*, *disagreed* or *strongly disagreed* to statements made. These results have been recorded as the percentage of students in all five countries responding to each level of the scale and listed according to the mode for each statement, from strongly agree, agree, disagree to strongly disagree (Table 3.2).

For textual description of the findings, the *strongly agree* and *agree* responses and the disagree and *strongly disagree* responses have been combined to form agreement or disagreement to the statements. Respondents mostly agreed with the attitude statements regarding *More computers should be made available, Don't mind using second-hand donated computers, Prefer own computer, Prefer own e-mail address, Do not mind sharing a computer, Computer fast enough for requirements (lecturing staff), Extremely important that institution keeps up with developments in the field of ICT, Would like to use ICT for specific tasks, Overall attitude of people towards ICT in department/institution positive, Do not feel awkward and reluctant when simply thinking about having to use a computer for whatever purpose, Confident of their ICT skills, In favour of application of ICT in different modes to nutrition training, ICT should only be used for certain parts of nutrition training where no other method is suitable, Interactive CDs better than handouts, Searching the*

web is time-consuming and *Searching the net for information easier than reading a book.* They mostly disagreed with statements regarding *Computer fast enough for requirements (students), Adequate support infrastructure for ICT in nutrition and undergraduate training, Administration/institutional management understands the necessity of using ICT in training, Feel frustrated with the use of ICT in their place of study, Current use of ICT in nutrition training is adequate for their needs* and that *ICT could replace classroom teaching.* Significant differences and correlations were found for specific attitude statements (Table 3.3).

TABLE 3.2: Percentage of responses to attitude statements for students (*N* = 591) and mode response for each statement in Phase I of the research programme

Attitude statements	Strongly agree (SA)	Agree (A)	Disagree (D)	Strongly disagree (SD)	Mode
More computers available to students	62	23	14	1	**SA**
Prefer to have own computer	62	35	2	1	**SA**
Prefer to have own e-mail address	69	31	0	0	**SA**
Extremely important to keep up with developments in ICT	49	45	6	1	**SA**
Use ICT for specific training/administrative/research tasks	48	47	4	1	**SA**
Apply ICT to nutrition training in whatever mode	30	55	13	2	**A**
ICT should only be used for certain parts of nutrition training where no other method is suitable	9	43	39	9	**A**
Interactive CD's are better than handouts	18	41	37	4	**A**
Searching the web is time-consuming	40	10	40	10	**A**
Searching the net for information is easier than reading a book	27	54	17	2	**A**
Confident of ICT skills	14	44	30	12	**A**
Computer fast enough for requirements	7	42	40	11	**A**
Support infrastructure for ICT in undergraduate training is adequate	10	36	32	23	**A**
Positive attitude of people towards ICT in department/institution	18	63	15	4	**A**
Do not like using 2nd-hand donated computers	17	33	38	12	**D**
Prefer not to share a computer	12	29	47	13	**D**
Current use of ICT in nutrition training is adequate for needs	4	38	40	18	**D**
Support infrastructure for ICT in nutrition training is adequate	8	33	34	25	**D**
Management does not really understand the necessity of using ICT in training	12	27	50	11	**D**
Frustrated with the use of ICT in place of study	13	25	43	19	**D**
ICT can replace classroom teaching	11	27	44	18	**D**
Awkward and reluctant when using a computer	4	15	40	42	**SD**

TABLE 3.3: Percentage of agreement to attitude statements for lecturing staff (N = 29) and students (N = 591) with indications of significant differences and correlations found with demographic variables in Phase I of the research programme

Attitude statements	Lecturer agree	Student agree	Significant differences (Kruskal-Wallis test)*	Spearman correlations**
AGREEMENT TO STATEMENT				
More computers should be made available	82	85	-SA students less positive (67%; p=0.0000) -Dietetics and medicine less positive (p=0.0000)	
Don't mind using second-hand donated computers	62	50	-Swaziland students more positive (80%; p<0.05) -Food science, nutrition and "other" felt less positive (p=0.0005)	Positive correlation with student age (r=0.09, p=0.03)
Prefer own computer	100	97	-SA students less positive than Swaziland (p=0.0060), Malawi (p=0.0025) and Zimbabwe (p=0.0019) -Medical students less positive (p=0.0000)	Positive correlations with lecturer age (r=0.40, p=0.03) and years experience (r=0.47, p=0.01)
Do not mind sharing a computer	72	60	-Zambia (28%) and Malawi (21%) students less positive (p<0.05) -Medical students less positive (p=0.0143)	
Prefer own e-mail address	100	100	-SA students less positive than Swaziland (p=0.0239), Malawi (p=0.0040) and Zimbabwe (p=0.0000) -Medical students less positive (p=0.0010)	Positive correlation with lecturer years experience (r=0.41, p=0.03)
Computer fast enough	58	#		
Extremely important that institution keeps up with developments in the field of ICT	96	94	-SA students less positive than Zambia (p=0.0000), Swaziland (p=0.0187), Malawi (p=0.0000) and Zimbabwe (p=0.0180) -Dietetics, home economics and medicine (p=0.0333) less positive	Positive correlation with student age (r=0.13, p=0.00)
Would like to use ICT for specific tasks	96	95	-SA students less positive than Zambia (p=0.0000), Swaziland (p=0.0080), Malawi (p=0.0000) and Zimbabwe (p=0.0002) -Dietetics, home economics, medicine and food science less positive (p=0.0000)	
Positive attitude of people towards ICT	96	81	-Nutrition and agricultural science less positive (p=0.0166)	
Do not feel awkward and reluctant when using a computer	100	82		
Confident of their ICT skills	87	58	-SA students more confident than students in Zambia and Malawi (p=0.0000) -Students in Zambia less confident than students in Swaziland (p=0.0015) –Students in Malawi less confident than students in Swaziland (p=0.0001) and Zimbabwe (p=0.0441 -Nutrition and the "other" less confident (p=0.0008)	Negative correlation between awkwardness and confidence in students (r=-0.11, p=0.01) and lecturing staff (r=-0.50, p=0.01)

Attitude statements	Lecturer agree	Student agree	Significant differences (Kruskal-Wallis test)*	Spearman correlations**
In favour of application of ICT in different modes to nutrition training	93	85	-SA students less in favour (p<0.05)	
ICT should only be used for certain parts of nutrition training where no other method is suitable	57	52	-Zambian students less positive than South Africa (p=0.0013) and Swaziland (p=0.0168)	
Interactive CDs better than handouts	59	64	-Medical and dietetic students less positive (p=0.0000)	
Searching the web is time-consuming	55	50	-Students in South Africa more in agreement than students in Zambia (p=0.0004) and Malawi (p=0.0028) -Dietetic, medical and home economic students more in agreement (p=0.0059)	
Searching the net for information easier than reading a book	71	81	-Medical students less positive (p=0.0000)	
DISAGREEMENT TO STATEMENT				
Computer fast enough for requirements	#	49	- Zambia (59%; p=0.0000), Malawi (61%; 0.0004) and Zimbabwe (67%; 0.0001) students less positive than South African students - Food science, nutrition, agricultural science and the "other" category less positive (p=0.0109)	
Adequate support infrastructure for ICT in: nutrition training undergrad training	32 38	41 45	-SA students more positive response (p<0.05) and Malawi more negative response (p<0.05) -Dietetics and medicine more positive (p=0.0000)	
Institutional management understands necessity of using ICT in training	43	39	-Malawi students more positive than Swaziland (p=0.0396) -Nutrition course students more positive (p=0.0199)	
Feel frustrated with the use of ICT in their place of study	36	38	-Home economics more frustrated (p=0.0059	
Current use of ICT in nutrition training is adequate for needs	41	42	-SA students more positive (p<0.05) -Dietetic, medical and home economics students more positive (p=0.0000)	Negative correlation (r=-0.12, p=0.01) with student age
ICT could replace classroom teaching	13	38	-SA less positive (p<0.05) -Students from Zimbabwe more positive than SA (p=0.0000) and Zambia (p=0.0206) -Agricultural science courses more positive (p=0.0000)	

* **Significant differences found for student demographics (Kruskal-Wallis test)**
** **Significant Spearman correlations found for student and lecturer demographics**
 # Lecturing staff agreed to statement whereas students disagreed to statement

3.1.6 ICT skills and training

To determine whether students had acquired and applied ICT skills at university or previously i.e. while they were scholars, students were asked how much new knowledge and how many new skills related to ICT they had acquired and applied over the past two to three years. It transpired that 52% indicated *very little*, whereas only 38% indicated that *the majority* had been acquired and applied in the past two to three years. Significant differences were found between countries (Chi square test p=0.0000) with most students in Zambia (65%), Malawi (65%) and Zimbabwe (60%) indicating *very little* and 57% and 49% of students in South Africa and Swaziland respectively indicating *the majority*. Lecturing staff on the other hand indicated that most of them had acquired and applied *the majority* of their new knowledge and skills related to ICT (67%) over the past 2-3 years.

Only 23% of students, as compared with 63% of lecturing staff, reported having time to attend ICT training. Most of their ICT training up to this point had been acquired from colleagues (33% of students and 29% of lecturing staff) or by training themselves (32% of students and 33% of lecturing staff), followed by formal courses offered by a computer training school (21% of students and 17% of lecturing staff) or ICT support services provided by the university (14% of students and 21% of lecturing staff).

Many students (57%) and lecturing staff (38%) did not know who paid for ICT training to students and staff at their university, but 33% of the students and 19% of the lecturing staff indicated that they paid themselves, whereas 27% of lecturing staff indicated that there was a staff development budget. A significant difference (Chi square test p=0.0000) was found with 45% of South African students reporting self payment as compared to about 25% in other countries and 11% of Zambian students indicating that there was a development budget. Students reported that they last attended any ICT training more than 2 years previously (54%) and only 19% and 15% had attended training in the past year or six months respectively, whereas 55% of the lecturing staff had attended training in the past year or six months. All lecturing staff and 97% of students thought that ICT literacy training is important.

Students and lecturing staff respectively rated their own, current level of ICT skills training and their ability to utilize what ICT can offer them as *average* or *good* in most cases, with *average* being the mode in all cases (Figure 3.6).

Responses to Likert scale ratings

☐ Excellent ▨ Good ■ Average ▪ Poor
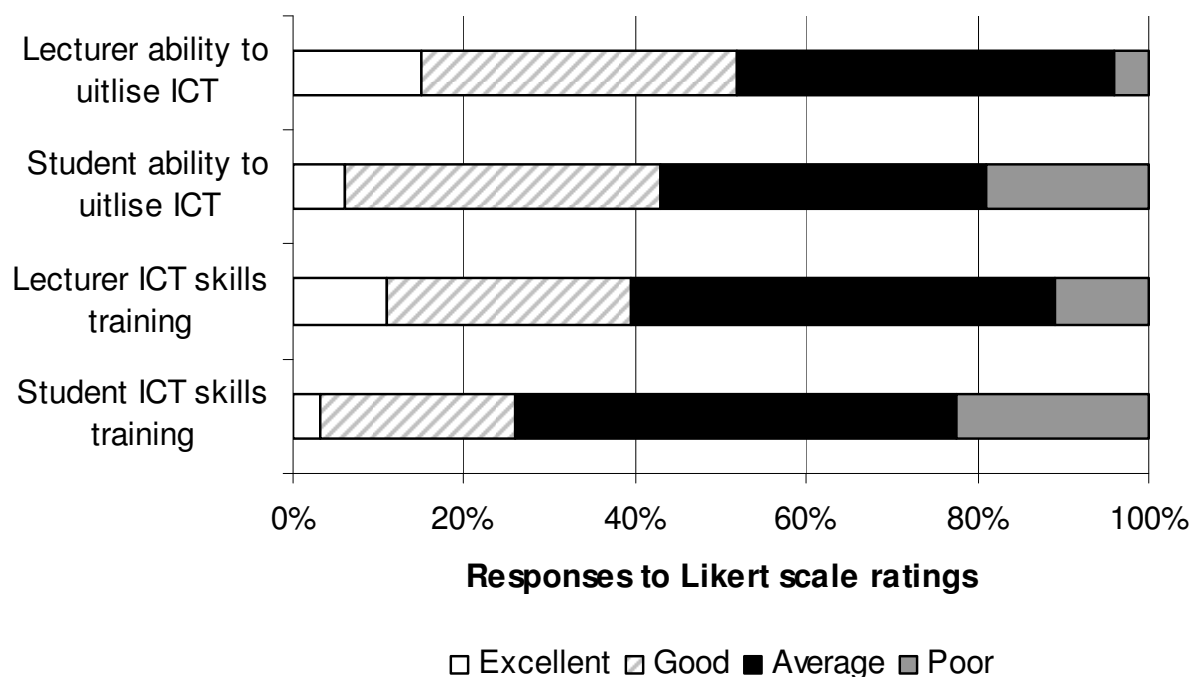
FIGURE 3.6: Percentage of students (*N* = 591) and lecturing staff (*N* = 29) rating their ability to utilize ICT and their skills training in Phase I of the research programme

Only 31% of students, but 54% of lecturing staff, indicated that they felt they had sufficient skills to instruct others in the use of particular software programs and hardware ICT. The level of confidence in their ICT skills, as indicated by their attitudes, followed the trend of confidence increasing as their rating of their ICT skills increased in both student and lecturer samples Significant differences were found between the skills levels (Bonferroni test p=0.0000) for students except between those that rated their skills as good or excellent (Bonferroni test p=0.6696), and for lecturing staff a significant difference was found between those rating their skills as average and excellent (Bonferroni test p=0.0016) (Figure 3.7).

The age of students and lecturing staff as well as lecturer years of experience were found not to be related to the rating of their ability to utilize what ICT can offer them, whereas there were significant differences in the ratings between countries and courses for the students (Table 3.4). Between countries: only in South Africa did more students (57%) rate their skills as good or excellent. Students in Malawi rated their skills as lowest (78% poor or average). Students studying nursing, nutrition and agricultural science rated their skills as lowest (>60% poor or average), whereas medical students rated their skills highest (58% good or excellent).
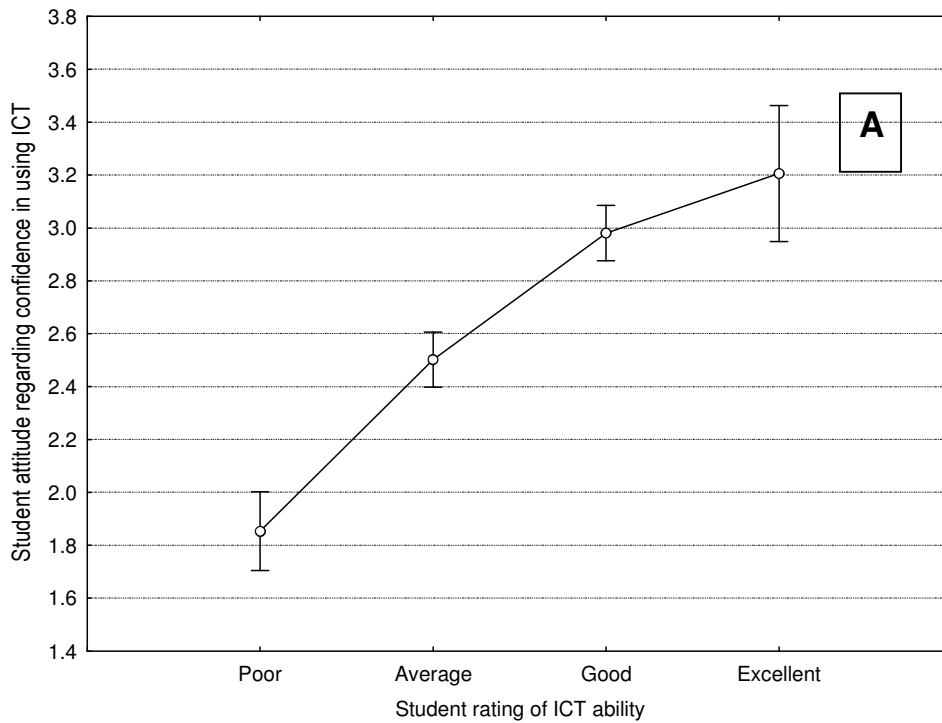
Vertical bars denote 0.95 confidence intervals
Attitude rating – 4 Strongly agree, 3 Agree, 2 Disagree, 1 Strongly disagree
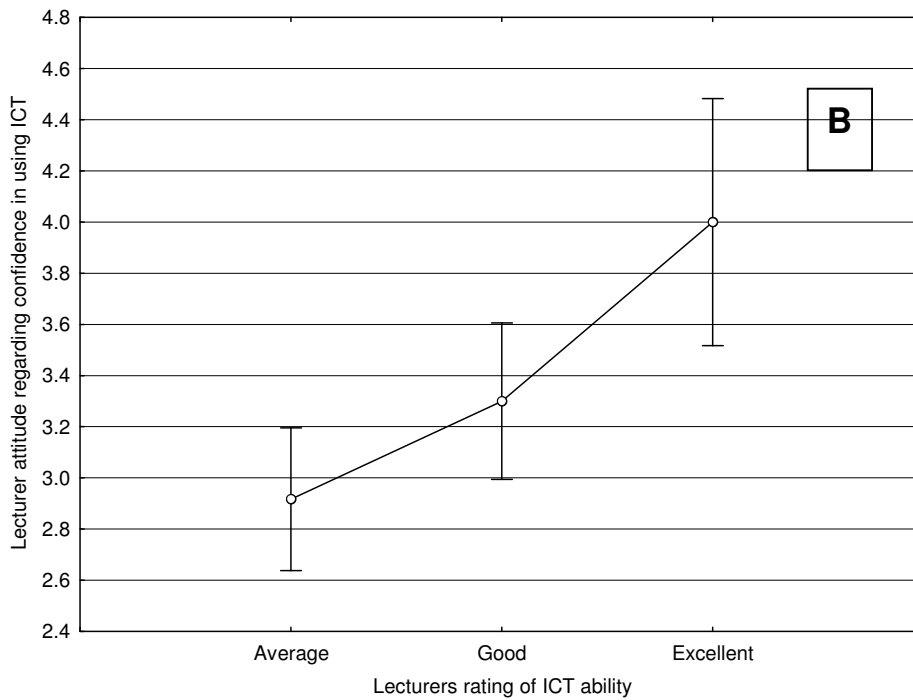
FIGURE 3.7: Comparison of student (*N* = 591) (A) and lecturer (*N* = 29) (B) ratings of their ICT ability (from poor to excellent) with their agreement to the attitude statement regarding their confidence in using ICT in Phase I of the research programme

TABLE 3.4: Comparison of percentage of student ratings between countries and courses regarding their ability to utilize what ICT can offer them (*N* = 591) in Phase I of the research programme

		Poor	Average	Good	Excellent	Chi square test p-value
Countries	South Africa	5.4	37.4	50.9	6.3	
	Zambia	23.0	44.3	26.2	6.6	
	Swaziland	13.8	37.9	37.9	10.3	p=0.0000
	Malawi	47.7	30.2	20.9	1.2	
	Zimbabwe	21.2	40.9	30.3	7.6	
Courses	Nursing	22.7	46.6	23.9	6.8	
	Dietetics	8.6	40.0	45.7	5.7	
	Home Economics	18.4	28.6	46.9	6.1	
	Food Science	18.2	31.8	43.2	6.8	p=0.0015
	Nutrition	27.3	37.9	28.0	6.8	
	Medicine	4.5	37.3	52.7	5.5	
	Agricultural Science	21.2	40.4	34.6	3.8	

3.1.7 Use of ICT in nutrition training

More than two-thirds of students (71%) and 96% of lecturing staff indicated that they thought ICT could add a new dimension to nutrition training at their university and 85% of students and 97% of lecturing staff thought that ICT could increase their productivity. Student age did not make any significant difference to these responses.

When asked how they currently use ICT in nutrition learning, 86% of students indicated for projects/assignments, 76% to keep up to date with current information, 75% to present information, 74% for communication and 69% to process/analyse data. When asked how they currently use ICT in nutrition training, 80% of lecturing staff indicated for projects/assignments, 89% to keep up to date with current information, 83% to present information, 77% for communication and 70% to process/analyse data. Only 19% of students (mostly in South Africa) and 46% of lecturing staff indicated that they had access to the latest software and programs related to nutrition data such as Food Finder, Epi Info on CD or in other electronic format.

Only 12% of students and 18% of lecturing staff indicated that they thought ICT was utilized optimally in nutrition courses at their university. Significant differences (Chi square test p=0.0000) were found between countries, with 82% of students in Malawi and 62% in Zimbabwe disagreeing that ICT was utilized optimally in nutrition courses at their university compared to the 30%, 44% and 53% of students in South African, Swaziland and Zimbabwe respectively. When comparing the mean ordinal responses regarding their

attitude that ICT support of nutrition training was adequate and whether ICT is utilized optimally in nutrition courses (Figure 3.8), those with a more positive attitude indicated that the ICT support of nutrition training was adequate (Bonferroni test p=0.0000). Those indicating that they did not know if ICT was utilized optimally in nutrition courses, were significantly more positive about the adequacy of ICT support of nutrition training (Bonferroni test p=0.0020) than those indicating it was not.
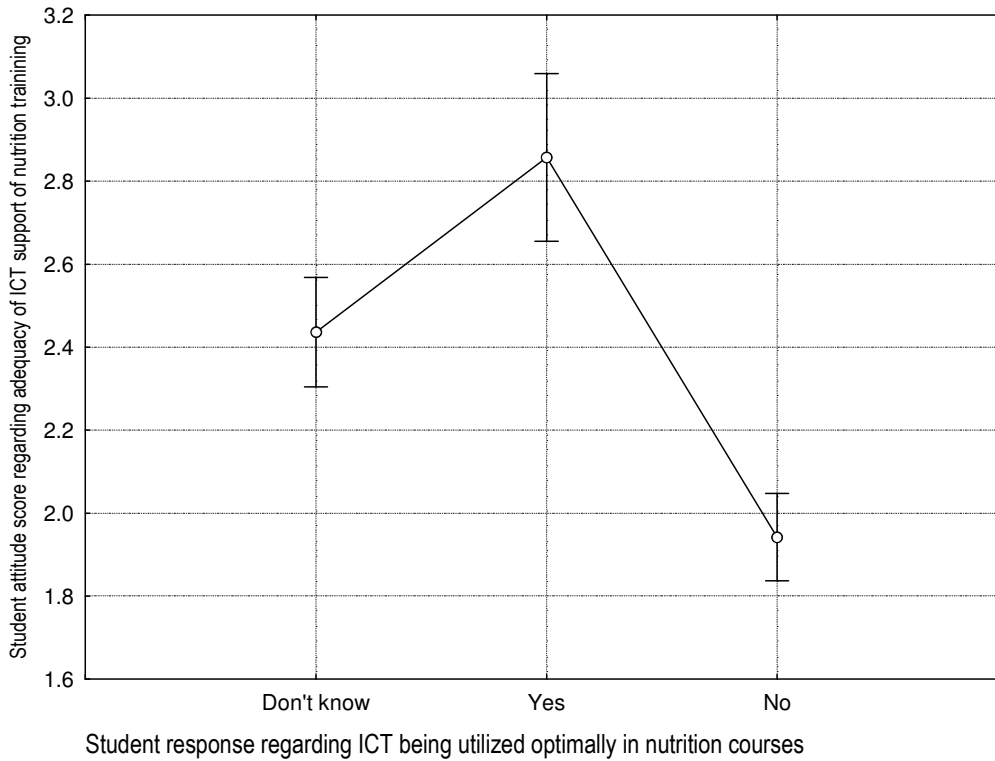
Attitude rating – 4 Strongly agree, 3 Agree, 2 Disagree, 1 Strongly disagree

FIGURE 3.8: Comparison of student attitude scores regarding adequacy of ICT in nutrition training and whether they thought ICT was being utilized optimally in nutrition courses in Phase I of the research programme

Similarly, attitudes regarding the adequacy of the current use of ICT in nutrition training were significantly more positive in those that indicated that they thought ICT was utilised optimally in nutrition courses and that the resources available for implementing ICT in teaching were adequate (Kruskal-Wallis test p=0.0000). Twenty-eight percent of students and 46% of lecturing staff indicated that there were resources available at their university for implementing ICT in teaching/training, but significant differences (Chi square test p=0.0000) were found between countries with more students in Zambia (47%), Malawi (42%) and Swaziland (30%) than Zimbabwe (17%) and South Africa (8%) indicating that resources were not sufficient.

3.2 PHASE II – Development and Validation of a Purpose Designed E-Learning Nutrition Module

3.2.1 Content validity

Twenty-seven of the forty-nine expert reviewers returned their evaluations providing a 55% response rate and all sub-modules were evaluated. Each sub-module was not necessarily evaluated by each reviewer but there were at least fifteen expert reviewers for each of the eleven sub-modules (Figure 3.9).
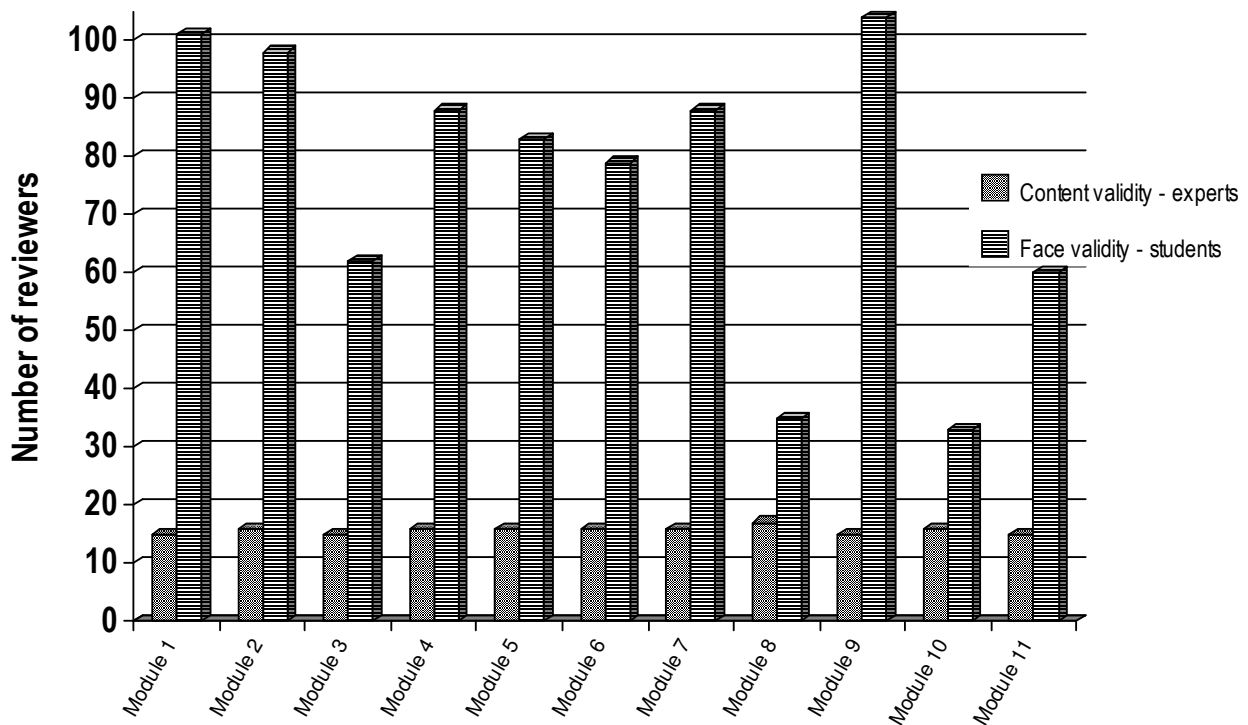
FIGURE 3.9: Number of reviewers for content validity (experts *N* = 27) and face validity (students *N* = 175) for each sub-module within the Nutrition and HIV/AIDS module in Phase II of the research programme

The qualitative responses of expert reviewers made most frequently (Table 3.5) indicated that the e-learning material was perceived as being very useful for the student, helpful and easy as a teaching tool for the lecturer and the VTS user-guide and preamble were clear, useful and user-friendly.

Regarding interaction, the expert reviewers indicated that the quizzes provided interaction, reinforcement, were effective and useful. The tasks, case studies and activities were relevant, useful, practical and stimulating. Keywords were important and helpful and

64

document links were useful and user-friendly. External links to the internet were good and useful although internet access was a barrier.   Links to other pages/modules were effective and graphics were good and facilitated learning.   Regarding the content, reviewers found the material to be comprehensive and outcome/evidence-based and that sufficient, current and relevant references were used. The depth was sufficient and at the correct level for undergraduates.   The material was relevant in the Southern African context. Material was in a logical order and the length of the sub-modules was easy to manage. Regarding the mode of presentation, reviewers reported that it was very user-friendly, interactive, self-paced and that the speed of the platform was appropriate/adequate.

Some comments and suggestions that need to be noted (Table 3.5) include that e-learning should not replace traditional teaching methods as it was *not enough*, *students cannot receive feedback, ask questions and cannot evaluate themselves on case studies as there is no-one to guide them* so the suggestion is that it be used as an additional tool or *for occasional difference in teaching*. Other comments indicated that it would save time for the lecturer (*would give more time to explain what the student did not understand, provides expert information that a lecturer may not have, takes care of a lot of details*).

Regarding interaction, it was suggested that more quizzes and more challenging questions should be included as well as the correct answers being supplied. It was also noted, that some document links were inaccessible and links to other pages/sub-modules were frustrating *as once you used the link you cannot easily get back to where you were working*. Some of the sub-modules (namely 3, 5, 8, 9 and 11) were reported as being too long/extensive/complex and it was suggested that a time-frame be allocated to each topic, taking into consideration that the *length of modules cannot be the same because of the type of material required and learning objectives to be covered*. Typographical errors were pointed out.

A few of the more general comments were that the *content was at times very touching, caring and thought-provoking*, an e*xcellent and innovative effort, deserving wide publicity.* It was noted that it is *a* very exciting instrument, a *terrific tool for education and home use* and that it *gives a broad perspective on HIV and covers all aspects necessary for integration*. As one reviewer said *I really enjoyed working through it and wish all my modules at university were like this!*

TABLE 3.5: Summary of the qualitative responses of expert reviewers indicating those made most frequently, less frequently and individual comments or suggestions (N = 27) in Phase II of the research programme

Aspects of evaluation	Most frequent comment(s)	Less frequent comment(s)	Individual comments/suggestions
USEFULNESS OF THE LEARNING MATERIAL			
To the student	Very useful (N = 13)	Extensive (N = 2) Good for self-study (N = 2) IT skills required (N = 2)	Good revision of nutrition basics Privilege for students to have info in condensed format Good integration of all aspects of HIV Comprehensive info that is specific to SA Very informative Could be used for in-service training of health professionals Students should complete tasks at home Interaction important
To the lecturer	Helpful as a teaching tool being more accessible and easy to use (N = 7)	Could save time for the lecturer (N = 3) Should not replace traditional teaching methods (N = 3)	Computers would be required
User guide and preamble	Clear (N = 15),	Useful (N = 3) User-friendly (N = 2)	
INTERACTIVITY			
Quizzes	Provide interaction, reinforcement and useful/effective (N = 10)	More quizzes and more challenging questions suggested (N = 5) Correct answers should be supplied (N = 2)	
Tasks / case studies / activities	Relevant/useful/ practical (N = 15)	Interactive and stimulating (N = 3)	Quite a lot Some too long Should be printable and compulsory Students should be provided with feedback Guideline/standard/answer only to be revealed when question was answered by student
Keywords	Important (N = 9) Helpful (N = 6)	Some keywords not accessible (2 mentioned)	Some keywords repeated too often
Document links	Useful and user-friendly (N = 9)	Inaccessible (N = 3 - blocking of pop-ups and unavailability of software)	Too extensive or too few Very useful, especially to read/print out articles Convert document links to PDFs

Aspects of evaluation	Most frequent comment(s)	Less frequent comment(s)	Individual comments/suggestions
External links to the internet	Good and useful ($N = 10$) Internet accessibility a barrier ($N = 6$)		
Links to other page/module	Effective ($N = 12$)	Frustrating ($N = 2$).	Inadequate
Graphics	Good ($N = 14$)		Some "*foreign*" pictures More pictures could be included Audio, video material and animation as well as games were suggested for inclusion to improve interactivity
CONTENT			
Scientific correctness	Comprehensive, outcome/evidence-based ($N = 12$) Current, relevant references used ($N = 10$) More than enough references ($N = 8$)	More references suggested ($N = 4$)	
Depth of content	Sufficient and "*nice and bite-sized*" ($N = 19$)		Too extensive Could be more detailed
Level of content	Correct for undergraduates ($N = 9$)	Too basic ($N = 2$)	To detailed or difficult for some of the topics Highly technical for non-medical and nutrition graduates
Relevancy of the material in the Southern African context	Relevant ($N = 18$)		Practical Pertinent, specifically the case studies Well-maintained throughout More countries could have been cited
Order	Logical ($N = 20$)		
Length	Easy to manage ($N = 9$)		Some sub-modules too long/extensive/complex Suggested that a time-frame be allocated to each topic
MODE OF PRESENTATION			
	Very user-friendly, interactive and self-paced ($N = 18$) Speed appropriate/ adequate ($N = 13$)	Bit slow ($N = 2$)	Not able to work on other applications without closing the VTS module Window does not fill the whole screen Icons at the bottom of the window are not labeled Difficult to get the full benefit if internet access is limited

3.2.2 Face validity

3.2.2.1 Demographics

The sample consisted of 175 students from three Southern African countries indicating a 77% response rate from the expected sample size (research was not possible in Zambia or Zimbabwe for this phase of the research). The students were mostly female with a mean age of 23.1 (3.99) years and included all targeted courses and years of study (Table 3.6). All eleven sub-modules were evaluated (co-investigators had identified specific sub-module(s) to be incorporated as self-study activities in the nutrition courses i.e. it was not expected that all sub-categories of students would complete all of the sub-modules, but that all sub-modules would be evaluated for face validity). Sub-modules 3 (35%), 8 (20%), 10 (19%) and 11 (34%) were evaluated by fewer than a third of the 175 students, whereas the other sub-modules were evaluated by at least half of the students [1 (58%), 2 (56%), 4 (50%), 5 (47%), 6 (45%), 7 (50%) and 9 (59%)] (Figure 3.9). Twenty-nine percent of students only evaluated one sub-module, 28% evaluated two to six sub-modules, 41% evaluated seven to ten sub-modules and 5% evaluated all eleven sub-modules.

TABLE 3.6: Demographic characteristics of the student evaluators of the e-learning nutrition in HIV/AIDS module (*N* = 175) in Phase II of the research programme

Demographics	% of sample
Gender: Female	85
Male	15
Country: South Africa	67
Swaziland	29
Malawi	4
Course: Dietetics	38
Nursing	21
Nutrition	17
Home economics	13
Medicine	8
Food/Agricultural sciences	3
Year of study: 1st	1
2nd	1
3rd	34
4th	29
5th	35

3.2.2.2 Administrative aspects of module completion

Regarding the administrative (Section B of the questionnaire) aspects in the questionnaire, the majority (64%) of students reported completing the sub-modules in numerical order and 80% reported that the instructions in the preamble were sufficient. Most (59%) students completed the sub-modules at home and alone (83%), whereas 38% did so in the computer lab and only 17% did so in small groups. It was reported that sub-modules were mostly completed (72%) after hours and not in the self-study time provided and that most did not have the support of a facilitator (74%). Students reported completing each of the sub-modules in less than one hour in 44% of cases, as intended, whereas 36% reported taking one to two hours and 10% taking two to three hours or more than three hours.

3.2.2.3 Self-reported IT skills for completion of the e-learning module

Students were required to self-rate their IT skills by responding to the statement: "*My IT skills were sufficient to complete these modules*", selecting either strongly agree, agree, disagree or strongly disagree. This was meant to indicate their own opinion on whether they felt able to utilize the e-learning module without further IT training being needed. Students most frequently indicated that they *strongly agreed* with this statement (mode). Only 5% of students *disagreed* with the statement that their IT skills were sufficient to complete the sub-module(s), whereas 49% *strongly agreed* with the statement and 46% *agreed*. Using an ordinal scale to calculate the mean self-rated IT skill score of 3.44 (0.59) indicated that they felt quite strongly that their IT skills were sufficient to complete the sub-module(s) (Figure 3.10).
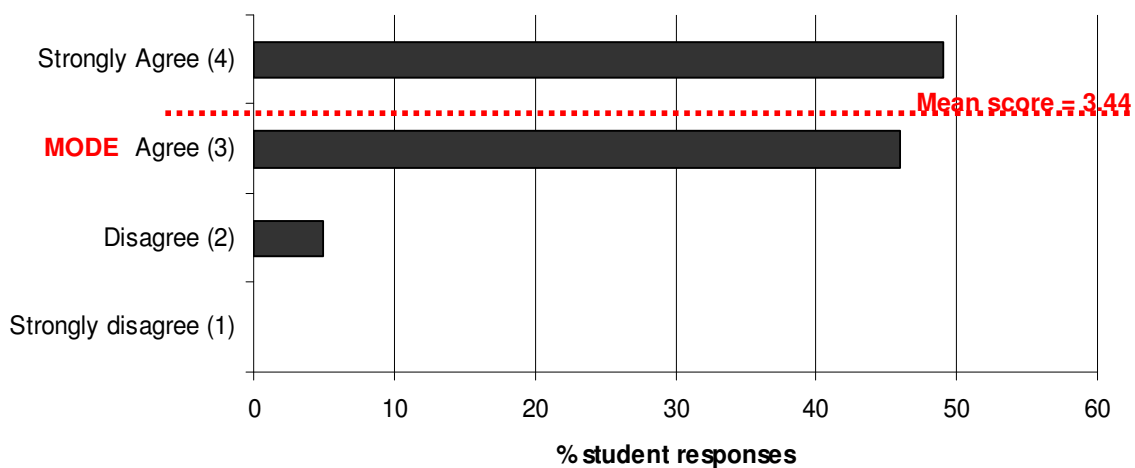
FIGURE 3.10: Percentage of student responses to attitude statement regarding their IT skills being sufficient to complete the e-learning sub-module(s) according to a Likert scale of agreement and indicating the mean ordinal score for this statement in Phase II of the research programme

No significant difference was found for gender, although female students tended to score their IT skills higher than males (Mann-Whitney test p=0.14) (Table 3.7). Mean self-rated IT skill to complete the sub-module(s) were significantly different between countries (Kruskal-Wallis test p=0.0000), specifically between South Africa (highest score) and Swaziland (lowest score) (Bonferroni test p=0.0000); courses (Kruskal-Wallis test p=0.0000) with medical and dietetic students rating their skills highest and home economics and nutrition students rating theirs as lowest; and year of study (Kruskal-Wallis test p=0.0001) with 4th year students rating their skills as highest (Bonferroni test p=0.0015 between 3rd and 4th year students and p=0.0000 between 4th and 5th year students). No significant differences (Kruskal-Wallis test) in mean self-rated IT skill to complete the sub-module(s) were found when comparing whether they learnt something from the e-learning material; whether they would recommend the Nutrition in HIV/AIDS module or this mode of learning or whether the level of the material or coverage of the topic was adequate for undergraduate students.

TABLE 3.7: Mean self-rated IT skill scores (having adequate IT skills to complete the course) for various demographic variables in Phase II of the research programme (*N* = 175)

Variable	Mean (SD) ordinal self-rated IT skill score (4 strongly agree – 1 strongly disagree)					
Countries*	South Africa 3.59 (0.56)	Malawi 3.29 (0.49)	Swaziland 3.09 (0.51)			
Gender**	Female 3.47 (0.59)	Male 3.28 (0.54)				
Course#	Nursing 3.22 (0.64)	Dietetics 3.74 (0.44)	Other 3.67 (0.58)	Nutrition 3.10 (0.56)	Medicine 3.85 (0.38)	Home Econ 3.06 (0.42)
Year of study##	2nd 3.00 (0.00)	3rd 3.36 (0.61)	4th 3.76 (0.43)	5th 3.25 (0.58)		

Kruskal-Wallis test *(p=0.0000); **(p=0.0930); # (p=0.0000); ## (p=0.0001)

3.2.2.4 Self-reported effectiveness of e-learning module as compared to conventional lectures

When students were asked to indicate whether they felt the e-learning material was *less effective*, *as effective* or *more effective* than conventional lectures, 41% percent felt it was *as effective* and 28% that it was *more effective*, with almost a third (31%) feeling it was less effective. The most frequent response (mode) was *as effective*. Providing these responses with an ordinal scale resulted in a mean effectiveness score of 1.97 (0.77) (Figure 3.11).
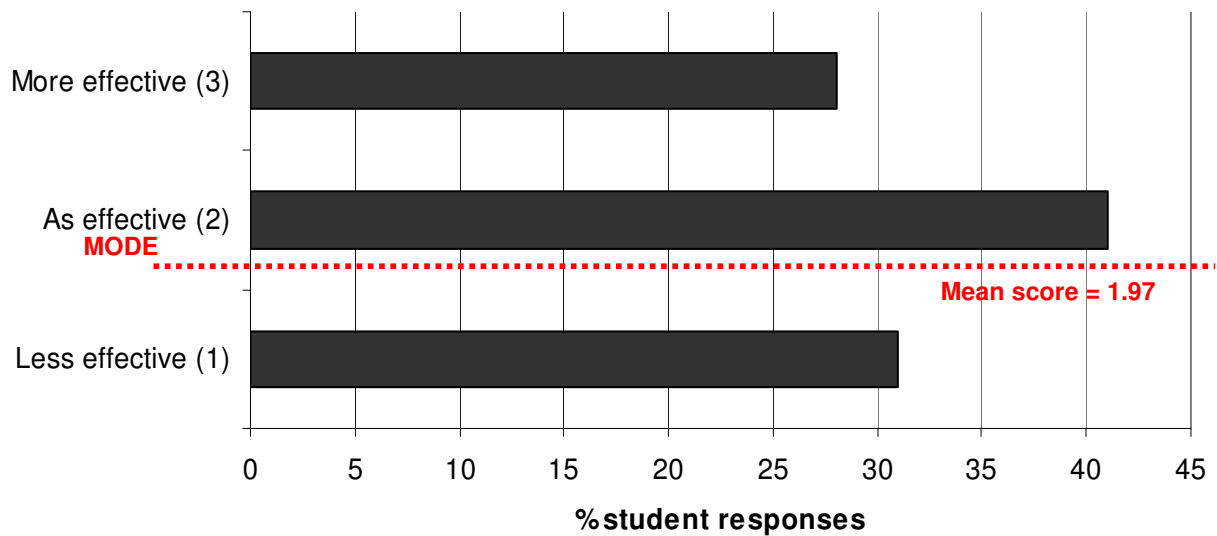
FIGURE 3.11: Percentage of student responses to attitude statement regarding the effectiveness of the e-learning material as compared to conventional teaching and indicating the mean ordinal score for this statement in Phase II of the research programme

Significant differences were found between courses (Kruskal-Wallis test p=0.0400) regarding the rating of the effectiveness of the e-learning module as compared to conventional teaching, specifically between Home economics and Nutrition students (Bonferroni test p=0.0411) and year of study (Kruskal-Wallis test p=0.0146), specifically between 3rd and 4th year students (Bonferroni test p=0.0045). Although not statistically significant, a trend was indicated (Bonferroni test p=0.898) that students in Malawi rated the e-learning module higher than those in South Africa (Table 3.8).

Significant differences were also found in that those who indicated that they would recommend the Nutrition in HIV/AIDS module (Kruskal-Wallis test p=0.0000) and the mode of learning (Kruskal-Wallis test p=0.0002), rated the effectiveness of the e-learning material higher than conventional lectures. In contrast, those that rated the effectiveness of the e-learning material lower than conventional lectures, felt that the topic was covered in too much depth for undergraduate students (Kruskal-Wallis test p=0.0007).

A significant (Kruskal-Wallis test p=0.0205) increase was shown in the student's self-rating of their IT skills (to complete the sub-module(s)) in relation to their rating of the effectiveness of the e-learning material as compared to conventional lectures (Figure 3.12).

TABLE 3.8: Mean scores regarding the effectiveness of the mode of learning as compared to conventional lectures for various demographic variables in Phase II of the research programme (*N* = 175)

Variable	Mean (SD) ordinal effectiveness score (3 = more effective, 2 = equally effective, 1 = less effective)					
Countries*	South Africa 1.92 (0.72)	Malawi 2.57 (0.53)	Swaziland 2.00 (0.87)			
Gender**	Female 1.94 (0.77)	Male 2.17 (0.76)				
Course#	Nursing 1.84 (0.73)	Dietetics 2.00 (0.72)	Other 2.00 (0.00)	Nutrition 1.75 (0.86)	Medicine 1.77 (0.73)	Home Econ 2.39 (0.84)
Year of study##	2nd 2.50 (0.71)	3rd 1.75 (0.75)	4th 2.25 (0.60)	5th 1.95 (0.85)		

Kruskal-Wallis test *(($p=0.0919$)); **($p=0.1783$); # ($p=0.0400$); ## ($p=0.0146$)
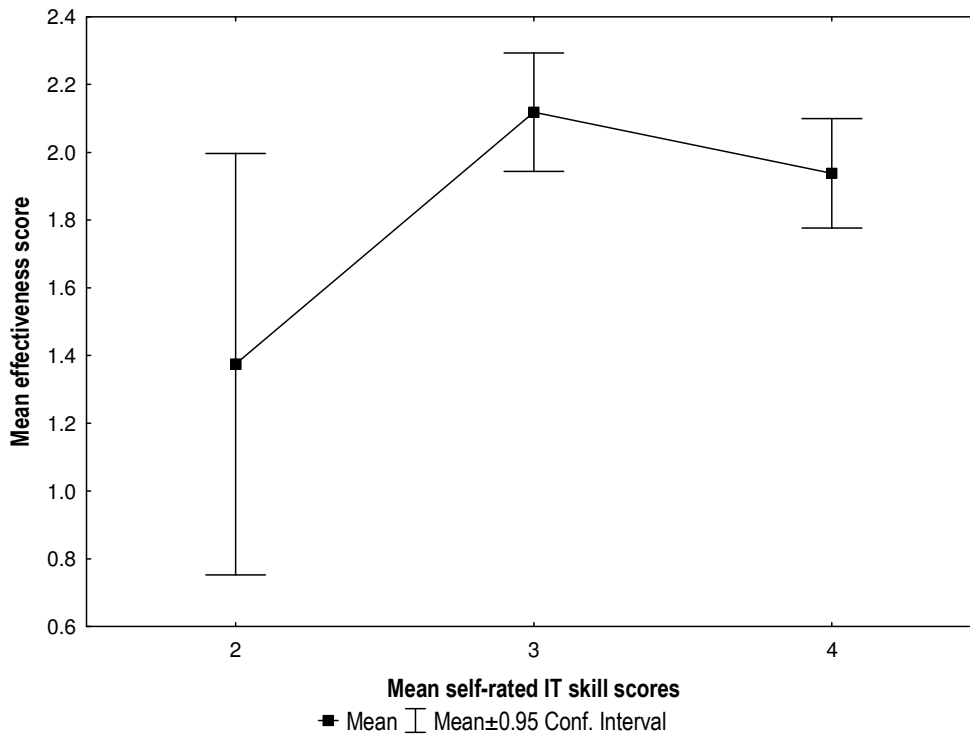
Effectiveness score range: 3=more effective, 2=as effective, 1=less effective
Self-rating IT skill score range: 4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree

FIGURE 3.12: Mean effectiveness scores (e-learning module as compared to conventional teaching) as compared to the mean self-rated IT skill scores (adequacy of IT skills to complete the e-learning material) in Phase II of the research programme

Almost all the students (90%) indicated that they would recommend the module to other students, but fewer (77%) indicated that they would recommend the mode of learning to other students.

3.2.2.5 Aspects regarding the content of the module

Regarding aspects of the content of the module (Section C), 87% reported that they felt the level was appropriate for undergraduate students, with 6% indicating that it was too basic and 2% that it was too difficult. The majority (83%) indicated that the topic was covered adequately in their opinion, whereas 13% said it was covered in too much depth. Almost all of the students (92%) reported that sufficient information was provided for them to be able to take action. Most indicated that it was culturally appropriate (90%) and that they had learnt something new (86%). More than two-thirds (69%) indicated that it was an appropriate time in their curriculum to study the sub-module(s).

3.2.2.6 Interactivity tools

Students were also asked to indicate whether they had utilized the interactivity tools available, 72%, 37% and 47% indicated that they had used the quizzes, assignments and case studies respectively. Forty-four percent of the students indicated that they did not feel that the assignments were applicable and 32% that the case studies were applicable (quizzes, assignments and case studies were not compulsory). The majority of students indicated that the icons (94%) and menu tabs (95%) were easy to follow. When asked to comment on the window size, familiarity of icons and whether the colour scheme was pleasing, 82%, 89% and 92% respectively responded positively.

Students reported using internal links (documents or linking to other pages in the module) often (67%) whereas the external links to websites were used less often (19%). Generally students indicated that they spent a brief time at the links and returned to the active sub-module and did not continue in the linked "new" sub-module or website. Fifty-nine percent of students indicated that the links were somewhat useful, whereas 30% found them very useful and only 5%, not useful. Internal links (61%) were found to be more useful than external links (14%). Generally the links were not found to be distracting, but 22% found them to be time-consuming for internal links and 7% for external links respectively. Cost was also indicated as a barrier to using external links (3%). Most students (91%) indicated that they used the keywords, but 56% indicated that they used them infrequently with only 23% reportedly using them often.

Regarding the visuals, which included all pictures and graphs, 81% reported that they could relate to them and 89% indicated that they added to their understanding. Eighty-one percent indicated that the visuals worked.

3.2.2.7 Self-reported enjoyment of the e-learning module

Students were asked to respond to the statement "*I enjoyed the presentation and delivery method of this method*" according to the Likert scale of strongly agree, agree, disagree or strongly disagree. This was therefore a self-rating of their attitude toward the e-learning module and the most frequent response was "*agree*". Almost all the students strongly agreed (21%) or agreed (68%) that they enjoyed the presentation and this mode of delivery. The mean score for enjoyment was 3.08 (SD 0.64) indicating that they felt very positive about the e-learning material (Figure 3.13).
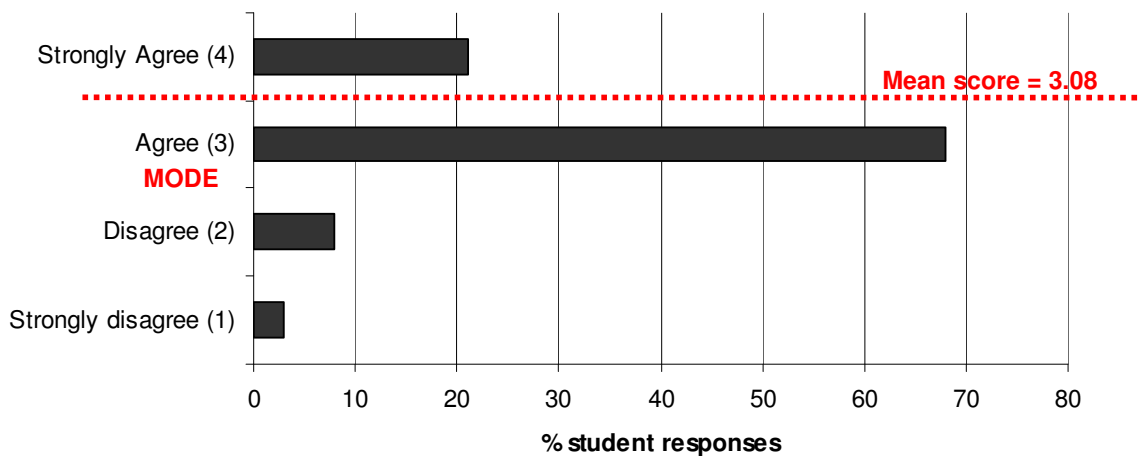
**FIGURE 3.13: Percentage of student responses to attitude statement regarding their enjoyment of the e-learning sub-module(s) and indicating the mean ordinal score for this statement in Phase II of the research programme**

When comparing the mean enjoyment scores, significant differences were found for gender (p=0.0083) with female students enjoying the module more than males (Mann-Whitney p=0.03) (Table 3.9). Significant differences were also found, between countries (Kruskal-Wallis test p=0.0001) specifically between South Africa (enjoying most) and Swaziland (enjoying the least) (Bonferroni test p=0.0001), courses (Kruskal-Wallis test p=0.0004) specifically between dietetic students who enjoyed it most and nutrition students who enjoyed it least (Bonferroni test p=0.0000) and year of study (Kruskal-Wallis test p=0.0000). The 3rd and 4th year students were significantly more positive than the 5th year students (Bonferroni test p=0.0064 and p=0.0000 respectively).

TABLE 3.9: Mean enjoyment scores for various demographic variables in Phase II of the research programme (N = 175)

Variable	Mean (SD) ordinal enjoyed score (4 strongly agree – 1 strongly disagree)					
Countries*	South Africa 3.21 (0.62)	Malawi 3.00 (0.00)	Swaziland 2.78 (0.62)			
Gender**	Female 3.13 (0.65)	Male 2.79 (0.51)				
Course#	Nursing 3.00 (0.63)	Dietetics 3.35 (0.57)	Other 3.00 (0.00)	Nutrition 2.68 (0.61)	Medicine 3.15 (0.69)	Home Econ. 2.91 (0.60)
Year of study##	2nd 3.00 (0.00)	3rd 3.03 (0.59)	4th 3.43 (0.54)	5th 2.87 (0.65)		

Kruskal-Wallis test *(p=0.0001); **(p=0.0083); # (p=0.0004); ## (p=0.0000)

When comparing mean self-rated IT skill scores to mean enjoyment scores, there was a significant relationship (Chi square test p=0.0033), with better rated IT skills resulting in a higher enjoyment (Figure 3.14).
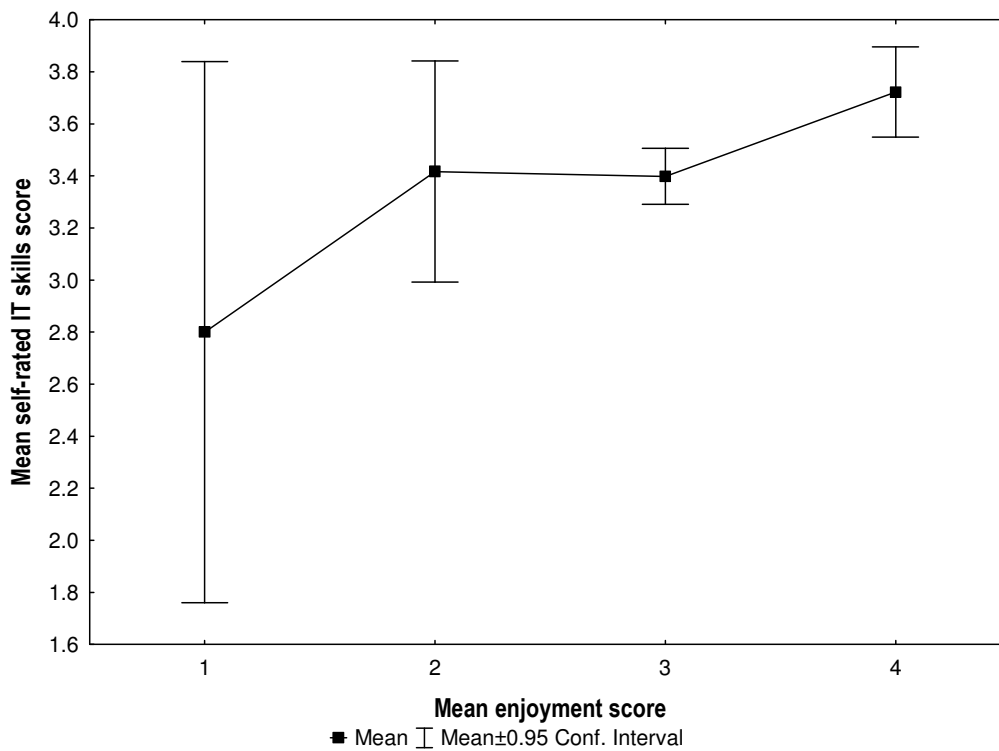
4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree

FIGURE 3.14: Mean self-rated IT skill score (adequacy of IT skills to complete e-learning material) as compared to mean enjoyment scores in Phase II of the research programme (N = 175)

It was also found that there was a significant relationship between mean enjoyment scores and mean effectiveness scores (Chi Square test p=0.0000) in that the more effective they rated the material, the more they enjoyed it (Figure 3.15). A significant difference was

found in that those who enjoyed the e-learning material more, would be more likely to recommend this mode of learning (Kruskal-Wallis test p=0.0056), found the level of the material more appropriate (Kruskal-Wallis test p=0.0245) and also found the coverage of the topic adequate for undergraduate students (Kruskal-Wallis test p=0.0081).
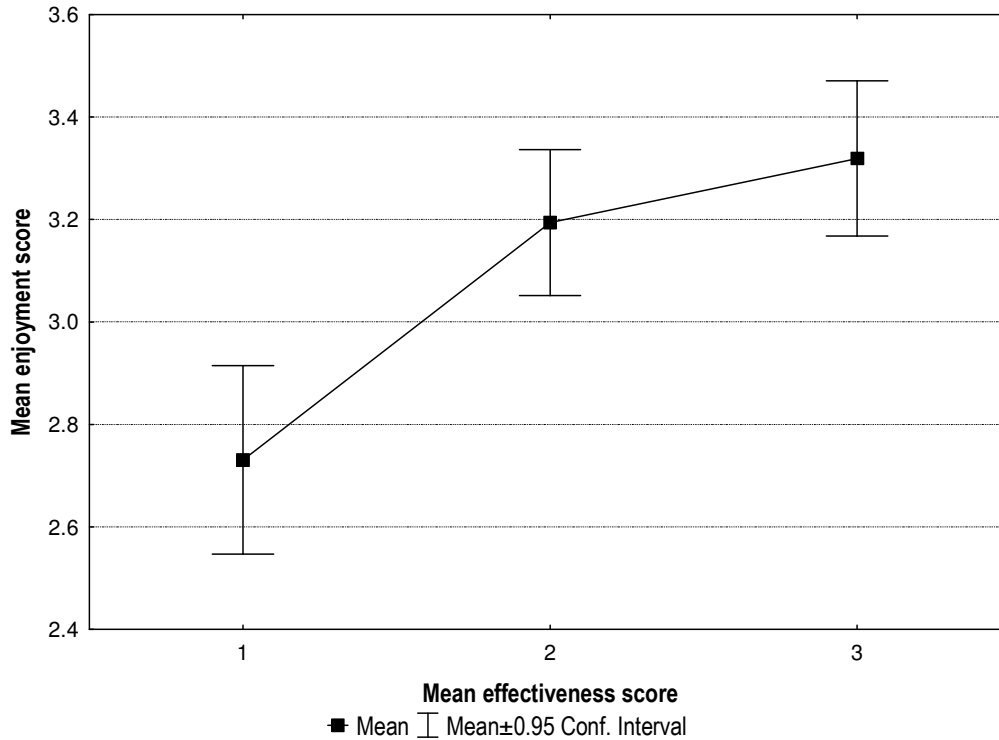
4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree

FIGURE 3.15: Mean enjoyment score as compared mean effectiveness scores regarding the e-learning module as compared to conventional teaching in Phase II of the research programme (*N* = 175)

3.3 PHASE III - Impact of the Purpose Designed E-Learning Nutrition Module on Students' Cognitive Knowledge

The final sample for phase III of the research programme comprised 173 pre- and post-questionnaires being completed for eight of the eleven sub-modules of the e-learning Nutrition in HIV/AIDS module. The pre- and post-tests comprised 20 True/False questions for each of the sub-modules, testing the students' cognitive knowledge. The same set of 20 questions was used for pre- and post-testing but in a randomized different order for the post-test.

Sixteen of the twenty-five second year BScD students completed both (pre- and post-test) questionnaires for one sub-module, seven of the fifteen third year BScD students

completed both questionnaires for one sub-module and twenty-five of the thirty NWU students completed both questionnaires for six sub-modules, indicating a response-rate of 74%. Since students had volunteered to take part in the research and to respect confidentiality, they were not followed up if they did not respond.

Pre-test cognitive knowledge scores attained by the students ranged from 47% to 69% and post-test cognitive knowledge scores from 51% to 82%. An improvement in cognitive knowledge of between 3% and 18% was attained by students for six of the eight sub-modules tested. Cognitive knowledge scores as attained by students, showed a decrease in knowledge of between less than 0.5% and 12% for two of the sub-modules (Figure 3.16).
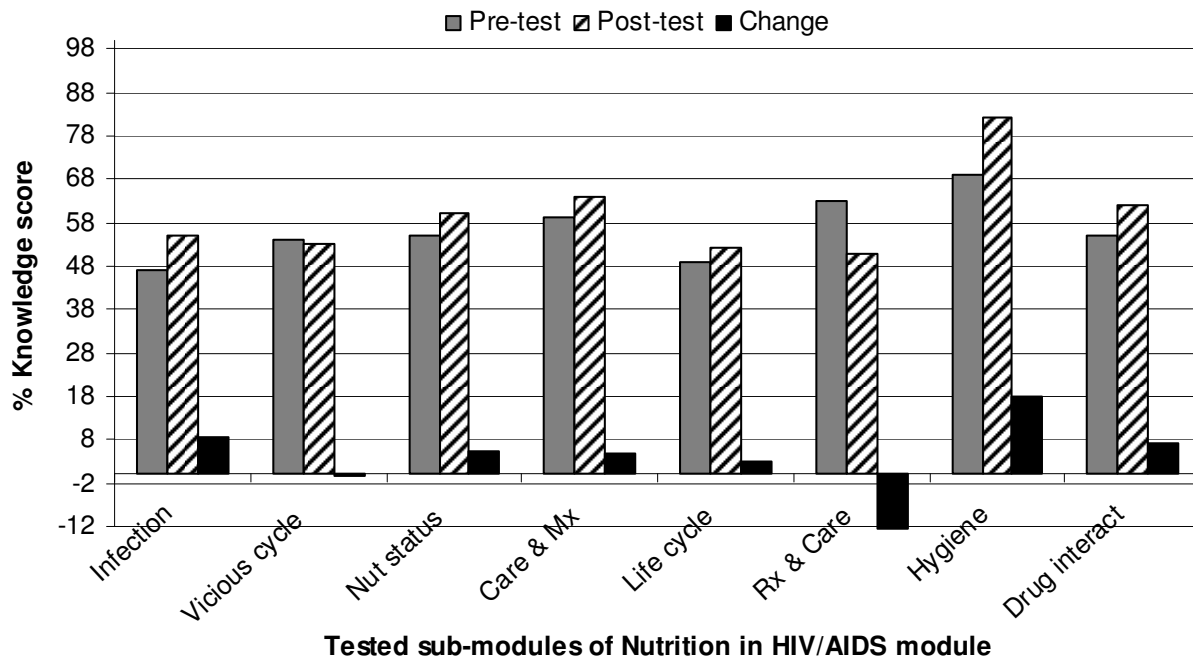
FIGURE 3.16: Mean percentage score for each sub-module for pre- and post-knowledge test and the mean percentage change in cognitive knowledge in Phase III of the research programme

Changes in student cognitive knowledge scores were significant for three of the sub-modules (Table 3.10). The greatest significant improvement in cognitive knowledge of 18% was found in the ***Food hygiene and food safety in the context of HIV/AIDS sub-module*** (Wilcoxon signed rank tests p=0012). The second greatest significant improvement of 9% was found in the ***Nutrition and infection complex sub-module*** (ANOVA p=0009). The ***Treatment and care practices of HIV/AIDS sub-module,*** showed a significant decrease of 12% (ANOVA p=0009).

TABLE 3.10: Pre- and post-knowledge scores and the mean change in knowledge score on completion of specific sub-modules in the e-learning module on Nutrition in HIV/AIDS in Phase III of the research programme

Nutrition in HIV/AIDS sub-modules tested	N	PRE-TEST		POST-TEST		CHANGE		
		Mean	SD	Mean	SD	Mean	SD	p-value
Nutrition and infection complex	25	9.32	1.91	11.08	1.41	1.76	2.31	**0.0009***
Vicious cycle between nutrition and HIV/AIDS	25	10.72	1.93	10.64	1.25	-0.08	2.55	0.8766*
Nutritional status assessment of PLWHA	25	11.00	1.78	12.08	2.56	1.08	3.20	0.0593**
Nutritional care and management of PLWHA	25	11.76	1.42	12.76	2.62	1.00	3.32	0.1615**
Caring for HIV/AIDS through the lifecycle	25	9.80	2.16	10.44	2.58	0.64	3.60	0.3896**
Treatment and care practices of HIV/AIDS	25	12.60	1.78	10.12	2.13	-2.48	3.02	**0.0009***
Food hygiene and food safety in the context of HIV/AIDS	16	13.75	2.08	16.31	2.18	3.56	2.92	**0.0012****
Food and drug interactions in the context of HIV/AIDS	7	11.00	2.24	12.43	2.27	1.43	4.08	0.1614**

*ANOVA; **Wilcoxon signed rank tests

The number of students correctly answering each question for the pre- and post-test was categorized according to quartiles indicating questions correctly answered by 25% or less, 26 to 50%, 51 to 74% and 75% of students or more respectively. Each quartile was given an ordinal value of one for the lower quartile and four for higher quartile. Mean quartile scores increased from pre- to post-knowledge tests for all of the sub-modules except the ***Treatment and care practices of HIV/AIDS sub-module*** (Table 3.11), but changes were not statistically significant and no significant correlations (Spearmans) were found.

TABLE 3.11: The mean and SD of pre- and post-test quartile scores for each of the 8 tested sub-modules in Phase III of the research

Sub-modules	Mean (SD)		Wilcoxon	Spearman correlations	
	Pre	Post	p-value	r-value	p-value
Treatment and care practices of HIV/AIDS	2.90 (1.12)	2.55 (1.28)	0.2635	0.32	0.17
Caring for HIV/AIDS through the lifecycle	2.50 (1.10)	2.70 (1.17)	0.5421	-0.06	0.81
Nutritional care and management of PLWHA	2.80 (1.06)	3.00 (1.12)	0.5721	0.03	0.91
Nutritional status assessment of PLWHA	2.60 (1.23)	2.95 (1.19)	0.5383	-0.21	0.38
Vicious cycle between nutrition and HIV/AIDS	2.65 (1.18)	2.65 (1.35)	0.9382	0.13	0.59
Nutrition and infection complex	2.40 (1.05)	2.70 (1.34)	0.3268	0.35	0.13
Food and drug interactions in the context of HIV/AIDS	2.70 (1.03)	2.85 (0.99)	0.6701	-0.09	0.72
Food hygiene and food safety in the context of HIV/AIDS	2.95 (1.05)	3.60 (0.94)	0.0806	0.06	0.81

The calculation of these quartiles per question (within each sub-module) also enabled the investigator to identify which questions may have been problematic i.e. those questions where there was no improvement in cognitive knowledge or a decrease in the number of students correctly answering a question from pre- to post-testing. These questions were further examined to gain an impression as to the possible reasons for the poor performance. They were classified as either questions with possible poor design (for example the question stem involving more than one aspect, ambiguous or imprecise terms used) or where the study material was possibly not clear resulting in confusion when answering a question. Thirty-one of the 160 questions were identified as problematic (19%) and could, at least in part, explain the poor performance of students in answering these questions (Tables 3.12 and 3.13).

TABLE 3.12: Questions identified with possible poor design causing confusion when answering in Phase III of the research programme

Sub-module	Question
Food hygiene and food safety in the context of HIV/AIDS	Foods most often associated with salmonellosis include unpasteurised milk, cheese and raw or uncooked meat, poultry and fish
Food and drug interactions in the context of HIV/AIDS	In patients with HIV, the consumption of prebiotics as found in onions, is recommended because they have stool-bulking properties which may help prevent constipation
Caring for HIV/AIDS through the lifecycle	After the age of 6 months a combination of a wide variety of foods should also be given to an infant three times per day
	The adolescent and adult segments of the population are at the highest risk of becoming HIV positive as a result of life style habits
	Mothers are often unsure that their breastmilk is enough for their baby. The production of breastmilk is dependent on the number of times the baby is put to breast for feeding and not on mother's nutritional status
Nutritional care and management of PLWHA	Vitamin B12 supplementation has been shown to improve both immune cell counts and natural killer cell activity in people with clinically significant vitamin B12 deficiency
	Eating smaller meals more often together with drinking of fluids mainly after and in between meals may improve appetite
Nutritional status assessment of PLWHA	The Malnutrition Universal Screening Tool is a five-step screening tool which identifies children and adults who are malnourished or at risk of undernutrition
	Blood levels of Vitamin A, Vitamin B12, Selenium and Zinc should be monitored regularly since they have been associated specifically with the progression of HIV infection
Vicious cycle between nutrition and HIV/AIDS	Some of the drugs used in the prevention of opportunistic infections, have adverse effects (e.g. diarrhoea) which may influence nutritional status
	AIDS dementia which includes loss of concentration, memory and language has been reported in up to 35% of people with HIV disease
	Although oxidative stress lies at the heart of HIV disease, excessive antioxidant supplementation is not recommended
Nutrition and infection complex	Cytokines are hormone-like proteins which regulate the intensity and duration of the immune response and are involved in cell-to-cell communication
	The use of a daily multivitamin supplement, including vitamin A, is recommended in HIV/AIDS because of the beneficial immunomodulation of such supplements
	Acquired immunity relies on the properties of the C- and T-cells respectively for protection against extra- and intra-cellular invading pathogens
	Oral iron supplementation is recommended for iron deficiency anaemia in the presence of severe protein energy malnutrition, in the very low birth weight infant, and in the presence of bacterial infections
Treatment and care practices of HIV/AIDS	Religion plays no role in the treatment of HIV

TABLE 3.13: Questions identified where the study material was possibly not clear resulting in confusion when answering in Phase III of the research programme

Sub-module	Question
Food hygiene and food safety in the context of HIV/AIDS	A Critical Control Point indicates a point, step or procedure at which control is essential to prevent/eliminate a food safety hazard, and not only to reduce it to an acceptable level
Food and drug interactions in the context of HIV/AIDS	The combined use of garlic supplements with ARVs is a recommended practice
Caring for HIV/AIDS through the lifecycle	Wet-nursing is a safe infant feeding option if the mother does not want to breastfeed her baby
	Mixed feeding increases the risk of HIV transmission from infected breastmilk
Nutritional care and management of PLWHA	Legumes, dried beans, peas, lentils, nuts or soya are poorer protein quality sources than animal foods, such as beef and chicken
Nutritional status assessment of PLWHA	Baseline nutritional status assessment should be considered a standard of care for all HIV-infected individuals in order to identify those at nutritional risk
Vicious cycle between nutrition and HIV/AIDS	The loss of protein from lean body tissue in HIV patients increases the protein requirement by up to 21%
	Weight loss without a known cause is a diagnostic feature of HIV-infection
	The home-made recipe for oral rehydration fluid is 1 liter boiled cooled water, 6 teaspoons sugar and ½ teaspoon salt
Nutrition and infection complex	B-cells are involved in humoral immunity which is mediated by antibodies
	IL-1, TNF, IL-6 are anti-inflammatory cytokines
Treatment and care practices of HIV/AIDS	"Chambe" as provided by some traditional healers, has been accepted as an adjunct to ARV treatment in South Africa and Malawi
	Itchy skin is a common symptom that care givers need to alleviate otherwise patients may scratch and cause further wounds
	Compliance in children who are on ARV treatment is better than that in adults
	Aloe is recommended for use in people living with HIV

CHAPTER 4: DISCUSSION

This is the first study investigating the effective incorporation of ICT in nutrition training at HEI in Southern Africa, crossing disciplinary borders and integrating the teaching of nutrition in medical, nutrition, home economics, dietetic, food science as well as agricultural science courses. Furthermore it is unique as a joint research forum following a collaborative and participative approach in developing e-learning material in the Southern African context. The key findings that this environment is conducive to the incorporation of e-learning material and that students enjoyed and found a purpose-designed e-learning nutrition module effective, make a unique contribution to the pool of knowledge for nutrition training in Southern Africa as well as adding to the broader context of educational research regarding the incorporation of technology in teaching and learning at HEI. The benefit to academic staff teaching nutrition-related courses would be the opportunity to broaden the variety of teaching methods utilized in nutrition curricula, keeping in mind that it should not replace conventional teaching methods. Another benefit is that the VTS platform can be utilized to provide local, interactive e-learning material for various nutrition-related topics keeping identified constraints such as lack of confidence in ICT skills, slow computers, irregular use of computers and inadequate internet access in mind.

The discussion will follow the phases of research in reaching the objectives set. The first phase assessed the current use, awareness, attitudes and practices of ICT in nutrition training to address the first two objectives and will be discussed in the context of how conducive nutrition training at HEI in Southern Africa is to the incorporation of ICT. Aspects that should be considered for the planning of e-learning activities in nutrition training at HEI in Southern Africa will be highlighted. The second phase of the research involved the development and validation of a purpose-designed e-learning nutrition module to address the third objective and the third phase determined the impact of the module on cognitive knowledge to address the fourth objective. These aspects will be discussed regarding the design of a pedogically sound e-learning nutrition module, indicating the experience of students with the HIV and Nutrition e-learning module and pointing out benefits and barriers to the incorporation of e-learning in nutrition courses at HEI in Southern Africa. The discussion will conclude with thoughts on engaging in a collaborative research approach.

4.1 Conducive Environment for the Incorporation of ICT in Nutrition Training in Southern Africa

Phase I of the research programme determined that the environment for nutrition training in HEI in Southern Africa is conducive to gaining the maximum benefit from the incorporation of ICT in teaching and learning, if specific constraints are taken into consideration. This conducive environment requires specific enabling factors to be present which include environmental (access to hardware, software and bandwidth,[22,38,42,43] institutional policy[38] and support[22,36,38,42]) and personal aspects (adequate computer literacy and skill,[15,22,26,36,38,42,43] confidence in using computers,[25] openness to change[19,36,38] and positive attitudes[25,38,43,45]).

4.1.1 Environmental aspects

On the surface, the high level of access to computers and the internet, for students studying nutrition-related courses in Southern Africa, seems to be in contradiction to the findings that African HEI are seriously constrained by a lack of computers and poor connectivity.[31,58,65] Findings in this study compare more favourably with that of the developed world where investigators report that most students own or have convenient use of a personal computer and the internet.[15,27] It is clear that the access reported does not indicate adequate access, since students have to share computers, are not able to utilize computers on a daily basis and request that more computers be made available. The above-mentioned contradiction can therefore be attributed to the difference between having access to a computer for your personal use and having access to computers which are available to others at the same time.

Students and lecturing staff would clearly prefer to have their own computers but students in some countries (Zimbabwe, Malawi and especially Zambia), seem not to mind using second-hand computers or sharing computers. This difference of opinion could be attributed to reduced access to computers in those countries and relates well to the account that the digital divide not only exists between developing and developed countries but also within regions.[29,30,39,56,57] These countries also fall within the group that the literature recognises as not emerging from internal conflict, political instability, poor governance and corruption, making progress on ICT for education more difficult, whereas South Africa, for example, is in a better position than most of Africa, having better infrastructure and a more mature economy.[23,56,65]

Additionally, as 40% of the sample in this phase of the research was from South Africa, the incongruity of access in the African context could possibly have been explained by this "skewing" of the sample as South Africa has been named as one of the exceptions regarding computer access in Africa.[65] However, when it is taken into consideration that it has been reported elsewhere that in South African HEI, only 41% of academic staff had access to a computer and 53% to the internet,[59] the incongruity cannot be satisfactorily explained and attributed only to the larger South African sample. Another consideration may be that the higher access rates are attributable to the health sciences environment as it has been shown that academic staff from health sciences utilized ICT more frequently than other disciplines in HEI in South Africa.[4]

The fact that despite requiring more computers, students do have access to computers, but fewer have access to the internet, is important to be considered when planning e-learning activities in nutrition training in Southern African HEI. Online or web-based e-learning activities would therefore not be utilized optimally, while e-learning activities utilizing computers could.

In contradiction to the findings in other African HEI,[58,65] computers were found to be fairly new, but slow in most cases. Another important consideration when planning e-learning activities under these circumstances would therefore be to ensure that the e-learning platform utilised does not slow the computers down further. The use of a CD-Rom was therefore seen as ideal under these circumstances rather than online or web-based activities.

The main barriers to access to a computer reported, support those in the literature for African HEI[57,65,67] namely financial and to a lesser extent poor connectivity and unstable electricity supply. Although the unstable electricity supply was not reported to a great extent, the situation in South Africa for example has deteriorated in this regard over the past year and results may be different currently. Speaking at the 2008 Africa Power and Electricity Congress and Exhibition under the theme: 'Africa's electricity supply challenges: A regulatory perspective' in Johannesburg, South Africa recently, the chairperson of the Energy Regulation Board, Sikota Wina, indicated that the electricity crisis for Southern Africa was more evident this year. "*To add salt to injury, even the most optimistic projections show that electricity supplies by and large shall continue to be outstripped by demand in this region for the next few years given the likelihood of continued strong*

economic performance and the high capital costs and long lead times of the required infrastructure enhancements," he said. He observed that the reasons for the poor state of power supply in SSA included the overall policy environment that was perceived to be weak or overly dynamic.[62]

With the internet café becoming an ubiquitous feature of African cities, a disturbing trend is emerging within higher education that students are accessing the internet, away from their place of study.[58] It is disturbing as it implies unnecessary cost to the student and was identified as a potential constraint to nutrition training in Southern Africa. Although most of the students seemed to have access to and use of computers at their place of study rather than at home, students in Zimbabwe, Malawi and Zambia reported accessing computers at friends and relatives or at internet cafes more frequently. These findings strengthen the argument that e-learning activities in these situations should not be online or web-based and should rather allow for students to access the e-learning platform easily from wherever they have access to a computer.

Students reported irregular use of computers, especially in Zimbabwe, Malawi and Zambia as supported by studies in Nigeria[67] and South America[68].. This may be as a result of fewer and slower computers being available or that it is not required of them within their courses. With regard to the incorporation of e-learning activities into nutrition training, this irregular use should be seen as a limiting factor for the number of e-learning activities incorporated into the curricula.

Software availability is an important aspect to keep in mind for the planning of e-learning activities. Most computers at the place of study had MS office, e-mail and internet browsers available and fewer had statistical packages or dietary assessment packages available.

The internet was reportedly used most frequently for learning purposes, which is corroborated by other investigators in the USA and South America.[68] Students reported that the internet was accessed most frequently for electronic journals, linking to association or organizational web-sites and less frequently for accessing databases. It has been noted that African HEI lack the necessary access to journals in which the bulk of academic research is published[58] but the situation seems to be improving. As internet access is limited, this need for providing electronic resources like journal articles should be

taken into consideration when planning e-learning activities. ICT in nutrition teaching and learning was used for projects/assignments, keeping up to date with current information, to present information, to communicate and to process/analyse data. A survey conducted by Czerniewicz and Brown in South African HEI also found that the most frequent specific teaching and learning activity was the writing of assignments. They warn therefore that the computers may presently be little more than an electronic typewriter, as other opportunities to implement ICT in teaching and learning are not really being exploited by academic staff and students alike.[4] To optimize use of computers for e-learning activities, therefore, students should be encouraged to engage with the e-learning material.

Fewer lecturing staff reported using the internet for teaching purposes, which links to results from surveys conducted in the Western Cape, South Africa where the same trend was found.[4,59] Those investigators suggest that students are therefore using computers independently as part of their learning strategies even when not required to do so,[4] which is an encouraging aspect to be considered when planning e-learning activities.

An essential enabling factor for the incorporation of ICT in teaching and learning is the commitment of the government and institution towards implementing ICT in the form of policy[38] as well as the availability of support including maintenance and technical expertise within the institution.[22,36,38,42] Although almost all of the lecturing staff and students felt that keeping up with developments in the field of ICT in the institution was extremely important, they were generally ignorant of the existence of ICT policies, security and safety precautions concerning ICT, whether any incentives were offered to staff and students to use ICT or where technical support came from at their institutions. It seems that attitudes regarding ICT are positive, but that policy and support may be one of the limiting factors for the incorporation of e-learning activities in this situation.

The reasons for the difference in ICT practices reported in this research programme are not clear but may be due to inherent factors within different countries, courses and year of study or age of students. For instance, different courses may have different focal points and emphasis on nutrition. Medical students might complete only brief nutrition courses within their very full curricula, whereas the focus of nursing and nutrition courses could be focussed on public health and preventive issues. Although mostly final year students were included in the research, this is different for the different courses e.g. 3rd year for food science and nutrition, 4th year for dietetics and 5th year for medical students. For

countries, these inherent factors could include countries not emerging from internal conflict, political instability, poor governance and corruption, making progress on ICT for education more difficult, not having economic and infrastructure stability, unlike South Africa and Swaziland.

4.1.2 Personal aspects

Various investigators have shown that it is important for students and academic staff to be motivated and confident of their ICT skills for the optimal incorporation of ICT in teaching and learning.[22,38,43] It was therefore encouraging to find that the majority of students and lecturing staff in this phase of the research felt comfortable using a computer. However, a number of students did not seem to be very confident of their ICT skills, especially students in Zambia and Malawi. It was found that the less awkward and reluctant the students and lecturing staff were about having to use a computer, the more confident they were about their ICT skills. Students and lecturing staff overall rated their current level of ICT skills training and their ability to utilize what ICT can offer them as average to good, corresponding well with findings from South Africa[59] and New Zealand[15]. Honey warns however that the usefulness of a self-rating instrument should be questioned when perception of one's skill or proficiency may relate to the need to perform certain tasks.[15] As expected,[22,38,43] confidence in using ICT increased in both students and lecturing staff as their rating of their ICT skills increased. It is therefore essential that students perceive the platform selected for e-learning activities as easy to use and within their ICT abilities. Less than a third of students and about half of the lecturing staff felt they had sufficient skills to instruct others in the use of particular software programs and hardware, which is important to take note of for planning e-learning activities.

The literature indicates that it is important for students and academic staff to have some degree of computer literacy or skill.[15,22,26,36,38,42,43] Although students felt that ICT literacy training was important, it seems that most knowledge and skills related to ICT were acquired recently and not during their school years. Generally students indicated that they did not have time to attend ICT training, rather acquiring training from peers or training themselves. Lecturing staff, on the other hand, did seem to have time to attend ICT training, but still acquired training mostly from colleagues or trained themselves as found by other investigators.[4] In line with a study done in Lagos, Nigeria at a HEI, where it was found that 91% of students were computer literate, but 16% had never undergone any computer literacy training,[67] very few of the lecturing staff or students had attended formal

courses offered by a computer training school or ICT support services provided by the university and when they did, usually paid for these themselves. Students and lecturing staff seemed to be unaware of ICT training opportunities at their university and whether the budget was adequate. When planning e-learning activities, therefore, the minimal training required for utilization of the platform and ease of use should be stressed.

Regarding e-learning activities in nutrition training specifically, students indicated that they felt that the implementation of ICT in teaching and learning could add a new dimension to nutrition training and could increase studying productivity. They also responded positively regarding the use of an e-learning module covering Nutrition and HIV/AIDS specifically. Students in South Africa were less in favour of the application of ICT in different modes for nutrition training and the use of ICT for specific tasks, but it seems that ICT is used more frequently in nutrition training in South Africa and is seen as adequate for their needs. Lecturing staff and students in Zambia and Malawi especially did not seem to think that the current use of ICT in nutrition training is adequate for their needs, highlighting the need to plan the incorporation of e-learning activities according to the needs of the curricula. Lecturing staff and students in Swaziland and Zambia felt that ICT could replace classroom teaching, but the others did not agree.

The nutrition training environment in HEI in Southern Africa seems to be conducive to incorporating e-learning activities and can add a much needed new dimension to nutrition training, but certain aspects need to be taken into consideration when planning e-learning activities. These aspects that were identified in the first phase of the research programme included that firstly, the material developed should not be dependent on internet access. Secondly, that the size of the programme should not be computer memory demanding. Thirdly, that the material should not require software not readily available on the students' computers. Furthermore, the platform selected should be easy to use and within the students' ICT abilities, not require additional training for use, provide resources not readily available other than via the internet, and be interactive to engage students. It was also clear that the e-learning material should not replace conventional teaching entirely or be over-utilised, but rather planned according to the needs of the curriculum. The Nutrition in HIV/AIDS e-learning module developed in Phase II of the research programme was therefore purpose designed taking these constraints and aspects into consideration.

4.2 Designing a Pedogically Sound E-Learning Nutrition Module

4.2.1 ICT abilities

Expert content reviewers indicated that the material would be useful to students and lecturing staff as an educational tool, but noted that the students would require a certain level of IT skills. The literature corroborates that having some degree of computer literacy or skill is essential[15,22,26,36,38,42,43] and indicates that confidence in using computers will help make e-learning more enjoyable.[25] In Phase I of the research, it had also been noted that the e-learning material should be easy to use and within the students' ICT abilities since they had not rated their general ICT skills or confidence level when using a computer very high. In answer to this possible barrier, almost all of the students reported that they felt their ICT skills were sufficient to complete the e-learning Nutrition in HIV/AIDS module, although statistically significant differences were found between countries, courses and year of study. The intention not to require additional training for utilizing the e-learning module was therefore met.

Moreover, investigators point out that students are more likely to achieve learning outcomes if they react positively and enjoy the learning event and/or materials.[22,26] It was indeed found that the higher the students rated their ICT skills, the more likely they were to report that they had learnt something, to find the coverage of the topic adequate and to recommend the Nutrition in HIV/AIDS module. They were also more likely to report having enjoyed the module and to rate the module's effectiveness higher in comparison to conventional lectures.

4.2.2 Flexibility

Although time had been provided for self-study during class time, students mostly reported completing the modules at home, alone and after-hours. This was interesting in view of results from Phase I of the research indicating that access to computers at their place of study was easier but highlights the benefit of flexibility that e-learning brings to teaching and learning namely being independent of time and place and being self-paced.[15,17,19,22,24-26,32,36,40,46,49,51,52]

4.2.3 Technical aspects and interactivity

Recognising the importance of the e-learning material being navigable and user-friendly,[40] it was valuable to note that students found aspects of the e-learning platform such as the icons and menu tabs easy to follow, the window size acceptable, the icons familiar and

colour scheme pleasing. Expert reviewers felt that the Nutrition in HIV/AIDS module was very user-friendly, interactive and self-paced. Some of their concerns regarding the mode of presentation, for instance, included not being able to work on other applications without closing the VTS module, the window not filling the whole screen which cannot be solved due to the restrictions of the platform. These restrictions are specifically related to risk-benefit calculations regarding the number of programming functions of the platform and the limitations of the target countries as identified in Phase I of the research.

Phase I of the research identified that the e-learning module should engage students. Interactivity which enables students to engage with the learning material is a reported benefit of e-learning material[22,23,32,40] and was was deemed very important by the expert reviewers. They reported that the applications utilized for the e-learning Nutrition in HIV/AIDS module were effective and provided interaction and reinforcement. Almost three-quarters of the students indicated that they had used the quizzes, although it was not compulsory for the purposes of this research. There was a suggestion from the expert reviewers that the correct answers to the quiz questions should be supplied, but due to the restrictions of the platform discussed previously, this was not possible.

Most students in this phase of the research indicated that they used the keywords, but about half indicated that it was seldom. The expert reviewers found them to be important and helpful. Internal links were seen as useful and user-friendly by the expert reviewers as well as the students. Links to other pages/modules were found to be mostly effective by the expert reviewers but were also found to be inadequate and frustrating by some. This frustration is due to the restrictions of the platform once again which does not allow for the "back" option which many are accustomed to on the internet. The students reported using the internal links more often than the external, for a brief time generally before returning to the active module. External links were reported as good and useful by expert reviewers, but internet accessibility was noted as a barrier and this was corroborated by student comments. Cost proved to be a barrier to the use of these links. This barrier was also identified in Phase I of the research and can be overcome by limiting the number of links to the website, providing them as optional reading material only or downloading the websites directly as a resource.

Expert reviewers felt that the tasks/case studies/activities were relevant, useful and practical, providing interaction with the study material being perceived as stimulating.

Suggestions were made that they should be compulsory and that students should be provided with feedback or allowed conditional continuance of learning. Making them compulsory is ultimately the decision of the lecturer using the material and will depend on the curricular needs and forms of assessment used, but would be recommended. Less than half of the students reported using the assignments and case studies, considering them not applicable. It should be remembered however that they were not compulsory for the purposes of the research, and the fact that the students spent time reading them, albeit not completing them, showed very positive involvement with the material on their part.

Expert reviewers generally felt that the graphics/pictures were good and facilitated learning. Students reported that they could relate to the visuals and that they added to their understanding. Providing a user guide and preamble is important and they were both deemed user-friendly by the expert reviewers. Students reported that the instructions provided were sufficient.

4.2.4 Contextualisation

Perhaps the most important task of the expert reviewers was to comment on the scientific correctness, depth and level of the material. Contextualization of the learning material has been reported as a benefit of incorporating ICT in teaching and learning so that content can be relevant, up-to-date, sufficient and useful[23,32] and locally produced in the required language/terminology.[47] Comments from this phase of the research from expert reviewers were that the material was comprehensive, outcome/evidence-based and that current, relevant references were used. Most expert reviewers felt that the depth of the content was sufficient, the level was correct for undergraduates and that the material was relevant to the Southern African context. Most of the students also indicated that in their opinion, the level was appropriate for undergraduate students, it was an appropriate time in their curriculum to study the module, that the topic was covered adequately, that it was culturally appropriate and that sufficient information was provided for them to be able to take action. Importantly, most indicated that they had learnt something new. Expert reviewers felt that the order of the modules was logical and most students reported completing the modules in numerical order. Half of the students reported completing each of the modules in less than 1 hour as intended.

4.2.5 Blended learning

Phase I of the research had clearly identified that the e-learning material should not replace conventional teaching entirely or be over-utilised and this is corroborated by the literature.[10,34,35] This view was echoed by the expert reviewers who felt that the students should still have some contact with a facilitator for feedback and discussion. There are those that feel that the best use of ICT is in playing a supplementary role or as blended learning,[3,4,23,34-38] and this seems to be the trend being followed by academic staff.[39]

Investigators who have determined students' perception of whether e-learning is more effective than more conventional teaching methods, have found that students perceive it as being more effective or at least as effective.[22,49] In agreement with these findings, in this phase of the research, two-thirds of students rated the e-learning material as at least as effective or more effective than conventional lectures. It is important to note that the less effective the students rated the e-learning material, the more they felt that the topic was covered in too much depth for undergraduate students. Conversely, as the ratings for effectiveness increased, so did their keenness to recommend the Nutrition in HIV/AIDS module and mode of learning. This may indicate that rating of effectiveness compared to conventional teaching may be influenced by the learning styles of the students rather than an expression of the usability of the e-learning material and has been alluded to in the literature.[22,46]

4.2.6 Impact on learning

The purpose designed e-learning Nutrition in HIV/AIDS module was therefore found pedagogically sound, leading to Phase III of the research programme aiming to determine the impact of the module on learning. The findings of the first two phases of the research, strongly supported by the literature,[3,10,23,34-38] indicating that the e-learning module would be more beneficial as part of blended learning, resulted in limited testing opportunities for this phase of the research. The challenge for this phase of the research was to ensure that the impact of learning was as a result of engaging with the e-learning material only and not influenced by other aspects of teaching and learning.

Six, of the eight sub-modules tested, showed an improvement in knowledge and seven of the eight sub-modules showed an improvement in the percentage of questions answered correctly. The range of improvement in mean knowledge scores (3% to 18%) for six of the sub-modules is in line with results from a similar study conducted at Stellenbosch

University with Dietetic students regarding an e-learning module on breastfeeding (also using the VTS platform), where the mean improvement in knowledge was 11%.[49] Various investigators have demonstrated that e-learning modules result in knowledge gains, but the percentage improvement and methodologies vary greatly between studies making comparisons difficult.[34,53] There is an emerging debate regarding current research in the field of ICT in teaching and learning, warning researchers of comparing results from studies as there is no distinction made between the type of technology utilized[43] and that much of the research suffers from poor quality, inappropriate design and lack of social responsibility.[39]

Improvements were significant for the BScD students for the **Food hygiene and food safety in the context of HIV/AIDS sub-module** and for the NWU students for the **Nutrition and infection complex sub-module** which negates the possible explanation for some of the results as being influenced by the different methodologies followed in testing (20 MCQs for the one sub-module for the BScD students as compared to 120 MCQs for the six sub-modules for the NWU students) and the time allocated for self-study (45 min for the one sub-module for the BScD students and two months for the NWU students) between the groups of students.

All of the sub-modules tested, except the **Treatment and care practices of HIV/AIDS sub-module** showed an improvement in the percentage of questions answered correctly and this was the only sub-module where there was a significant decrease in knowledge. It is hypothesized that this may indicate either poor design of the MCQs or the learning material for that specific sub-module, but a definitive answer is not possible.

Nineteen percent of questions had been answered correctly for the pre-test by the majority of students, but were answered incorrectly by the majority of students for the post-test. From these results it can be inferred that certain aspects were "not learnt" from the study material. It has been reported that True/False type MCQs are difficult to design,[80] leading the investigators to believe that certain questions may not have been well-designed, were ambiguous, double-barreled, too long or poorly constructed. Alternatively, the e-learning material may not have provided sufficient clarity to enable the students to answer correctly.

4.3 Collaborative Research Approach

Regarding the collaborative research with collaborators from six Southern African HEI and support from Swedish collaborators, it was found that when in direct contact during the workshops, involvement and commitment were very high, but on return to busy schedules, participation and communication was often lacking. Although the distance communication e-room was available, it was underutilized. Testing in some countries was extremely difficult where the universities were not functioning well as a result of political unrest (e.g. Zambia, Zimbabwe). Relocation of some of the investigators resulted in limited participation for certain phases of the research in some countries, and none for Botswana. Motivation to complete and finalise testing was repeatedly required and notwithstanding many e-mail and telephonic conversations, some phases of the research programme had to be completed without the participation of all collaborators after it was evident that there was no prospect of it being completed. After consultation with promotors, it was decided that no further testing would be possible. Overall however, collaboration provided a depth to the development phases and to results allowing for extrapolation to other Southern African countries and even perhaps to developing countries in other parts of the world.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

The objectives of this collaborative research programme were to firstly determine whether the environment of nutrition training in Southern Africa is conducive to the incorporation of ICT in teaching and learning and if so, to develop a relevant and pedogically sound e-learning nutrition module taking identified constraints within this environment into consideration and to make recommendations for the incorporation of ICT in nutrition training in Southern Africa.

Although there is widespread accessibility to computers, the internet, personal e-mail addresses and reliable printing facilities for students and lecturing staff involved in nutrition-related courses at Southern African HEI, it is still felt that more computers should be made available. Students and lecturing staff are sharing computers and not all are using them on a daily basis. Although computers at the place of study and work have MS office, e-mail and internet browsers available, those at home are used predominantly for word processing, since e-mail and internet browsers are not readily availble. Although computers are fairly new, they are not fast enough and a lack of sufficient finance seems to be the main barrier to internet access at home.

Students rate their current levels of ICT skills training and ability to utilize what ICT can offer them as average to good and their confidence in using the technology increases as these ratings increase. Although ICT literacy training is deemed important, most knowledge and skills related to ICT were acquired at university from peers or training themselves. The cost of training is usually met by the students themselves and they are unaware of ICT training opportunities at their university and whether the budget is adequate.

Policies and support at institutional level regarding ICT seem to be lacking, or students have been unaware of any, but the institutional attitude to ICT is seen as positive and supportive. Students and lecturing staff feel that ICT could add a new dimension to nutrition training, increasing study productivity and they are in favour of the application of ICT in different modes to nutrition training. Most seem to indicate that the current use of ICT in nutrition training is inadequate for their needs, but are divided on the issue of ICT being able to replace classroom teaching.

The purpose designed e-learning Nutrition in HIV/AIDS module was validated and found to be useful to students and lecturing staff as an educational tool, being user-friendly,

interactive and self-paced. The majority of students reported that their ICT skills were sufficient to complete the e-learning activity. Although most students rated this mode of e-leaning as at least as effective or more effective than conventional lectures, one of the most important messages conveyed was that this mode of learning should not replace traditional teaching methods.

The content was found to be comprehensive, outcome/evidence-based and incorporating current, relevant references. The depth of the content was sufficient, the level was correct for undergraduates and the material was relevant to the Southern African context. The interactivity of the mode of learning was deemed important, helpful and effective providing interaction and reinforcement, with most students utilizing the interactivity tools.

Almost all the students indicated that they would recommend the Nutrition in HIV/AIDS module to other students, and that they enjoyed the presentation. Importantly, most students indicated that they had learnt something new.

There was a general improvement in cognitive knowledge after working through the e-learning material confirming previous studies indicating that well-designed e-learning modules have the potential to increase the performance of students.

The Nutrition in HIV/AIDS module is available on the VTS website for use by any interested parties and has been supplied to various people showing interest at the ITANA 2nd Conference held in South Africa in September 2005 and the 1st International Conference on ICT for Development, Education and Training held in Ethiopia in May 2006. Currently, the e-learning Nutrition in HIV/AIDS module is being implemented in the following courses at Stellenbosch University:

- BSc Diet IV – Nutrition in the life cycle as part of Community Nutrition [2005-2008]
- BSc Diet III – selected modules as part of Therapeutic nutrition (HIV/AIDS) and Community Nutrition (Food security) [2005-2008]
- BSc Diet II – linked to Breastfeeding module in Nutrition in the Life Cycle [2007-2008]
- MBChB III – selected modules as part of Health and Disease in Communities module [2007-2008]
- Diploma in Management of HIV - Vicious cycle between nutrition and HIV/AIDS [2008]

Areas that could be improved in specific countries/HEI and courses regarding the access and support for ICT in education have been identified and should be addressed. These include improved connectivity especially in Malawi, Zimbabwe and Zambia and a stable electricity supply in Swaziland (and most probably other SSA countries under present conditions). More available computers are required especially in Malawi, Zimbabwe, Zambia and Swaziland for students following Food science, Agricultural science, Home economics, Nursing and Nutrition courses. Students registered for Food and Agricultural sciences courses also specifically indicated that faster computers are required. More intensive ICT skills training should be considered especially in Malawi, Zambia and Swaziland and specifically for students following Agricultural science, Nursing and Nutrition courses. HEI should consider budgeting for ICT training of their students and academic staff and consider providing dedicated time as well as incentives to academic staff for the development of e-learning material.

HEI in Malawi, in particular, need to address the lack of policy support and/or promotion of ICT in education, and technical support is required mostly in Malawi, Zimbabwe and Zambia. Limited use of ICT in nutrition training was identified in Malawi and Zambia specifically, as well as in Home economics courses. Attitudes toward ICT in departments of Agricultural science and Nutrition, in particular, were reported as negative and need to be addressed.

The restrictions of the VTS platform should be considered in updated versions of the programme and addressing the limitation of student internet access by limiting the number of external links, making external links non-compulsory or downloading websites. Recommendations to include more quizzes and more challenging questions should be considered by authors of sub-modules as well as the question of converting all document links to PDF-format which would make the material more user-friendly and enable printing of tasks/assignments/case studies. Audio, video material and animation as well as games suggested to improve interactivity, should be reviewed by the authors of the sub-modules. The length and/or time frames for sub-modules 3, 5, 8, 9 and 11 should be addressed by the authors of these sub-modules.

Certain issues need to be considered for any further research on this topic, such as better construction of multiple choice questions and an alternative format (not True/False) for

pre- and post-testing of knowledge to determine the impact on learning as well as the limitation of incorporating the e-learning activity as blended learning.

A further recommendation would be the incorporation of this e-learning module into health professionals' in-service training or as continuing professional development and into other nutrition-related courses in Southern African HEI. Additionally, the VTS platform should be utilized for other nutrition-related topics and incorporated into health sciences curricula, but always keeping the amount of e-learning included in the curricula, in mind. Further research in other disciplines should be undertaken utilizing this collaborative approach.

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CHAPTER 7: ADDENDA

ADDENDUM 1: SAfrITaN partner countries, institutions and members (alphabetically by country)

BOTSWANA

UNIVERSITY OF BOTSWANA AND BOTSWANA-BAYLOR CHILDREN'S CENTRE OF EXCELLENCE, PRINCESS MARINA HOSPITAL
Represented by: Gabriel Anabwani MBChB

MALAWI

UNIVERSITY OF MALAWI [www.unima.mw]
Represented by: Chrissie M Chawanje PhD
Ezekiel Namacha

SOUTH AFRICA

MEDICAL UNIVERSITY OF SOUTH AFRICA (MEDUNSA) [www.ul.ac.za]
Represented by: Roy D Kennedy M Nutr, RD(SA)

STELLENBOSCH UNIVERSITY [www.sun.ac.za]
Represented by: Demetre Labadarios PhD, MBChB
Debbi Marais M Nutr, RD(SA)
Janicke Visser BSc (Diet), RD(SA)
Irene Labuschagne BSc (Diet), RD(SA)

SWAZILAND

UNIVERSITY OF SWAZILAND [www.uniswa.sz]
Represented by: Thokozile E Sibiya PhD

ZAMBIA

UNIVERSITY OF ZAMBIA [www.unza.zm]
Represented by: Martha N Musukwa B Sc (Agric), MSc
Drinah Banda Nyirenda PhD

ZIMBABWE

UNIVERSITY OF ZIMBABWE [www.uz.ac.zw]
Represented by: Alice Nkungula PhD

SWEDEN

ADDENDUM 2: Projection of available lecturing staff and students for sample size estimation for KAP survey in the collaborating HEI in Southern Africa

Country Target	Univ of Swaziland	Univ of Malawi	MEDUNSA	Stellenbosch Univ	Univ of Zimbabwe	Univ of Zambia	Total
Lecturing staff in Departments of:							
Dietetics	-	-	5	10	-	-	
Nutrition	1	3	-	10	3	-	
Home Economics	5	-	-	-	6	1	
Medical	-	-	50	50	-	53	
Nursing	-	-	10	15	-	-	
Agric science	30	-	-	5	-	7	
Food Science	1	2	-	5	4	3	
Total	**37**	**5**	**65**	**95**	**13**	**64**	**279**
Final year students in Departments of:							
Dietetics	-	-	15	25	-	-	
Nutrition	-	15	-	-	20	-	
Home Economics	20	12	-	18	25	31	
Medical	-	35	200	200	60	57	
Nursing	60	20	100	150	-	14	
Agric science	100	20	-	30	-	46	
Food Science	-	11	-	25	20	20	
Total	**180**	**113**	**315**	**448**	**125**	**168**	**1349**

ADDENDUM 3: KAP questionnaire for lecturing staff

> # The objective of this questionnaire is to gather information to determine the current state of affairs about Information and Communication Technology (ICT)* in nutrition training, rather than as a basis for judgement or evaluation.

* To define the term, ICT is the use of:

Computers for information retrieval, storage & documentation

Communication, email, networking

Training & development

Edutainment

Processing & dissemination of information

Creating of new knowledge, facilities & information

Internet, LAN, WAN

Category: Lecturing staff

It should not take longer than 20 minutes to complete the questionnaire.

Thank you for giving up some of your valuable time to assist us with this project.

You can answer most of the questions simply by ticking the appropriate box or selection of boxes.

SECTION A - Socio demographic

Please indicate which category you would fall into (choose only one):

1	Home Economics	Dietetics	Food Science	Nutrition		
	Agricultural sciences	Medical	Nursing	Other: _____		
2	Age	_____ years				
3	Gender	Male	Female			
4	Years of work experience	_____ years				
5	Designation	Junior lecturer	Lecturer	Senior lecturer	Ass. Prof	Professor
	Other: _____					
6	Institution					
7	Country					

SECTION B - Computer access and usage

1	Does your current institution/department have a policy that supports and/or promotes the use of ICT/computers in academic programs?	Yes	No	Don't know
2	Do you have a personal e-mail address?		Yes	No
3	Do you have access to a computer?		Yes	No

If no, please DO NOT complete the rest of Section B - continue with Section C

| 4 | If yes, where do you have **access** to a computer? (Mark all appropriate blocks) |

	Yes	No	
Own home			
Friends			
Relatives			
Internet/Cybercafe			
Own office			
Shared office			
Computer laboratory/Centre			

Other: _____

5 If you DO NOT have access outside of your place of work, indicate why by choosing the most appropriate reason (choose only one)?

Economic	Security/Safety	Electricity	Connectivity		

Other _____

| 6 | Indicate the location of the computer that you use most often (choose only one): |

Library		
Laboratory		
Home		
Internet/Cybercafé		
Office		
Computer lab/centre		

Other _____

7	Indicate **how often** you use/access a computer and for **how long** at a time usually (complete only one per column).			
		Frequency	Time (hours)	
	Daily			
	Weekly			
	Monthly			
	Rarely			
8	What time of the day do you **mostly** use/have access to a computer at home and at work (choose only one per column)?			
		Home	Place of work	
	10h00 – 13h00			
	13h00 – 16h00			
	16h00 – 20h00			
	Unrestricted			
9	How old is your computer since it was bought new at home and at work (choose only one per column)?			
		Home	Place of work	
	< 1 year			
	1<2 years			
	2<3 years			
	3<5 years			
	>5 years			
	Don't know			
10	Do you have access to reliable printing facilities?		Yes	No

11	Which software programmes are installed and available on your computer at home and at work (Mark all appropriate blocks)?		
		Home	Place of work
	MS Office 95 - 2000 (including MS Word, Frontpage, Excel, Access, PowerPoint)		
	Statistical packages (Epi-Info, SPSS, SAS, Statistica)		
	E-mail		
	Dietary assessment packages		
	Internet browsers (e.g. Netscape, Internet Explorer)		
	Don't know		

12	What do you **mostly** use the computer for at home and at work (Mark all appropriate blocks)?		
		Home	Place of work
	Word processing (writing documents/reports)		
	Databases (information storage/retrieval)		
	Spreadsheets (eg. Excel, SAS)		
	Statistics (data processing)		
	PowerPoint presentations		
	Programming		
	Internet searches (literature searches)		
	E-mail		
	Reading news, keeping informed of wordly events		

13	a.Does the University have any technical support services available related to the use of computers?	Yes	No	Don't know
13	b.**If** your answer to the previous question is **"yes"** tick the **most** appropriate box (choose only one):			
	Support provided within department/institution			
	Support provided by private company			
	Support provided within & from outside the institution			
	Support solicited privately/informally			
	Unsure of who provides support			
14	a.Do you have reliable technical support for software?	Yes	Sometimes	Never
14	b.Do you have reliable technical support for hardware?	Yes	Sometimes	Never
15	Does your computer have Internet access?	Yes	No	Don't know
16	What do you **mostly** use your internet for (choose only one)?			
	Access to electronic Journals			
	Links to Associations/Organisational web-sites			
	Data bases			
17	Do you use the internet for teaching purposes?	Yes	No	Don't know
18	Rate the security and safety precautions concerning ICT within your department/institution (eg. Firewalls, anti-virus programmes, theft):			

Non-existing	Poor	Average	Good	Excellent	Don't know

SECTION C - Attitudes

1	I regard keeping up with developments in the field of ICT in my institution as extremely important.			
	Strongly agree	Agree	Disagree	Strongly disagree
2	I like/would like to use ICT for specific training/administrative/research tasks.			
	Strongly agree	Agree	Disagree	Strongly disagree
3	a.I feel the support infrastructure for ICT in nutrition training in my institution/department is adequate for now.			
	Strongly agree	Agree	Disagree	Strongly disagree
3	b.I feel the support infrastructure for ICT in undergraduate training in my institution/department is adequate for now.			
		Agree	Disagree	Strongly disagree
4	Our department/institution should make more computers available to students.			
	Strongly agree	Agree	Disagree	Strongly disagree
5	I feel awkward and reluctant when simply thinking about having to use a computer for whatever purpose.			
	Strongly agree	Agree	Disagree	Strongly disagree
6	I would describe the overall attitude of people towards ICT in my department/institution as positive.			
	Strongly agree	Agree	Disagree	Strongly disagree
7	I prefer to have my own computer.			
	Strongly agree	Agree	Disagree	Strongly disagree
8	I prefer to have my own e-mail address.			
	Strongly agree	Agree	Disagree	Strongly disagree
9	I feel confident about my ICT skills.			
	Strongly agree	Agree	Disagree	Strongly disagree
10	I do not like using second-hand donated computer equipment.			

		Strongly agree	Agree	Disagree	Strongly disagree
11	I prefer not to share a/my computer with anybody else.				
		Strongly agree	Agree	Disagree	Strongly disagree
12	Administration/institutional management does not really understand the necessity of using ICT in training.				
		Strongly agree	Agree	Disagree	Strongly disagree
13	a.I feel frustrated with the use of ICT in my place of study.				
		Strongly agree	Agree	Disagree	Strongly disagree
13	b.Briefly support your answer in 13a.				
14	I think ICT can replace classroom teaching.				
		Strongly agree	Agree	Disagree	Strongly disagree
15	My computer is fast enough for my requirements.				
		Strongly agree	Agree	Disagree	Strongly disagree
16	I am in favour of applying ICT to nutrition training in whatever mode (eg for classroom teaching, in the library or in distance learning.				
			Agree	Disagree	Strongly disagree
17	ICT should only be used for certain parts of nutrition training where no other method is suitable.				
		Strongly agree	Agree	Disagree	Strongly disagree
18	The current use of ICT in nutrition training is adequate for my needs.				
		Strongly agree	Agree	Disagree	Strongly disagree
19	Searching the net for information is easier than reading a book.				
		Strongly agree	Agree	Disagree	Strongly disagree
20	Interactive CD's are better than handouts.				
		Strongly agree	Agree	Disagree	Strongly disagree
21	Searching the web is time-consuming				
		Strongly agree	Agree	Disagree	Strongly disagree

SECTION D - ICT skills and training

1	Does your department/institution offer any incentives to staff and students to use ICT?			
		Yes	No	Don't know

2	a.How would you rate your ability to utilise what ICT offers to you?			
	Poor/Inefficient	Average	Good	Excellent

2	b.Briefly support your answer in 2a.

3	How much new knowledge and skills related to ICT have you acquired and applied over the past 2-3 years?		
	The majority	Very little	Nothing

4	Do you think ICT literacy training is important?	Yes	No

5	How would you rate your current level of ICT skills training?				
	Not applicable	Poor	Average	Good	Excellent

6	a.Do you have time to attend ICT training?			
	Not applicable	Yes	No	It depends

6	b.Briefly support your answer in 6a.

7	In what format did you acquire **most** of your ICT training up to this point (choose only one)?	
	Formal courses (e.g. offered by a computer training school)	
	ICT support services provided by my institution	
	From colleagues	

	Training by myself			
8	Who pays for ICT training to students and staff of your institution (choose only one)?			
	Self			
	Staff development budgets			
	Free			
	Don't know			
9	What is the most urgent need regarding your own ICT skills training?			
10	a.Do you have sufficient skills to instruct others in the use of particular **software programs and hardware ICT**?	Yes	No	
10	b.If your answer in the previous question is "yes" list the applicable programs and aspects			
11	When last did you attend any ICT training (choose only one)?			
	In the past 6 months			
	In the past year			
	In the past 2 years			
	More than 2 years ago			
12	How many ICT training opportunities are provided per year at your institution (choose one)?			

	12 or more	6-11	1-5	Don't know	

13	Do you think the annual budget at your current institution for ICT training of students/staff is adequate?	Yes	No	Don't know

SECTION E - ICT and Nutrition training

1	Is copyright applicable to the use of ICT in education and training?	Yes	No	Don't know
2a	a.Do you think ICT can add a new dimension to nutrition training in your institution?			
		Yes	No	Don't know
2	b.Briefly support your answer in 2a.			
3	Do you think that ICT can increase your research/teaching productivity?			
		Yes	No	Don't know
4	How do you currently use ICT in nutrition training/learning (Mark all appropriate blocks)?			
		Yes	No	
	Keep up to date with current information			
	Process/analyse data			
	Present information			
	In projects/assignments			
	Communication			
	As an alternative to classroom teaching			
5	Would you be prepared to use a distance learning module regarding Nutrition and HIV/AIDS?	Yes	No	Don't know
6	Do you have access to the latest software and programs related to nutrition data eg Food Finder, Epi Info on CD or in other electronic format?	Yes	No	Don't know
7	If yes, list commonly used programmes.			
8	Do you think ICT is utilised optimally in nutrition courses within your institution?			
		Yes	No	Don't know
9	Are there resources available at your current institution for implementing ICT in teaching/training?	Yes	No	Don't know

The objective of this questionnaire is to gather information to determine the current state of affairs about Information and Communication Technology (ICT)* in nutrition training, rather than as a basis for judgement or evaluation.

* To define the term, ICT is the use of:

Computers for information retrieval, storage & documentation

Communication, email, networking

Training & development

Edutainment

Processing & dissemination of information

Creating of new knowledge, facilities & information

Internet, LAN, WAN

Category: Students

It should not take longer than 20 minutes to complete the questionnaire.

Thank you for giving up some of your valuable time to assist us with this project.

Please note that the information provided is anonymous and will be handled confidentially. Results as a whole may be used for congresses and/or publications. By completing this questionnaire you are consenting to partake in the study.

You can answer most of the questions simply by ticking the appropriate box or selection of boxes.

SECTION A - Socio demographic

Please indicate which category you would fall into (choose only one):

1	Home Economics	Dietetics	Food Science	Nutrition		
	Agricultural sciences	Medical	Nursing	Other: _____		
2	Age	_____ years				
3	Gender	Male	Female			
4	Year of study	2	3	4	5	6
5	Institution					
6	Country					

SECTION B - Computer access and usage

1	Does your current institution/department have a policy that supports and/or promotes the use of ICT/computers in academic programs?				
			Yes	No	Don't know
2	Do you have a personal e-mail address?			Yes	No
3	Do you have access to a computer?			Yes	No

If no, please DO NOT complete the rest of Section B - continue with Section C

4	If yes, where do you have **access** to a computer? (Mark all appropriate blocks)		
		Yes	No
	Own home		
	Friends		
	Relatives		
	Internet/Cybercafe		
	Classroom		
	Library		
	Computer laboratory/Centre		
	Other: _____		

5	If you **DO NOT** have access **outside of your place of study**, indicate why by choosing the most appropriate reason (choose only one)?			
	Economic	Security/Safety	Electricity	Connectivity
	Other _____			

6	Indicate the location of the computer that you use **most often** (choose only one):	
	Library	
	Laboratory	
	Home	
	Internet/Cybercafé	
	Classroom	
	Computer lab/centre	
	Other _____	

7	Indicate **how often** you use/access a computer and for **how long** at a time usually (complete only one per column).				
		Frequency	Time (hours)		
	Daily				
	Weekly				
	Monthly				
	Rarely				
	What time of the day do you **mostly** use/have access to a computer at home or place of study (choose only one per column)?				
		Home	Place of study		
	10h00 – 13h00				
	13h00 – 16h00				
	16h00 – 20h00				
	Unrestricted				
9	How old is your computer since it was bought new at home/place of study (choose one per column)?				
		Home	Place of study		
	< 1 year				
	1<2 years				
	2<3 years				
	3<5 years				
	>5 years				
	Don't know				
10	Do you have access to reliable printing facilities?			Yes	No
11	Which software programmes are installed and available on your computer at home or place of study (Mark all appropriate blocks)?				
			Home	Place of study	
	MS Office 95 - 2000 (including MS Word, Frontpage, Excel, Access, PowerPoint)				
	Statistical packages (Epi-Info, SPSS, SAS, Statistica)				
	E-mail				
	Dietary assessment packages				
	Internet browsers (e.g. Netscape, Internet Explorer)				
	Don't know				
	Other: _____				
12	What do you mostly use the computer for at home or place of study (Mark all appropriate blocks)?				
			Home	Place of study	
	Word processing (writing documents/reports)				
	Databases (information storage/retrieval)				
	Spreadsheets (eg. Excel, SAS)				
	Statistics (data processing)				
	PowerPoint presentations				
	Programming				
	Internet searches (literature searches)				
	E-mail				
	Reading news, keeping informed of wordly events Other				

13	a.Does the University have any technical support services available related to the use of computers?			
		Yes	No	Don't know
13	b.**If** your answer to the previous question is **"yes",** tick the **most appropriate** answer (Choose only one):			
	Support provided within department/institution			
	Support provided by private company			
	Support provided within & from outside the institution			
	Support solicited privately/informally			
	Unsure of who provides support			
14	a.Do you have reliable technical support for software?	Yes	Sometimes	Never
14	b.Do you have reliable technical support for hardware?	Yes	Sometimes	Never
15	Does your computer have Internet access?	Yes	No	Don't know
16	What do you **mostly** use your internet for (choose only one)?			
	Access to electronic Journals			
	Links to Associations/Organisational web-sites			
	Data bases			
	Other:_____			
17	Do you use the internet for learning purposes?	Yes	No	Don't know
18	Rate the security and safety precautions concerning ICT within your department/institution (eg. Firewalls, anti-virus programmes, theft):			

Non-existing	Poor	Average	Good	Excellent	Don't know

SECTION C - Attitudes

1	I regard keeping up with developments in the field of ICT in my institution as extremely important.			
	Strongly agree	Agree	Disagree	Strongly disagree
2	I like/would like to use ICT for specific training/administrative/research tasks.			
	Strongly agree	Agree	Disagree	Strongly disagree
3	a.I feel the support infrastructure for ICT in <u>nutrition training</u> in my institution/department is adequate for now.			
	Strongly agree	Agree	Disagree	Strongly disagree
3	b.I feel the support infrastructure for ICT in <u>undergraduate training</u> in my institution/department is adequate for now.			
	Strongly agree	Agree	Disagree	Strongly disagree
4	Our department/institution should make more computers available to students.			
	Strongly agree	Agree	Disagree	Strongly disagree
5	I feel awkward and reluctant when simply thinking about having to use a computer for whatever purpose.			
	Strongly agree	Agree	Disagree	Strongly disagree
6	I would describe the overall attitude of people towards ICT in my department/institution as positive.			
	Strongly agree	Agree	Disagree	Strongly disagree
7	I prefer to have my own computer.			
	Strongly agree	Agree	Disagree	Strongly disagree
8	I prefer to have my own e-mail address.			
	Strongly agree	Agree	Disagree	Strongly disagree
9	I feel confident about my ICT skills.			
	Strongly agree	Agree	Disagree	Strongly disagree

10	I do not like using second-hand donated computer equipment.			
	Strongly agree	Agree	Disagree	Strongly disagree
11	I prefer not to share a/my computer with anybody else.			
	Strongly agree	Agree	Disagree	Strongly disagree
12	Administration/institutional management does not really understand the necessity of using ICT in training.			
	Strongly agree	Agree	Disagree	Strongly disagree
13	a.I feel frustrated with the use of ICT in my place of study.			
	Strongly agree	Agree	Disagree	Strongly disagree
13	b.Briefly support your answer in 13a.			
	_____			
14	I think ICT can replace classroom teaching.			
	Strongly agree	Agree	Disagree	Strongly disagree
15	My computer is fast enough for my requirements.			
	Strongly agree	Agree	Disagree	Strongly disagree
16	I am in favour of applying ICT to nutrition training in whatever mode (eg for classroom teaching, in the library or in distance learning.			
	Strongly agree	Agree	Disagree	Strongly disagree
17	ICT should only be used for certain parts of nutrition training where no other method is suitable.			
	Strongly agree	Agree	Disagree	Strongly disagree
18	The current use of ICT in nutrition training is adequate for my needs.			
	Strongly agree	Agree	Disagree	Strongly disagree
19	Searching the net for information is easier than reading a book.			
	Strongly agree	Agree	Disagree	Strongly disagree
20	Interactive CD's are better than handouts.			
	Strongly agree	Agree	Disagree	Strongly disagree
21	Searching the web is time-consuming			
	Strongly agree	Agree	Disagree	Strongly disagree

SECTION D - ICT skills and training

1	Does your department/institution offer any incentives to staff and students to use ICT?			
		Yes	No	Don't know
2a	How would you rate your ability to utilise what ICT offers to you?			
	Poor/Inefficient	Average	Good	Excellent	
2b	Briefly support your answer in 2a.			
	_____			
3	How much new knowledge and skills related to ICT have you acquired and applied over the past 2-3 years?			
	The majority	Very little	Nothing		
4	Do you think ICT literacy training is important?		Yes	No
5	How would you rate your current level of ICT skills training?			
	Not applicable	Poor	Average	Good	Excellent
6a	Do you have time to attend ICT training?			
		Not applicable	Yes	No	It depends
6b	Briefly support your answer in 6a.			
	_____			

7	In what format did you acquire **most** of your ICT training up to this point (choose only one)?		
	Formal courses (e.g. offered by a computer training school)		
	ICT support services provided by my institution		
	From colleagues		
	Training by myself		
	Other: _____		
8	Who pays for ICT training to students and staff of your institution (choose only one)?		

	Self	
	Staff development budgets	
	Free	
	Don't know	
	Other: _____	

9	What is the most urgent need regarding your own ICT skills training?
	_____

10	a.Do you have sufficient skills to instruct others in the use of particular **software programs and hardware ICT**?		
		Yes	No
10	b.If your answer in the previous question is "yes" list the applicable programs and aspects		
	_____		

11	When last did you attend any ICT training (choose only one)?	
	In the past 6 months	
	In the past year	
	In the past 2 years	
	More than 2 years ago	

12	How many ICT training opportunities are provided per year at your institution (choose only one)?			
	12 or more	6-11	1-5	Don't know

13	Do you think the annual budget at your current institution for ICT training of students/staff is adequate?			
		Yes	No	Don't know

SECTION E - ICT and Nutrition training

1	Tick **all** the nutrition topics that have been included in your training (Mark all appropriate blocks):			
	Nutritional Biochemistry/Physiology		Food hygiene/safety	
	Therapeutic nutrition/Nutrition in disease		Food security/diversity	
	Community nutrition/health		Product development	
	Maternal/child health/nutrition/care		Nutrition assessment	
	Other _____			

2	Is copyright applicable to the use of ICT in education and training?			
		Yes	No	Don't know
3a	Do you think ICT can add a new dimension to nutrition training in your institution?			
		Yes	No	Don't know
3b	Briefly support your answer in 3a.			
	_____			
4	Do you think that ICT can increase your studying productivity?	Yes	No	Don't know

5	How do you currently use ICT in nutrition training/learning (Mark all appropriate blocks)?			
		Yes	No	
	Keep up to date with current information			
	Process/analyse data			
	Present information			
	In projects/assignments			
	Communication			
	Other:_____			
6	Would you be prepared to use a distance learning module regarding Nutrition and HIV/AIDS?			
		Yes	No	Don't know
7	Do you have access to the latest software and programs related to nutrition data eg Food Finder, Epi Info on CD or in other electronic format?			
		Yes	No	Don't know
8	If yes, list commonly used programmes.			
9	Do you think ICT is utilised optimally in nutrition courses within your institution?			
		Yes	No	Don't know
10	Are there resources available at your current institution for implementing ICT in teaching/training?			
		Yes	No	Don't know

ADDENDUM 5: SAFRITaN Nutrition and HIV/AIDS Module curriculum

1. Overview-introduction to HIV/AIDS
[Authors: Dr GM Anabwani and Dr L Chiwona-Karltun]
- Chronology of disease
- Etiology (global , Africa and country specific)
- Pathophysiology
- Epidemiology (Global, Africa and Southern Africa country specific)
- Modes of transmission, risk groups, high risk behaviour
- Natural course in adults and children
- Laboratory diagnosis and monitoring
- Classifications- clinical signs and symptoms

2. **HIV/AIDS Voluntary Testing and Counselling**
[Author: Mr G de Swardt (NGO – The Triangle project)]
- Promotion of HIV-status testing Voluntary
- Within family disclosure-family care unit
- Other special care situations
- Promotion of safe practices
- Ethics, confidentiality and stigma
- Sexual conduct
- STDs
- Management of injuries

3. **Nutrition and infection complex**
[Author: Prof D Labadarios]
- Nutrition- immune status in the context of infection
- Acute phase response in relation to nutrition
- Immunomodulation of the acute phase response by nutrition
- Infection-malnutrition linkages
- Malnutrition associated morbidity and mortality

4. **Vicious cycle between nutrition and HIV/AIDS**
[Author: Mr R Kennedy]
- Nutritional complications of HIV/AIDS - macro, micro, food intake, malabsorption, nutrient requirements, wasting syndrome
- Medical complications - cardiovascular, renal failure, opportunistic diseases
- and other infections, lipodystrophy, central nervous system and other systemic
- complications and the effects on nutritional status

5. **Nutritional status assessment of PLWHA**
[Authors: Mrs D Marais and Dr AN Nkungula]
- Anthropometry
- Biochemical
- Clinical
- Dietary
- Socio-economic, food security, avoidances, taboos
- Monitoring and evaluation of nutritional status (rapid assessment)
- Vulnerable groups including pregnant teenagers, women, children, involuntarily displaced populations; displaced; migrants

6. **Nutritional care and management of PLWHA**
[Authors: Mrs I Labuschange and Mr C Pietersen]
General Nutritional guidelines – from each country should be available on
- Diet therapy
- Specific Symptomatic interventions, thrush, diarrhoea, nausea, weight loss, lack of appetite, heartburn and distension, fatigue, fat intolerance, taste changes, constipation
- Diet analysis - family nutrition therapy (link to traditional foods)
- Nutritional supplements, protein, energy, CHOs, fat, micronutrients
- Nutritional Support - Enteral and Parenteral

7. **Caring for HIV/AIDS through the lifecycle**
[Authors: Mrs J Visser and Mrs D Marais]
- Introduction of lifecycle concept
- Pregnancy
- Infant feeding options and HIV, PMTCT
- Child, adolescence, adulthood and elderly- pregnant teenagers, women, involuntarily displaced populations; migrants
- Social issues

8. **Food hygiene and food safety in the context of HIV/AIDS**
[Authors: Dr CM Chawanje and Mr R Kennedy]
- Preparation and storage
- Food borne diseases
- Water
- Personal hygiene
- Street foods, convenience foods
- Food safety when travelling

9. **Treatment and care practices of HIV/AIDS**
[Authors: Dr L Chiwona-Karltun, Mr Roy Kennedy and Ms M Musukwa]
- Anti-retroviral Therapy
- Models of care and health policies (family care, child care, home based care, community based care, DOT) country specific
- Alternative therapies
    - Herbal and Dietary supplements
    - Meditation and Mediation, Traditional Healers, Sangoma, prayer, acupuncture
    - Safety and efficacy
- Self-care, personal hygiene, lifestyle, self-pampering
- Advocacy, communication and health promotion

10. **Food Security and Socio-economic Impact of HIV/AIDS**
[Authors: Dr B Ogle & Dr T Sibiya]
- National and household level food security
- Introduction to livelihood analysis and impact of HIV/AIDS

11. **Food and Drug Interactions in the context of HIV/AIDS**
[Author: Prof D Labadarios]
- Drugs for opportunistic infections
- Management of food and drug interaction
    - Symptomatic treatment
    - Anti-retroviral, HAART
- Lipodystrophy syndrome
- Muscular dystrophy

ADDENDUM 6: Preamble to the Nutrition in HIV/AIDS module

Project title: Information Technology (IT) with a Human Face: A collaborative research project to improve higher nutrition training in Southern Africa

What is this project about?

In 1999, the Nutrition section at the Department of Medical Sciences at Uppsala University, Sweden, started a Sida financed programme under the heading Global NutrITion for university colleagues from Africa in the field of nutrition. By 2004, over 150 academic teachers in nutrition from 50 countries in Africa, Asia and Latin America had participated in the programme, and continue networking and collaborating via the electronic Global NutrITion network (www.globnut.net). In 2002, a group of African alumni from the Global NutrITion programme hosted a very successful pan-African congress in Nairobi, Kenya, called ITANA (www.itananutrition.org). The ITANA e-society (www.itananutrition.org) was inaugurated at the congress and one of the strategic objectives is the improvement of knowledge, skills and attitudes of target groups in nutrition and modern IT applications through development, implementation and evaluation of long distance training strategies and/or programmes aimed at individuals or institutions. A research project, initiated by SAfrITaN, is the first response to the marked paucity of data in the Southern African region with regard to the use of IT in higher training in nutrition. This initiative will draw on the existing Global NutrITion network created to advance our understanding of the current use of, and provide practical insights into, computer-based training and this can improve nutrition training in the partner institutions and communities. SAfrITaN received financial support form Sida in 2003 to 2005.

Who is involved?

Alphabetically by country:

Botswana

Dr GM Anabwani (Department of Medicine, University of Botswana)

Malawi

Dr CM Chawanje* (Department of Applied Sciences, University of Malawi)

South Africa

Prof Demetre Labadarios* (Division of Human Nutrition, Stellenbosch University)

Ms D Marais* (Division of Human Nutrition, Stellenbosch University)

Mr Roy Kennedy (Division of Human Nutrition, Stellenbosch University)

Mrs I Labuschagne (Division of Human Nutrition, Stellenbosch University)

Mrs J Visser (Division of Human Nutrition, Stellenbosch University)

Swaziland

Dr TE Sibiya* (Faculty of Agriculture, Home Economics Department, University of Swaziland,)

Zambia

Dr D Nyirenda* (PAM, Programme Against Malnutrition, Zambia)

Ms M Musukwa (Department of Animal Science, University of Zambia)

Zimbabwe

Dr A Nkungula* (Department of Technical Education, University of Zimbabwe,)

* Global NutITion alumni

TECHNICAL SUPPORT

Sweden:

Dr Britta Ogle (Department of Rural Development Studies (DRDS), Swedish University of Agricultural Sciences)

Dr L Chiwona-Karltun (Deptartment of Plant Biology & Department of Rural Development Studies, Swedish University of Agricultural Sciences)

Gabriel Westman

Why Nutrition and HIV/AIDS?
Although human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) is recognised predominantly as a health problem, the epidemic has multiple social and economic dimensions and implications since it affects adults in their most productive years of life. The spread of HIV/AIDS has become a major constraint to development in affected areas, with the bulk of this global burden affecting sub-Saharan Africa. The UNAIDS estimates that of the 36 million adults and children living with HIV/AIDS globally, 24,5 million live in sub-Saharan Africa.

Is this programme unique?
Although educational material regarding HIV/AIDS and Nutrition has been developed for Africa (USAID and Fanta supported), the manual was designed to assist trainers in their teaching and not as an interactive programme for students. The SAfrITaN programme uses VTS and imparts practical skills in addressing defined specialised issues on the relationship of nutrition and HIV/AIDS -

VTS is a software tool supported by a web-platform (http:www.vtshost.com) which is a free software tool for web-based learning that was developed by Gabriel Westman and Erik Bergman as part of the Global NutrITion programme with financial support from the Swedish International Development Cooperation Agency (Sida). Key features of this programme are that it enables the creation of professional-looking, low-bandwidth interactive teaching material without extensive work or technical knowledge required by the lecturer. It enables material to be presented via the internet or from a CD, hard drive or Local Area Network (LAN) and opens up the possibility of sharing courses on the world-wide web. The most important aspect of this platform is that it was specifically designed for use in developing countries, therefore taking the unique situation and specific constraints of developing countries into account.

How was the material designed and by whom?
This training material has been developed by the SAfrITaN group and the authors designed modules according to their areas of expertise. The group was then given the opportunity of an internal peer review of the draft modules at a SAfrITaN workshop, by presenting the manuscripts to the group. Once the draft manuscripts were finalised, they were converted to the VTS format and sent for expert peer review via CD-Rom to determine content and face validity. External reviewers were suggested by SafrITaN members according to their expertise in a specific area(s) of HIV/AIDS or the nutritional aspects involved. Educational experts, NGOs involved in HIV/AIDS and IT specialists were also nominated. Reviewers were requested to comment on the following aspects of the module(s) sent to them for review: scientific correctness/relevance; usefulness; interactivity; evidence base; and level of presentation. Once reviewer's comments had been incorporated, the final version of the module was developed and provided for testing and evaluation by you, the user.

Future developements
These modules will be updated according to the comments provided during this testing and evaluation phase and thereafter provided **free of charge** on the ITANA website. SAfrITaN hope to expand their effort to include more topics in higher nutrition education.

How does it work?
The modules were developed to provide locally relevant, interactive self-study computer-based training material in Nutrition and HIV/AIDS and thus to support higher nutrition training in the region. Respective modules should not take longer than an hour to complete and the modules can be completed sequentially or independently. The target group to evaluate the modules is students following nutrition courses at higher education institutions (including Dietetics, Nutrition, Home Economics/Consumer Sciences, Medicine, Nursing, Agricultural Sciences and Food Science).

ADDENDUM 7: List of nominated external reviewers of the Nutrition in HIV/AIDS module

South Africa
- Mrs Maritha Marais (Module 8)
- Prof Marietjie Herselman (Module 5)
- Mrs Marianne Visser (Module 4)
- Anna Coutsoudis (All modules)
- The Triangle Project (All modules)
- Prof Mark Cotton (All modules)
- Prof Bob Mash (All modules)

Sweden
- Prof Friis (All modules)
- Prof Thorkild (All modules)
- Hans Rosling (All modules)
- Ted Greiner (All modules)
- David Finer KI (All modules)

Zimbabwe
- Lucy Malaba (All modules)

Zambia
- Prof Bathi (Module 9)
- Prof Kelly (All modules)
- Prof Chintu (Module 11)

USA
- Cade Fields-Gardner (All modules)
- Gustavo Wong (All modules)
- Alan Whiteside (All modules)

Swaziland
- Elen Piwoz (All modules)

ADDENDUM 8: Projection of available courses for face validity in the collaborating HEI in Southern Africa per sub-module of the Nutrition in HIV/AIDS module

Sub-module	Swaziland	Malawi	South Africa	Zimbabwe	Zambia
I. Introduction	Home Economics		Dietetics, Nursing, Home Economics		Agricultural science
2. Voluntary testing and councelling	Nursing		Dietetics, Medical, Nursing		Medical
3. Nutrition and infection complex	Home Economics		Dietetics, Medical		Nursing
4. Vicious cycle nutrition & HIV/AIDS	Home Economics		Dietetics, Medical, Nursing		Nutrition
5.Nutrition Status Assessment of PLWHA	Home Economics		Dietetics, Nursing	Medical	Nutrition
6. Nutritional Care and management	Home Economics, Nursing		Dietetics, Nursing		Nutrition
7. Caring for HIV/AIDS throughout the lifecycle	Nursing		Dietetics, Nursing		Nursing
8. Food hygiene and food safety in the context of HIV/AIDS	Home Economics	Food Science	Dietetics, Food Science	Food Science	Food science
9. Treatment and care practices of HIV/AIDS	Home Economics, Nursing		Dietetics, Nursing, Medical	Home economics, Nutrition, Nursing	Food science, Medical
10. Food security and socio-economic impact of HIV/AIDS	Home Economics, Agricultural science		Dietetics, Home Economics		Agricultural science
11. Food and drug interactions in the context of HIV/AIDS	Home Economics, Nursing		Dietetics, Medical		Medical

ADDENDUM 9: Letter of invitation to reviewers of the Nutrition in HIV/AIDS module

Dear Colleague

In 1999, the Nutrition section at the Department of Medical Sciences at Uppsala University, Sweden, started a Sida financed programme under the heading Global NutrITion for university colleagues from Africa in the field of nutrition. By 2004, over 150 academic teachers in nutrition from 50 countries in Africa, Asia and Latin America had participated in the programme, and continue networking and collaborating via the electronic Global NutrITion network. In 2002, a group of African alumni from the Global NutrITion programme hosted a very successful pan-African congress in Nairobi, Kenya, called ITANA The ITANA e-society was inaugurated at the congress and one of the strategic objectives is the improvement of knowledge, skills and attitudes of target groups in nutrition and modern IT applications through development, implementation and evaluation of long distance training strategies and/or programmes aimed at individuals or institutions. A research project, initiated by SAfrITaN (Southern African IT and Nutrition research group), is the first response to the marked paucity of data in the Southern African region with regard to the use of IT in higher training in nutrition. SAfrITaN receives financial support from Sida from 2003 till 2005.

The SAfrITaN research group include the following, Dr GM Anabwani (Department of Medicine, University of Botswana); Dr CM Chawanje (Department of Applied Sciences, University of Malawi); Prof D Labadarios, Mrs D Marais; Mrs I Labuschagne and Mrs J Visser (Department of Human Nutrition, Stellenbosch University, South Africa); Mr R Kennedy (Department Human Nutrition, Stellenbosch University – previously MEDUNSA, South Africa); Dr TE Sibiya (Faculty of Agriculture, Home Economics Department, University of Swaziland); Dr D Nyirenda (Programme Against Malnutrition, Zambia); Ms M Musukwa (Department of Animal Science, University of Zambia) and Dr A Nkungula (Department of Technical Education, University of Zimbabwe), with technical support from Dr B Ogle (Department of Rural Development Studies, Swedish University of Agricultural Sciences (SLU)); Dr L Chiwona-Karltun (Department of Plant Biology & Department of Rural Development Studies, SLU) and Dr G Westman (Sweden).

The SAfrITaN group has developed a learning material on Nutrition and HIV/AIDS for use in undergraduate training **(including Dietetics, Nutrition, Home Economics/Consumer Sciences, Medicine, Nursing, Agricultural Sciences and Food Science)** in the region. It contains 11 modules as follows:

1. Overview-introduction to HIV/AIDS [Chronology of disease; Etiology; Pathophysiology; Epidemiology; Modes of transmission; Natural course in adults and children; Laboratory diagnosis and monitoring and Classifications]

2. **HIV/AIDS Voluntary Testing and Counselling** [Promotion of testing; Within family disclosure; Other special care situations; Promotion of safe practices; Ethics, confidentiality and stigma; Sexual conduct; STDs; Management of injuries]

3. **Nutrition and infection complex** [Nutrition-immune status in the context of infection; Acute phase response in relation to nutrition; Immunomodulation of the acute phase response by nutrition; Infection-malnutrition linkages; Malnutrition associated morbidity and mortality]

4. **Vicious cycle between nutrition and HIV/AIDS** [Nutritional complications of HIV/AIDS; nutrient requirements; wasting syndrome; Medical complications-cardiovascular, renal failure, opportunistic diseases and other infections, lipodystrophy, CNS and other systemic; complications and the effects on nutritional status]

5. **Nutritional status assessment of PLWHA** [Anthropometry; Biochemical; Clinical; Dietary; Monitoring and evaluation of nutritional status]

6. **Nutritional care and management of PLWHA** [General Nutritional guidelines; Specific Symptomatic interventions: thrush, diarrhoea, nausea, weight loss, lack of appetite, heartburn and distension, fatigue, fat intolerance, taste changes, constipation; Diet analysis - family nutrition therapy; Nutritional supplements, protein, energy, CHOs, fat, micronutrients; Nutritional Support]

7. **Caring for HIV/AIDS through the lifecycle** [Introduction of lifecycle concept; Pregnancy; Infant feeding options and HIV, PMTCT; Child, adolescence, adulthood and elderly; pregnant teenagers, women, involuntarily displaced populations; migrants]

8. **Food hygiene and food safety in the context of HIV/AIDS** [Preparation and storage; Food borne diseases; Water; Personal hygiene; Street foods, convenience foods; Food safety when traveling; HACCP]

9. **Treatment and care practices of HIV/AIDS** [Anti-retroviral Therapy; Models of care and health policies (family care, child care, home based care, community based care, DOT); alternative therapies; Herbal and Dietary supplements; Meditation and Mediation, Traditional Healers, Sangoma, prayer, acupuncture; Safety and efficacy; Self-care, personal hygiene, lifestyle, self-pampering; Advocacy, communication and health promotion

10. **Food Security and Socio-economic Impact of HIV/AIDS** [National and household level food security; Introduction to livelihood analysis and impact of HIV/AIDS]

11. **Food and Drug Interactions in the context of HIV/AIDS** [Drugs for opportunistic infections; Management of food and drug interaction; Symptomatic treatment; Anti-retroviral, HAART; Lipodystrophy syndrome]

The material uses VTS [VTS is a software tool supported by a web-platform which is a free software tool for web-based learning] to impart practical skills in addressing defined specialized issues on the relationship of nutrition and HIV/AIDS. Key features of VTS are that it enables the creation of professional-looking, low-bandwidth interactive teaching material without extensive work or technical knowledge required by the lecturer. It enables material to be presented via the internet or from a CD, hard drive or Local Area Network (LAN) and opens up the possibility of sharing courses on the world-wide web. The most important aspect of this platform is that it was specifically designed for use in developing countries, therefore taking the unique situation and specific constraints of developing countries into account.

You agreed at the ITANA workshop, to provide us with feedback regarding the material. It would be greatly appreciated and please do not feel obliged to evaluate all of the modules unless you have the time. Evaluation of one or two modules where you feel you have more expertise would be greatly appreciated. These modules will be updated according to the comments provided during this testing and evaluation phase and thereafter provided free of charge on the ITANA website. Please would you evaluate according to the following principles and provide feedback using the attached form. All comments and suggestions would be greatly appreciated to further improve on this educational programme.

Dr Britta Ogle
Department of Rural Development Studies (DRDS)
Swedish University of Agricultural Sciences

Name: _____

Modules Reviewed – Please tick the appropriate block

1. Overview- introduction to HIV/AIDS		7. Caring for HIV/AIDS through the lifecycle	
2. HIV/AIDS Voluntary Testing and Counselling		8. Food hygiene and safety in the context of HIV/AIDS	
3. Nutrition and infection complex		9. Treatment and care practices of HIV/AIDS	
4. Vicious cycle between nutrition and HIV/AIDS		10. Food security & socio-economic impact of HIV/AIDS	
5. Nutritional status assessment of PLWHA		11. Food & Drug Interactions in the context of HIV/AIDS)	
6. Nutritional care and management of PLWHA			

Usefulness:
- To the student
- For the lecturer (instead of traditional teaching methodology)
- Of instruction in the user guide and preamble
- Other

Interaction
- Quizzes
- Tasks/Case studies/Activities
- Links to keywords
- Links to documents
- Links to internet sites
- Links to other pages / modules
- Other

Completeness
- All aspects covered in sufficient detail (Depth)
- Other

Scientific correctness
Most recent evidence-based data used
- References
- Additional resources required
- Other

Relevancy
- To the Southern African context
- Of activities ie. Quizzes, tasks, case studies
- Of pictures
- Other

Level correct for undergraduate students
Modules
- Order of modules – logical
- Length of individual modules
- Other

Mode of presentation
- User-friendly
- Speed
- Other

Further comments:

ADDENDUM 10: Evaluation forms for students regarding Nutrition and HIV/AIDS modules

INTERACTIVE CD-ROM-NUTRITION and HIV/AIDS EVALUATION QUESTIONNAIRE-Students

> **Please note that the information provided is anonymous and will be handled confidentially. Results as a whole may be used for congresses and/or publications. By completing this questionnaire you are consenting to partake in the study.**

Section A: Personal Information

1   Age (Years)   [   ]

2   Gender | Male | Female |

3   Country

Botswana	Malawi	South Africa
Swaziland	Zambia	Zimbabwe

4   Category

Home Economics	Dietetics	Nutrition	Medicine
Food science	Agronomy	Animal science	Nursing

Other_____

5   Student category | Undergraduate | Postgraduate |

6   Year of study

1	2	3	4	5	6

Section B: Administrative

1   Please indicate which module(s) you have completed [Select all completed]:

1. Overview-introduction to HIV/AIDS	7. Caring for HIV/AIDS through the lifecycle
2. HIV/AIDS Voluntary Testing and Counselling	8. Food hygiene and safety in the context of HIV/AIDS
3. Nutrition and infection complex	9. Treatment and care practices of HIV/AIDS
4. Vicious cycle between nutrition and HIV/AIDS	10. Food security & socio-economic impact of HIV/AIDS
5. Nutritional status assessment of PLWHA	11. Food & Drug Interactions in the context of HIV/AIDS)
6. Nutritional care and management of PLWHA	

2   **If** you completed **more than 1 module**, did you do the modules in numerical order? | Yes | No |

3   Were the instructions in the preamble sufficient for you to complete the module(s)? | Yes | No |

4   My IT skills were sufficient to complete these modules.

Strongly Agree	Agree	Disagree	Strongly disagree

5   In what format was the module administered [choose only 1]?

CD	online/internet	intranet	hard drive

6   Where **mostly** did you complete the module(s)? [choose only 1]

Home	Classroom	Computer lab	Internet café	Library	Other

7   Did you complete the course or modules …..

in class situation	alone	in small groups

8   When did you complete the module?

During class time	After hours

9   **If** the modules were completed in **class time**, was a facilitator available?

Yes	No

10   **If yes** was the facilitator

Subject lecturer	IT staff	External facilitator	Other

11   How much time did it take you to complete **a module on average** [choose only 1]?

< 1hour	1-2 hours	2-3 hours	> 3 hours

12a   Compared to conventional lectures did you find this mode of learning

Less effective	Equally effective	More effective

12b   Explain why   _____

13a   Would you recommend this HIV module to other students?

Yes	No

13b   Please justify your answer_____

14a   Would you recommend this mode of learning for other courses?

Yes	No

14b   Please justify your answer_____

Section C: Content

1   Considering your year of study, was the level of this module [choose 1 only]?

too basic	appropriate	too difficult	don't know

2a   Was the topic covered?

inadequately	adequately	too much in depth

2b   **If not covered adequately**, please indicate where inadequate and suggest relevant topics/references.

_____

3   Is the HIV/AIDS information in this module sufficient to enable you to take necessary preventative/
treatment action according to your profession or area of interest?

Yes	No	Don't know

4a   Is the HIV/AIDS information in this module appropriate for the specific needs
and cultural context in your country?

Yes	No	Don't know

4b **If no,** please indicate which country specific information or tools should be included

and used to strengthen the module

_____

5	Were you able to answer the questions in the quizzes correctly?	Yes	No	Not applicable

6	Were you able to complete the recommended assignments?	Yes	No	Not applicable

7	Were you able to work through the case studies?	Yes	No	Not applicable

8a	Was this the appropriate time in your training to study this module?	Yes	No

8b **If not,** please recommend when it would be the most suitable time?

_____

9	Did you learn something new about HIV/AIDS and nutrition?	Yes	No

Section D: Mode of Delivery

This course is delivered in Virtual Training Studio mode (VTS):

1 The size of the window was optimal to view the content.

Strongly Agree	Agree	Disagree	Strongly disagree

2 The following are easy to follow and use:

a. Icons	Yes	No
b. Menu tabs	Yes	No

3 The icons were familiar to me.

Strongly Agree	Agree	Disagree	Strongly disagree

4 The colour scheme of the pages/slides was pleasing to the eye

Strongly Agree	Agree	Disagree	Strongly disagree

5 Indicate the links you used?

a. Keywords	Yes	No
b. Internal links	Yes	No
c. External links	Yes	No

6	How useful were the links?	Not useful	Somewhat useful	Very useful

7   How often did you click to see the definition of the keywords?

Never	Seldom	Most of the time	Always

8   If you used internal links, how much time did you spend on the other module or document?

Briefly and returned to active module	Continued in the linked module

9   If you used external links, how much time did you spend on that link?

Briefly and returned to active module	Continued in that link

10   Did you find the internal links?

a. Distractive	Yes	No
b. Useful	Yes	No
c. Time consuming	Yes	No

d. Other: _____

11   Did you find the external links?

a. Distractive	Yes	No
b. Useful	Yes	No
c. Time consuming	Yes	No
d. Costly	Yes	No

e. Other: _____

12   Could you relate to the visuals (video clips/sound/pictures) used?

Yes	No

13   Did the visuals contribute to enhancing/clear understanding?

Yes	No	Sometimes

14   Did the visuals work?

Yes	No

If not explain why _____

15   I enjoyed the presentation and delivery method of this module?

Strongly Agree	Agree	Disagree	Strongly disagree

If not explain why _____

ADDENDUM 11: Knowledge questionnaires for the 8 sub-modules tested (only pre-tests provided as post-tests were the same in a randomly different order)

> Please note that the student number provided will be be handled confidentially. Results as a whole may be used for congresses and/or publications. By completing this questionnaire you are consenting to partake in the study.

PRE-TEST: Food and Drug Interactions in the context of HIV/AIDS
Please answer the following questions by ticking (√) either TRUE or FALSE for EACH question.

1	Human studies have shown that garlic enhances immunity by stimulating lymphocyte proliferation and macrophage phagocytosis.	TRUE	FALSE
2	Clinical signs of the lipodystrophy seen in patients with HIV may include one or more of the following: facial wasting, loss of fat from limbs and buttocks, decreased waist circumference, truncal obesity, "buffalo hump" and increased breast size.	TRUE	FALSE
3	Routine monthly biochemical assessment of patients on ARV therapy include fasting serum triglycerides, total cholesterol and glucose.	TRUE	FALSE
4	A multivitamin and mineral supplement, providing 100-150% of the RDA, is recommended in patients with HIV.	TRUE	FALSE
5	In patients with HIV, the consumption of prebiotics as found in onions, is recommended because they have stool-bulking properties which may help prevent constipation.	TRUE	FALSE
6	Use of protease inhibitors (PI) is associated with increased serum cholesterol and serum triglycerides levels.	TRUE	FALSE
7	It is recommended that all HIV medication is taken with food.	TRUE	FALSE
8	The goal of ARV therapy is both to suppress HIV replication and immune function.	TRUE	FALSE
9	ARV medication in general, may adversely affect nutritional status by increasing appetite, nausea, vomiting, dry mouth, decreased nutrient absorption, impaired nutrient metabolism and increased nutrient losses or requirements.	TRUE	FALSE
10	Food and/or nutrients alter the effectiveness of some ARV drugs by changing their metabolism and excretion, but not their absorption.	TRUE	FALSE
11	Flavor enhancers such as salt, spices, or lemon are thought to be an effective means of managing changes in or loss of taste.	TRUE	FALSE
12	The combination of healthy diet and exercise for HIV patients on ARV therapy is associated with diminished body fat, reversed subcutaneous fat loss and improved metabolic control.	TRUE	FALSE
13	The protease inhibitor, Saquinavir, should be taken within 2 hours of a high fat and calcium meal.	TRUE	FALSE
14	Eating a healthy diet decreases the risk of developing drug-nutrient and/or drug-food interactions.	TRUE	FALSE
15	The combined use of garlic supplements with ARVs is a recommended practice.	TRUE	FALSE
16	Herbal remedies like ginseng are less toxic than ARV medication.	TRUE	FALSE
17	A high energy and protein, low fat diet decreases the absorption of Indinavir and AZT.	TRUE	FALSE
18	The lipodystrophy (LD) syndrome seen in patients with HIV is associated mostly with the use of protease inhibitors (PI).	TRUE	FALSE
19	Supplementation with the Hypoxis plant extract (The African Potato) in HIV positive patients has been shown to increase bone marrow activity.	TRUE	FALSE
20	ARVs are not curative, but do decrease viral load, slow the progression of the disease, increase life expectancy and improve the quality of life of HIV positive patients.	TRUE	FALSE

STUDENT NO: _____

POST-TEST: Food hygiene and food safety in the context of HIV/AIDS

Please answer the following questions by ticking (√) either TRUE or FALSE for EACH question.

1	Symptoms of salmonella food contamination, e.g. diarrhoea, usually start 2 to 5 days after eating the contaminated food	TRUE	FALSE
2	Cholera, caused by *Vibrio cholerae*, is a severe infectious disease which is endemic in most tropical countries, and results in diarrhoea	TRUE	FALSE
3	Symptoms of campylobacter food contamination, e.g. diarrhoea, usually start 2 to 5 days after eating the contaminated food	TRUE	FALSE
4	Prior thorough washing of hands with soap and warm water before between touching raw and cooked food is the only important consideration in food hygiene	TRUE	FALSE
5	The NON-GRAS compounds are additives that are yet to be tested as safe	TRUE	FALSE
6	It is not safe to add raw eggs to milk shakes	TRUE	FALSE
7	The HACCP Plan involves 9 principles	TRUE	FALSE
8	Food hygiene practices aim to prevent contamination in food preparation areas, prevent micro-organisms from multiplying in food and reaching dangerous levels	TRUE	FALSE
9	A critical limit may be a value of pH, temperature, time, limits in microbiological growth criteria, level of cleanliness or levels of chlorine	TRUE	FALSE
10	Botulism is the deadliest type of food poisonings	TRUE	FALSE
11	To sterilize water taken from a river or well, one can add 2 teaspoons of bleach to 25 litres of water	TRUE	FALSE
12	It is safe to use unpasteurised milk	TRUE	FALSE
13	Raw and undercooked chicken, meat, fish, eggs, unpasteurised milk, and non-tap water hold the highest contamination risk	TRUE	FALSE
14	The temperature danger zone is 45-150°F	TRUE	FALSE
15	Although *Escherichia coli* food contamination is the cause of a distinctive form of gastroenteritis, many strains of *E.coli* live peacefully in the gut	TRUE	FALSE
16	When washing dishes, it is the soap and not the heat of the water which is more important for hygiene	TRUE	FALSE
17	A Critical Control Point indicates a point, step or procedure at which control is essential to prevent/eliminate a food safety hazard, and not only to reduce it to an acceptable level	TRUE	FALSE
18	Foods most often associated with salmonellosis include unpasteurised milk, cheese and raw or uncooked meat, poultry and fish	TRUE	FALSE
19	HIV/AIDS can be spread by food and sharing eating utensils like cups, plates, knives and forks which have been used by HIV-infected people	TRUE	FALSE
20	Foods most commonly found to contain *Listeria* include unpasteurised milk, cheese and raw or uncooked meat, poultry and fish	TRUE	FALSE

STUDENT NO: _____

Please note that the student number provided will be be handled confidentially. Results as a whole may be used for congresses and/or publications. By completing this questionnaire you are consenting to partake in the study.

PRE-TEST: Nutrition and HIV/AIDS

Please answer the following questions by ticking (√) either TRUE or FALSE for EACH question.

1	Cracked nipples, mastitis and breast abscesses do not increase the risk of HIV transmission through breastmilk	TRUE	FALSE
2	One of the major advantages of the 2000 CDC growth charts is that breastfed infants were represented in the sample	TRUE	FALSE
3	Disclosure to family and friends is essential for peace of mind of an HIV positive person	TRUE	FALSE
4	There is strong evidence that viral load increases the risk for transmission during pregnancy	TRUE	FALSE
5	Alcoholic beverages should be limited to 1 drink per day for women and 2 drinks per day for men living with HIV/AIDS	TRUE	FALSE
6	Compliance in children who are on ARV treatment is better than that in adults	TRUE	FALSE
7	Anorexia commonly occurs in HIV/AIDS and is often exacerbated by opportunistic infections and medication	TRUE	FALSE
8	The adolescent and adult segments of the population are at the highest risk of becoming HIV positive as a result of life style habits	TRUE	FALSE
9	The US Food and Drug Administration approved the use of AZT in 1987 after clinical trials showed that it was an effective anti-retroviral agent and that it lengthened life expectancy	TRUE	FALSE
10	Growth faltering is diagnosed when a child's weight does not increase for 2 consecutive months	TRUE	FALSE
11	The loss of protein from lean body tissue in HIV patients increases the protein requirement by up to 21%	TRUE	FALSE
12	Oral thrush from Candida infection may occur when the CD4+ count is >300/microlitre	TRUE	FALSE
13	Complimentary medicine such as aromatherapy is used together with conventional medicine, to help lessen the patients' discomfort	TRUE	FALSE
14	Staple foods like cereals, starchy roots and starchy fruits should make up the largest part of a meal	TRUE	FALSE
15	Blood levels of Vitamin A, Vitamin B12, Selenium and Zinc should be monitored regularly since they have been associated specifically with the progression of HIV infection	TRUE	FALSE
16	Weight loss without a known cause is a diagnostic feature of HIV-infection	TRUE	FALSE
17	Chronic diarrhoea may persist in HIV-infected people even when there is no evidence of a pathogenic organism altering small bowel function with associated atrophy of the villi	TRUE	FALSE
18	As a result of the nausea and vomiting caused by infections and medication in HIV-infected people, restriction of salt intake is not recommended at all	TRUE	FALSE
19	Follow-up nutritional status assessments should be considered 1-2 times per year for symptomatic HIV/AIDS patients	TRUE	FALSE
20	Itchy skin is a common symptom that care givers need to alleviate otherwise patients may scratch and cause further wounds	TRUE	FALSE
21	HAART (highly active antiretroviral therapy) is a term for a potent combination anti-HIV treatment, usually with four or more drugs from different classes	TRUE	FALSE
22	It is important to drink at least 4 glasses of safe, clean water every day	TRUE	FALSE
23	Impaired immune function increases infection rates and is associated with loss of lean body mass, anorexia and hypermetabolism, which leads to malnutrition	TRUE	FALSE
24	The home-made recipe for oral rehydration fluid is 1 liter boiled cooled water, 6 teaspoons sugar and ½ teaspoon salt	TRUE	FALSE
25	Fats and oils are good sources of energy and can help one gain body weight, properties which can be particularly important for people living with HIV/AIDS	TRUE	FALSE
26	Although oxidative stress lies at the heart of HIV disease, excessive antioxidant supplementation is not recommended	TRUE	FALSE
27	A 24-hour dietary recall using a standardized list of foods and food portion sizes assesses a person's habitual diet	TRUE	FALSE

28	The appendix is one of the organs with specialised functions for the development and maturation of the cellular elements of the immune system	TRUE	FALSE
29	Some of the herbal remedies recommended by traditional healers alleviate discomfort, such as nausea, headaches, diarrhoea	TRUE	FALSE
30	Basophils are classified as T-cells	TRUE	FALSE
31	One of the differences between non-specific and specific immunity is that there is a lag time between exposure and response in specific immunity, whereas the response is immediate for non-specific immunity	TRUE	FALSE
32	A total lymphocyte count of <1800 cells per microlitre suggests a deficit in the visceral protein compartment, which subsequently leads to an abnormal hypersensitivity response to antigens	TRUE	FALSE
33	It is difficult to determine the HIV status of an infant after birth as the infant of an infected mother may have maternal antibodies in his/her blood until 12 months of age	TRUE	FALSE
34	The Malnutrition Universal Screening Tool is a five-step screening tool which identifies children and adults who are malnourished or at risk of undernutrition	TRUE	FALSE
35	B- and T-cells originate and mature in the bone marrow	TRUE	FALSE
36	The Alternative medicine approach implies that a patient uses some other therapy which has been recommended by a conventional doctor in place of conventional medicine	TRUE	FALSE
37	It is unlikely that irregular ARV use would induce drug resistance	TRUE	FALSE
38	Vitamin B12 supplementation has been shown to improve both immune cell counts and natural killer cell activity in people with clinically significant vitamin B12 deficiency	TRUE	FALSE
39	Cytokines are hormone-like proteins which regulate the intensity and duration of the immune response and are involved in cell-to-cell communication	TRUE	FALSE
40	Serum albumin levels below 32g/L could predict mortality	TRUE	FALSE
41	It is estimated that 50% of the 40 million people living with HIV/AIDS are in the 15-24 year age group	TRUE	FALSE
42	A fresh oral rehydration solution should be made every day	TRUE	FALSE
43	A mid-arm circumference of <12.5cm in children between the age of 6-59 months indicates wasting	TRUE	FALSE
44	A greater resistance to growth hormone in men seems to result in larger loss of lean body tissue and sparing of fat tissue when compared with women who tend to lose more body fat than lean body tissue	TRUE	FALSE
45	Helper T cells express CD8 molecules and are differentiated into inflammatory Th1 cells which eliminate pathogens from the vesicular system and Th2 cells which are required for antibody synthesis by B cells against T-dependent antigens of extracellular pathogens	TRUE	FALSE
46	Pain alleviation in those suffering from HIV is intricate involving emotions in terms of anger, depression and anxiety but not physical pain	TRUE	FALSE
47	Aloe is recommended for use in people living with HIV	TRUE	FALSE
48	Mothers are often unsure that their breastmilk is enough for their baby. The production of breastmilk is dependent on the number of times the baby is put to the breast for feeding and not on the mother's nutritional status	TRUE	FALSE
49	The use of a daily multivitamin supplement, including vitamin A, is recommended in HIV/AIDS because of the beneficial immunomodulation of such supplements	TRUE	FALSE
50	Prophylactic treatment against Candida infections is recommended in HIV-infected patients	TRUE	FALSE
51	Health care workers should be aware that special risk groups for HIV include not only sex workers and their clients or intravenous drug users but also refugees/migrants and street children	TRUE	FALSE
52	Fat malabsorption and steatorrhoea are prominent symptoms early in HIV disease	TRUE	FALSE
53	People living with HIV/AIDS are recommended to do at least 30 minutes of exercise at least 3 times a week	TRUE	FALSE
54	Severe weight loss is diagnosed by a 15% loss of body weight in one month and indicates the onset of clinical AIDS	TRUE	FALSE
55	The severity of growth failure among HIV-positive children is associated with reduced survival	TRUE	FALSE
56	IL-1, TNF, IL-6 are anti-inflammatory cytokines	TRUE	FALSE
57	Eating smaller meals more often together with drinking of fluids mainly after and in between meals may improve appetite	TRUE	FALSE
58	No single food contains all the nutrients that our bodies need throughout our lifecycle	TRUE	FALSE
59	As little as 5% weight loss has been found to be associated with increased risk of opportunistic infections and HIV/AIDS associated death	TRUE	FALSE
60	It has been shown that only Vitamins A, C, B6, B12 and folate play an important role in the immunodysfunction of malnutrition	TRUE	FALSE

61	Oral iron supplementation is recommended for iron deficiency anaemia in the presence of severe protein energy malnutrition, in the very low birth weight infant, and in the presence of bacterial infections	TRUE	FALSE
62	Acquired immunity relies on the properties of the C- and T-cells respectively for protection against extra- and intra-cellular invading pathogens	TRUE	FALSE
63	In general terms, adult energy requirements are 45 kCal per kilogram per day if severe weight loss has occurred	TRUE	FALSE
64	Cytokines are responsible for the increase in energy expenditure, gluconeogenesis, lipolysis, decreased vascular permeability and skeletal muscle proteolysis	TRUE	FALSE
65	It is well-documented that children born to HIV positive mothers are more likely to have a low birth weight	TRUE	FALSE
66	Innate / non-specific immunity is the first line of defense against invading microorganisms, eliciting the same response on re-exposure to the same pathogen	TRUE	FALSE
67	Enteral nutrition using liquid feeds should be considered when an adequate nutrient intake cannot be achieved by foods taken orally	TRUE	FALSE
68	A single weight rather than the trend on a child's growth chart should be used for the interpretation of nutritional status in children	TRUE	FALSE
69	Reduced food intake is the major contribution to weight loss in HIV/AIDS	TRUE	FALSE
70	Adding 125 ml of full cream milk, 2 tablespoons of peanut butter and 2 teaspoons of sugar to 200g of cereal would double the energy provided, as compared to the cereal alone	TRUE	FALSE
71	The acute phase response is elicited by any injurious influence on the body be it trauma or a noxious substance or infection	TRUE	FALSE
72	In the absence of breastfeeding during the first 2 months of life, an infant is nearly 4 times more likely to die from diarrhoea, and/or respiratory and other infections	TRUE	FALSE
73	Constipation can be prevented by eating more insoluble fibre, which can be found in such foods as raw vegetables and fruit, dried fruit, wholemeal dark bread, whole-grain cereals, nuts and seeds	TRUE	FALSE
74	In patients on ARV therapy, waist and hip circumferences should be measured in addition to weight measurement	TRUE	FALSE
75	Infection in itself elicits the acute phase response, which further deteriorates nutritional status through various cytokine mediated mechanisms	TRUE	FALSE
76	Some of the drugs used in the prevention of opportunistic infections, have adverse effects (e.g. diarrhoea) which may influence nutritional status	TRUE	FALSE
77	In an asymptomatic HIV-infected adult, the daily energy intake should be increased by 20-30% to maintain body weight	TRUE	FALSE
78	After the age of 6 months a combination of a wide variety of foods should also be given to an infant three times per day	TRUE	FALSE
79	Zinc supplementation has been found to be especially beneficial in significantly decreasing both the mean daily number of watery stools as well as the number of days with watery diarrhoea	TRUE	FALSE
80	Legumes, dried beans, peas, lentils, nuts or soya are poorer protein quality sources than animal foods, such as beef and chicken	TRUE	FALSE
81	The Frankfurt plane indicates that the top of the external auditory meatus (ear canal) should be higher than the inferior margin of the bony orbit (cheek bone)	TRUE	FALSE
82	The South African guidelines on breastfeeding by HIV positive mothers recommend that the risk associated with not breastfeeding should be less than the potential risk of HIV transmission through breastmilk	TRUE	FALSE
83	The malnutrition associated with HIV/AIDS is thought to contribute to the frequency but not the severity of opportunistic infection and/or HIV disease progression	TRUE	FALSE
84	In the case of HIV, nutritional status is strongly predictive of survival and functional status	TRUE	FALSE
85	The rate of sexual transmission of HIV is reduced by 65% through the use of condom intervention	TRUE	FALSE
86	During a clinical examination of HIV patients, lymph nodes must be examined	TRUE	FALSE
87	A BMI of 16.5 indicates moderate thinness	TRUE	FALSE
88	It is essential that home carers wear surgical gloves at all times while working with their HIV patients	TRUE	FALSE
89	It is only severe zinc deficiency that is known to reduce thymic hormone production and activity, the numbers of CD4+ cells and suppression of immune function	TRUE	FALSE
90	St John wort is recommended for treating depression in HIV patients	TRUE	FALSE

91	It has been confirmed that high dose vitamin A supplementation, in certain vulnerable populations, can reduce mortality, but has no beneficial effects on respiratory infection-associated morbidity and mortality in adults	TRUE	FALSE
92	AIDS dementia which includes loss of concentration, memory and language has been reported in up to 35% of people with HIV disease	TRUE	FALSE
93	Lymphomas that involve the small bowel can lead to malabsorption, diarrhoea and intestinal obstruction	TRUE	FALSE
94	Sugar and sugar-containing foods should be avoided by people living with HIV/AIDS	TRUE	FALSE
95	Current recommendations on the use of multi-micronutrient supplements indicate that the composition of such supplements should be at levels not exceeding twice the RDA	TRUE	FALSE
96	In the USA, 10% of all reported AIDS cases occur in the population group of 50 years and older	TRUE	FALSE
97	It is currently recommended that if the HIV+ mother chooses to exclusively breastfeed her baby, she should do so for up to 3 months only	TRUE	FALSE
98	In HIV disease loss of body cell mass is the best predictor of death and death becomes imminent when approximately 66% of lean body tissue has been lost	TRUE	FALSE
99	Vegetables and fruits are an important part of a healthy and balanced meal	TRUE	FALSE
100	Religion plays no role in the treatment of HIV	TRUE	FALSE
101	B-cells are involved in humoral immunity which is mediated by antibodies	TRUE	FALSE
102	"Chambe" as provided by some traditional healers, has been accepted as an adjunct to ARV treatment in South Africa and Malawi	TRUE	FALSE
103	Recreational drug use in South Africa is extensive and it is well documented that such a practice enhances HIV transmission by 15%	TRUE	FALSE
104	Palliative care is an approach, which improves the quality of life of patients through the prevention, assessment and treatment of pain and other physical, psychosocial and spiritual problems	TRUE	FALSE
105	Various studies have shown conclusively that magnesium supplementation is recommended in HIV-infected patients	TRUE	FALSE
106	A clinical assessment should include the evaluation of the presence of diarrhoea and symptoms of gastrointestinal distress	TRUE	FALSE
107	It is estimated that 4% of infants of HIV-positive mothers, may become infected through breastfeeding	TRUE	FALSE
108	Children older than 1 year of age may be given undiluted cow's milk and other dairy foods	TRUE	FALSE
109	In severe cases of diarrhoea, the daily fluid intake recommended is up to three litres	TRUE	FALSE
110	When diarrhoea occurs, large amounts of water and electrolytes can be lost from the body and these have to be replaced in order to prevent dehydration	TRUE	FALSE
111	If taken correctly, HAART (highly active antiretroviral therapy) reduces the viral load usually to undetectable levels within six months of treatment	TRUE	FALSE
112	There is strong evidence that caesarian delivery increases the risk for transmission during labour	TRUE	FALSE
113	Exclusive breastfeeding is defined as giving an infant no other food or drink, not even water or expressed breast milk, with the exception of drops or syrups consisting of vitamins and mineral supplements or medicines	TRUE	FALSE
114	It is estimated that 10-25% of infants of HIV-positive mothers, may become infected during pregnancy and delivery	TRUE	FALSE
115	Wet-nursing is a safe infant feeding option if the mother does not want to breastfeed her baby	TRUE	FALSE
116	Mixed feeding increases the risk of HIV transmission from infected breastmilk	TRUE	FALSE
117	Kaposis sarcoma does not affect nutritional status directly because it is the chemotherapy for cancer treatment which suppresses the already compromised immune system, thereby influencing nutritional status	TRUE	FALSE
118	Changing the position of the bedridden sick person every 4 hours may prevent bed sores	TRUE	FALSE
119	Baseline nutritional status assessment should be considered a standard of care for all HIV-infected individuals in order to identify those at nutritional risk	TRUE	FALSE
120	Erythroblasts originate in the blood	TRUE	FALSE

STUDENT NO: _____

ADDENDUM 12: Ethics approval for SAfrITaN research programme

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot • your knowledge partner

13 Desember 2004

Mev D Marais
Departement Menslike Voeding

Geagte mev Marais

NAVORSINGSPROJEK: **"INFORMATION TECHNOLOGY WITH A HUMAN FACE: A COLLABORATIVE RESEARCH PROJECT TO IMPROVE HIGHER NUTRITION TRAINING IN SOUTHERN AFRICA"**
PROJEKNOMMER : **N04/09/159**

My brief van 27 September 2004 verwys.

Ek bevestig graag hiermee dat die Komitee vir Mensnavorsing die goedkeuring van bogenoemde projek deur die Voorsitter, op sy vergadering van 15 November 2004 bekragtig het.

Met vriendelike groete

CJ VAN TONDER
NAVORSINGSONTWIKKELING EN -STEUN (TYGERBERG)

CJVT/ev