COMPUTER-RELATED MUSCULOSKELETAL DYSFUNCTION AMONG ADOLESCENT SCHOOL LEARNERS IN THE CAPE METROPOLITAN REGION

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DECLARATION

“I, the undersigned, hereby declare that the work contained in this thesis is my original work and that I have not previously in its entirety or in part submitted it at any university for a degree.”

Signature:…… **Date:……**

ABSTRACT

INTRODUCTION

Computer use has been identified as a risk factor for the development of musculoskeletal dysfunction among children and adolescents internationally. Computer exposure has increased in the Western Cape since 2002, with the inception of a project to install computer laboratories in all schools in the province. As musculoskeletal dysfunction experienced during adolescence is predictive of musculoskeletal disorders in adulthood, it is essential to identify all risk and/or associative factors.

METHODOLOGY

A descriptive study was conducted with the aim to investigate whether the musculoskeletal dysfunction of high school learners in the Cape Metropolitan region was related to their computer use. This study was conducted in two phases. Phase 1 of the study entailed the completion of a new questionnaire, the Computer Usage Questionnaire, by grade 10-12 learners. The learner sample was divided in a computer and a non-computer group depending on their exposure to the school computer. Phase 2 of the study involved the assessment of the ergonomic design of the computer laboratories at randomly selected high schools within the Cape Metropolitan region.

RESULTS

A total of 1073 learners (65% girls & 35% boys), aged 14-18 years, completed the CUQ in phase 1 of the study. The results indicated that learners in the computer group had greater weekly exposure to computers than the non-computer group. The prevalence of musculoskeletal dysfunction among this learner sample was 74%. The most common body areas of dysfunction were the head, low back and neck. The female gender, playing sport and using the school computer for more than three years were associated with musculoskeletal dysfunction. Weekly computer use of more than seven hours was predictive of general musculoskeletal dysfunction, low back pain and neck pain.

Twenty nine computer laboratories within 16 selected high schools were assessed by means of the Computer Workstation Design Assessment (CWDA). Out of a total score of 40, the computer laboratories obtained average scores of less than 45%, indicating compliance with less than half of the standard ergonomic requirements.

The average scores for the workspace environment was less than 40%. The design of the desk, chair and computer screen had the poorest compliance to ergonomic guidelines.

DISCUSSION AND CONCLUSION

The prevalence of musculoskeletal dysfunction among this sample was higher than among other similar samples on the same study topic. The higher prevalence may be attributed to the poor ergonomic design of the computer laboratories in the Cape Metropolitan region. Learners' reduced participation in activities such as sport and working on a computer due to their musculoskeletal dysfunction, may impact on their choice of a future career. The tendency of learners not to seek medical advice for their musculoskeletal dysfunction may predispose the development of chronic musculoskeletal disorders.

Education of related parties on safe computing habits as well as advice on the ergonomic design of computer laboratories is recommended to prevent the progression of adolescent musculoskeletal dysfunction into chronic disorders in adulthood.

ABSTRAK

INLEIDING

Internasionaal is rekenaargebruik geïdentifiseer as een van die risiko faktore vir die ontwikkeling van muskuloskeletale disfunksie by kinders and adolesente. Sedert 2002 het die blootstelling aan rekenaars in die Wes Kaap toegeneem met die instelling van ‘n projek om rekenaarlaboratoria in alle skole van die provinsie te installeer. Dit is noodsaaklik om alle risiko- en/of bydraende faktore te identifiseer aangesien muskuloskeletale disfunksie wat tydens adolessensie ervaar word, aanduidend is van muskuloskeletale toestande tydens volwassenheid.

METODOLOGIE

‘n Beskrywende studie was uitgevoer met die doel om vas te stel of die muskuloskeletale disfunksie van hoërskool leerders in die Kaapse Metropool verband hou met hul rekenaargebruik. Hierdie studie het uit twee fases bestaan. Fase 1 van die studie het die voltooiing van ‘n nuwe vraelys, die Rekenaargebruikvraelys (RGV), deur graad 10-12 leerders, behels. Die leerder groep was opgedeel in ‘n rekenaar- en ‘n nie-rekenaargroep afhangend van hul blootstelling aan die skoolrekenaar. Fase 2 van die studie het die evaluering van die ergonomiese ontwerp van die rekenaarlaboratoria behels by ewekansig-geselekteerde skole binne die Kaapse Metropool.

RESULTATE

‘n Totaal van 1073 leerders (65% dogters & 35% seuns), wie 14-18 jaar oud was, het die RGV voltooi. Die resultate het aangedui dat leerders in die rekenaargroep meer weeklikse blootstelling aan rekenaars gehad het as die nie-rekenaargroep. Die prevalensie van muskuloskeletale disfunksie by hierdie leerder proefgroep was 74%. Die mees algemene liggaamsareas van disfunksie was die kop, lae rug en nek. Die vroulike geslag, speel van sport en skoolrekenaargebruik van meer as drie jaar was aanduidend vir algemene muskuloskeletale disfunksie, lae rugpyn en nekpyn. Weeklikse rekenaargebruik vir meer as sewe ure was aanduidend van algemene muskuloskeletale disfunksie, lae rugpyn en nekpyn.

Fase 2 van die studie het die assessering van 29 rekenaarlaboratoria behels binne 16 skole d.m.v. die Rekenaar Werkstasie Ontwerp Assessering (RWOA). Uit ‘n totale telling van 40, het die rekenaarlaboratoria tellings van minder as 45% behaal, wat aandui dat aan minder as die helfte van die standaard ergonomiese vereistes voldoen is.
Die gemiddelde tellings vir die werkstasie omgewing was minder as 40%. Die evaluering van die tafel, stoel en rekenaarskerm het die minste aan ergonomiese riglyne voldoen.

BESPREKING EN AFSLUITING

Die prevalensie van muskuloskeletale disfunksie in hierdie proefgroep was hoër as vir soortgelyke proefgroepe op dieselfde studie onderwerp. Dit mag toegeskryf word aan die swak ergonomiese ontwerp van die rekenaarlaboratoria in die Kaapse Metropool. Leerders se verminderde deelname aan aktiwiteite soos sport en werk op ‘n rekenaar a.g.v. hul muskuloskeletale disfunksie, mag hul keuse van ‘n toekomstige beroep beïnvloed. Die neiging van leerders om nie mediese advies te verkry vir hul muskuloskeletale disfunksie nie, mag hulle predisponeer tot die ontwikkeling van chroniese muskuloskeletale toestande. Onderrig van die betrokke partye i.t.v. veilige rekenaargewoontes, sowel as advies oor die ergonomiese ontwerp van rekenaarlaboratoria word aanbeveel om te progressie van adolesente muskuloskeletale disfunksie tot chroniese toestande in volwassenheid te voorkom.

CONTENTS

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- My family for teaching me good values and principles.
- The best friends in the world, for making me laugh and keeping me grounded.

DEDICATION

I dedicate this thesis to the memories of:

- My grandmother, Maria Dorothea Smith

&

- My best friend, Adean Dirks

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GLOSSARY

- Adolescent: Aged 13-18 years.
- Anthropometrics: Measurements of the human body and its components.
- CAT: Computer Application Technology.
- CCEI: Computerized Classroom Environment Inventory.
- Computer group: School learners using computer for curriculum delivery of school subjects three or more times per week.
- Computer Laboratory: Classroom with a number of workstations used for curriculum delivery of school subjects.
- Computer Studies: School subject delivered by means of computers
- Computer workstation: The furniture and computer equipment at one station.
- Compu-typing: School subject delivered by means of computers.
- CUQ: Computer Usage Questionnaire. A measurement tool for assessing musculoskeletal dysfunction among school learners.
- CWDA: Computer Workstation Design Assessment.
- EMDC: Education and Management Development Centre.
- Ergonomics: The science concentrating on the study of the person in his/her working activities in the work and home environment.
- Khanya Project: WCED initiative to install computer laboratories in all schools of the Western Cape.
- Musculoskeletal System: All soft tissue structures (i.e. muscles, fascia, ligaments, tendons, skin, cartilage) and bony components.
- Musculoskeletal Dysfunction: Refers to pain, discomfort, stiffness, aching, pins and needles or tingling originating in structures of the musculoskeletal system.
- Non-computer group: School learners using the school computer for curriculum delivery less than three times per week.
- Posture: A term that indicates the relative position of the body segments during rest or activity (Twomey & Taylor 2000).
- WCED: Western Cape Education Department.

CHAPTER 1
INTRODUCTION

Musculoskeletal pain among children and adolescents is a world-wide phenomenon. The prevalence of musculoskeletal dysfunction among South African, African and international learner samples, ranges between 13% and 86% (Petersen, Brulin & Bergstrom 2006; Bejia, Abid, Ben Salem, Letaief, Younes, Touzi & Bergaoui 2005; Puckree, Silal & Lin 2004; Prista, Balague, Nordin & Skovron 2004; Mikkelsson, Salminen & Kautiainen 1997). These statistics of children and adolescents correlates with results from published studies conducted on adult samples (Hupert, Amick, Fossel, Coley, Robertson & Katz 2004; Cook, Burgess-Limerick & Chang 2000 and Evans & Patterson 2000).

Musculoskeletal pain experienced during childhood and adolescence is the main predictor for musculoskeletal dysfunction in adulthood (Brattberg 2004 and Leboeuf-Yde & Kyvik 1998). Among the adult workforce, musculoskeletal dysfunction is the main reason for health-related work disorders, leading to reduced worker productivity and increased financial expenditure due to medical costs and disability claims (European Labour Force Survey 1999 and Morse, Dillon, Warren, Levenstein & Warren 1998). In order to address the high prevalence of musculoskeletal dysfunction among children and adolescents and prevent increasing disability in adulthood, it is imperative to identify risk- and associative factors for the development of musculoskeletal dysfunction.

A number of risk factors for the development of adolescent musculoskeletal dysfunction have been identified (Trevelyan & Legg 2006 and Balague, Troussier & Salminen 1999). These risk factors include psychosocial factors (Siivola, Levoska, Latvala, Hoskio, Vanharanta, & Keinanen-Kiukaanniemi 2004), competitive sports (Harreby, Nygaard, Jessen, Larsen, Storr-Paulsen, Lindahl, Fisker & Laegaard et al. 1999), poor ergonomic design of school furniture (Murphy, Stubbs & Buckle 2004) and computer use (Hakala, Rimpela, Saarni, & Salminen 2006). Aspects of computer use that are related to musculoskeletal dysfunction include the frequency and duration of computer use (Hakala et al. 2006), the posture assumed at the workstation (Greig, Straker & Briggs 2005 and Laeser, Maxwell & Hedge 1998) and the furniture or equipment provided at the computer workstation (Zandvliet & Straker 2001).

It has been reported that the prevalence of musculoskeletal dysfunction is directly proportional to learners' exposure to computers (Hakala et al. 2006, Alexander & Currie 2004, Sjolie 2004, and Burke & Peper 2002). Learners, who use computers more frequently and for longer periods at a time, are more prone to develop musculoskeletal dysfunction (Hakala et al. 2006, Alexander & Currie 2004, and Harris & Straker 2000). During prolonged postures and repetitive activities, such as computer use, certain muscles and joints are loaded differently (Kumar 2001). Muscles will develop different amounts of fatigue depending on the posture and activities and eventually lead to altered muscle kinetics and joint kinematics. These changes will cause an abnormal loading pattern according to the design of the joint (Kumar 2001). Continuation of these static postures and repetitive activities may lead to cumulative fatigue of the muscles, with reduced stress-bearing capacity of tissues, which may precipitate injury and pain (Kumar 2001).

Body areas that are typically affected during computer use include the low back, neck and shoulder regions (Hakala et al. 2006, Alexander & Currie 2004 and Burke & Peper 2002). These mentioned areas are especially vulnerable to external factors during the fast growth spurt of puberty. Abnormal loading of musculoskeletal structures during this phase of adolescents' development may lead to altered joint kinetics and kinematics and cause dysfunction (LeResche, Mancl, Saunders & Korff 2005, Kumar 2001 and Neinstein 1996). During computer use, the postures of the low back, neck and shoulder regions are influenced by the furniture at the computer workstation (Milanese & Grimmer 2004 and Murphy et al. 2004).

The components of the computer workstation include the chair, desk, computer screen, keyboard and input device (e.g. mouse). Ideally, the various components of the computer workstation should be adjustable to allow for safe use by learners of different ages and different anthropometrics (Milanese & Grimmer 2004; Bennett 2002 and Zandvliet & Straker 2001). Workstations that do not have adjustable features, will cause learners to adapt their postures to suit the environment in which they are working as well as the type of activity they are engaged in (Greig et al. 2005 and Laeser et a. 1998). Learners' awkward or constraint postures may lead to overload of muscles, ligaments and tendons and asymmetrical loading of joints, predisposing them to dysfunction (Kumar 2001).

Studies conducted on school learners using computers have focused on two main areas of intervention. The first area of intervention is concerned with the ergonomic design of the computer workstation to improve learners' postures and reduce musculoskeletal complaints. It has been advised that the heights of the chair, desk and computer screen has to be adjustable to allow for different heights of learners to assume a safe posture at the workstation (Milanese & Grimmer 2004 and Straker, Briggs & Greig 2002). If either the chair or the desk is too low, or the screen is too high, it will cause learners to assume a posture with a posterior pelvic tilt, increased thoracic kyphosis and a forward chin position (Murphy et al. 2004, Milanese & Grimmer 2004 and Straker et al. 2002). Increased thoracic kyphosis has been associated with low back pain (Murphy et al. 2004 and Milanese & Grimmer 2004) and excessive cervical extension with neck and upper limb dysfunction (Straker et al. 2002). It has been recommended that the keyboard should be placed on a separate tray below the level of the elbow, to prevent awkward postures of the neck and shoulders which will strain soft tissue structures, causing inflammation and pain (Kumar 2001).

The second area of intervention focused on educating learners on ergonomic principles of computer use. It has been reported that education of children on good posture, body mechanics and ergonomics has had a valuable impact on learners' knowledge of back care principles. Learners also seem to retain this ergonomic knowledge over a long period and thus obtain long term benefit from the intervention (Cardon, De Bourdeaudhuij & De Clercq 2002 and Shinn, Romaine, Casimano & Jacobs 2002).

Computer exposure is beneficial to learners as they become computer literate at an early age and develop technological skills that can be used in their tertiary education and future careers (Subrahmanyam, Greenfield, Kraut & Gross 2001 and Becker 2000). Statistics South Africa reported (*Census at School* 2002) that 25% of South African school learners had access to computers in schools by 2001. Computer exposure in schools of the Western Cape has expanded since 2002, with the inception of the Western Cape Education Department (WCED) initiative, the Khanya Project (WCED 2006). The Khanya Project aims to aid learners' computer knowledge, but also to address severe shortages of educators. By November 2006 613 schools have had computer laboratories installed for curriculum delivery of certain school subjects, with more than half of the learner population of the Western Cape already benefiting from the project (Khanya Project 2006).

A review of 11 databases in June 2005, via the medical library of Stellenbosch University, retrieved no published literature on the impact of computer exposure on the musculoskeletal health of South African school learners. Due to the predictive nature of adolescent musculoskeletal dysfunction for musculoskeletal disorders and disability in adulthood (Leboeuf-Yde & Kyvik 1998), it is necessary to determine whether adolescents in the Western Cape have musculoskeletal dysfunction and to determine associative and risk factors. The main aim of this study is thus to determine whether the musculoskeletal dysfunction of high school learners is related to their computer exposure.

CHAPTER 2
A SYSTEMATIC REVIEW

INTRODUCTION

A systematic review on the prevalence of computer-related musculoskeletal dysfunction among children and adolescents will be presented in this chapter. This review was conducted between July and September 2006. The process of conducting the review, the analysis of obtained data and the implications of these results will be presented in this chapter**.**

Children's exposure to computers and other information technology devices may predispose them to similar or even more severe musculoskeletal disorders in adulthood (Barrero & Hedge 2002). Musculoskeletal dysfunction experienced during childhood and adolescence is the main predictor of musculoskeletal disorders in adulthood (Brattberg 2004 and Leboeuf-Yde & Kyvik 1998). Among the adult population musculoskeletal dysfunction is the main cause of work-related health problems, with negative implications for their social and economic well-being (European Labour Force Survey 1999 and Morse et al. 1998).

Computer exposure has been identified as one of the risk factors for the development of musculoskeletal dysfunction among children and adolescents (Hakala et al. 2006 and Alexander & Currie 2004). The available literature on children's musculoskeletal dysfunction is divided upon whether computer exposure is a risk factor or not. A number of studies reported positive associations between computer exposure and musculoskeletal dysfunction (Zapata, Moraes, Leone, Dario-Filho & Silva 2006; Ramos, James & Bear-Lehman 2005; Sjolie 2004; Jacobs & Baker 2002 and Jones & Orr 1998). However, insignificant findings were reported on the impact of computer exposure on musculoskeletal pain among Dutch and Danish learner samples (Diepenmaat, Van der Wal, De Vet & Hirasing 2006 and Harreby et al. 1999). A large epidemiological study conducted recently in Finland, identified computer exposure of 2-3 hours and more than 5 hours as a risk factor for the development of neck/ shoulder and low back pain, respectively (Hakala et al. 2006).

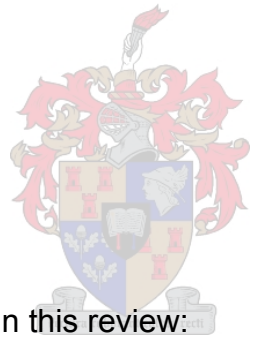
The aim of this systematic review was thus to assess the current literature and to determine whether computer exposure has an impact on the prevalence of musculoskeletal dysfunction among children and adolescents.

2.1 OBJECTIVES

The objective of this systematic review was to assess the available literature and to provide the best evidence on whether computer exposure has an impact on the prevalence of musculoskeletal dysfunction of children and adolescents.

The following questions were addressed in this review:

- What is the prevalence of the musculoskeletal dysfunction among children and adolescents exposed to computers?
- Which body areas are most commonly affected by dysfunction among children and adolescents exposed to computers?
- Which factors related to computer use (e.g. exposure, workstation design, posture at computer workstation, etc) are risk- and/ or associative factors for developing musculoskeletal dysfunction among children and adolescents?
- Is exposure to computers a risk factor for musculoskeletal dysfunction among children and adolescents?



2.2 DEFINITIONS

The following definitions were used in this review:

- School-aged children: children: 6-18 years
- Children: aged 6-12 years
- Adolescents: aged 13-18 years
- Musculoskeletal dysfunction: aches, pain, discomfort, stiffness, pins and needles originating in specific areas of the musculoskeletal system.
- Computer exposure: the frequency and duration of computer use at home and/ or school; for personal use or for the delivery of school curriculum subjects.

2.3 REVIEW METHOD

2.3.1 SELECTION CRITERIA

2.3.1.1 Types of Studies

Descriptive (epidemiological) studies assessing the impact of computer use on the prevalence of musculoskeletal dysfunction among school-aged children were included. Cross- sectional, case control and case series studies were included. Experimental studies, single case studies and reviews were excluded from this study (review). Only studies published in the English language were included in the review.

2.3.1.2 Types of Participants

Children and/or adolescents aged 6-18 years were included in the study that used computers at school and/or home. Both boys and girls were included in the review.

2.3.1.3 Types of Outcomes

The prevalence of musculoskeletal dysfunction among children/ adolescents and the relation to computer use was the main outcome assessed. The classification of musculoskeletal dysfunction in terms of body areas affected, severity of dysfunction and the limitations in activity level was also assessed.

2.3.2 SEARCH STRATEGY

2.3.2.1 Introduction

Prior to conducting this review the following databases were searched to determine whether a similar review had been conducted in the past 5 years: Cochrane Library, Physiotherapy Database of Evidence (PEDro) and Pubmed. No similar review was found on these databases.

2.3.2.2 Databases

Eleven databases were searched during July-September 2006 in order to retrieve as much published literature on the topic of the prevalence of musculoskeletal dysfunction among school-aged children using computers. The databases searched were: Medline via Pubmed, Africa-Wide, Cinhall, ERIC, OVID, PEDro, Psycinfo, Proquest, Science Direct, SCOPUS and Web of Science.

All the databases were searched from their inception date to include all possible literature sources. All of the abovementioned databases were accessed via the Library of Stellenbosch University.

2.3.2.3 Trial Search

Prior to conducting the review, numerous key words and search strategies were trialed to gain the most appropriate and comprehensive literature sources. The trails were conducted during July 2006 on the Medline database via Pubmed.

2.3.2.4 Keywords

The following key words were used for the review of all the databases:

Child; adolescents; learners; students

School; education

Health; musculoskeletal health

Pain [MeSH]

Low back pain [MeSH]; Neck pain [MeSH]

Low back pain; neck pain; shoulder pain

Ergonomics; computer workstation

Posture [MeSH]

Computer [MeSH]

Technology [MeSH]; information technology

2.3.2.5 Secondary Searching

2.3.2.5.1 Pearling

The reference lists of obtained articles were searched for extra sources not found in the main database searches.

2.3.2.5.2 Hand searches

No hand searches of journals were conducted as the most important journals were indexed in the databases searched.

2.3.3 DATA COLLECTION AND METHODOLOGICAL ANALYSIS

2.3.3.1 Critical Appraisal

2.3.3.1.1 Hierarchy of Evidence

Each study was critically appraised by determining its level on the National Health and Medical Research Council of Australia's Hierarchy of Evidence (NH-MRC 2006) and by assessing its methodological quality (Table 2.1). The Hierarchy of Evidence determines the possibility for errors within the measurement procedures, possible bias within each study design and errors interpreting results.

Table 2.1: NH-MRC Hierarchy of Evidence

Level	**Intervention**
I	A systematic review of level II studies
II	A randomized controlled trial
III-1	A pseudo-randomized controlled trial (e.g. alternate allocation)
III-2	A comparative study with concurrent controls: • Non-randomized, experimental trial • Cohort study • Case control study • Interrupted time series with a control group
III-3	A comparative study without concurrent controls: • Historical control study • Two or more single arm study • Interrupted time series without a parallel control group
IV	Case series with either post-test or pre-test/ post-test outcomes

2.3.3.1.2 Methodological Appraisal

The Critical review form-Quantitative Studies of Law, Stewart, Letts, Pollock, Bosch & Westmorland (1998) was used for assessing the methodological quality of each study (Table 2.2). This appraisal tool could be used for qualitative and quantitative study designs. It had an accompanying document giving guidelines as how to use the tool and allowed for standardized interpretation of findings. The appraisal was done by the main researcher (LS). A second reviewer (QL) conducted the critical appraisal of a sub-sample (n= 3) of the retained articles. The reviewers had to reach consensus on the appraisal of the articles. In the instance that the study design was not mentioned by the authors, the design was identified after scrutinizing the description of the methodology. The reviewers would discuss differences in the case of disagreement and come to a conclusion.

Table 2.2: Methodological Appraisal Tool (Law et al. 1998)

Question	**Study Design**
1	Study purpose clearly stated (Yes=1; No=0)
2	Literature review relevant (Yes=1; No=0)
3a	Study design appropriate (Yes=1; No=0)
3b	Biases present (Yes=0; No=1)
4a	Sample described in detail (Yes=1; No=0)
4b	Sample size justified (Yes=1; No=0)
4c	Informed consent obtained (Yes=1; No=0)
5a	Outcomes measures reliable (Yes=1; No=0)
5b	Outcomes measures valid (Yes=1; No=0)
6a	Results statistical significance reported (Yes=1; No=0)
6b	Results: appropriate analysis used (Yes=1; No=0)
6c	Clinical importance of results reported (Yes=1; No=0)
7	Conclusions appropriate (Yes=1; No=0)
8a	Clinical implications reported (Yes=1; No=0)
8b	Limitations reported (Yes=1; No=0)

2.3.3.2 Description of included studies

In order to provide a clear description of each study, specific data was extracted from each retained article. Table 2.3 illustrates the summary headings of information retrieved from each review study, ranging from the author to the clinical implications of the studies. The headings were validated by the second reviewer (QL). Extracted data was stored on a Microsoft Excel XP database.

Table 2.3: Summary Headings

1. Author	9. Gender of participants
2. Year of publication	10. Definition of musculoskeletal pain/ dysfunction/ discomfort
3. Country in which study was conducted	11. Computer exposure description
4. Data collection period	12. Measurement tools used
5. Study design	13. Prevalence of musculoskeletal pain
6. Location of study (home/ school)	14. Associative/ risk factors
7. Sample size	15. Statistical tests and calculations
8. Sample age range	16. Clinical implications

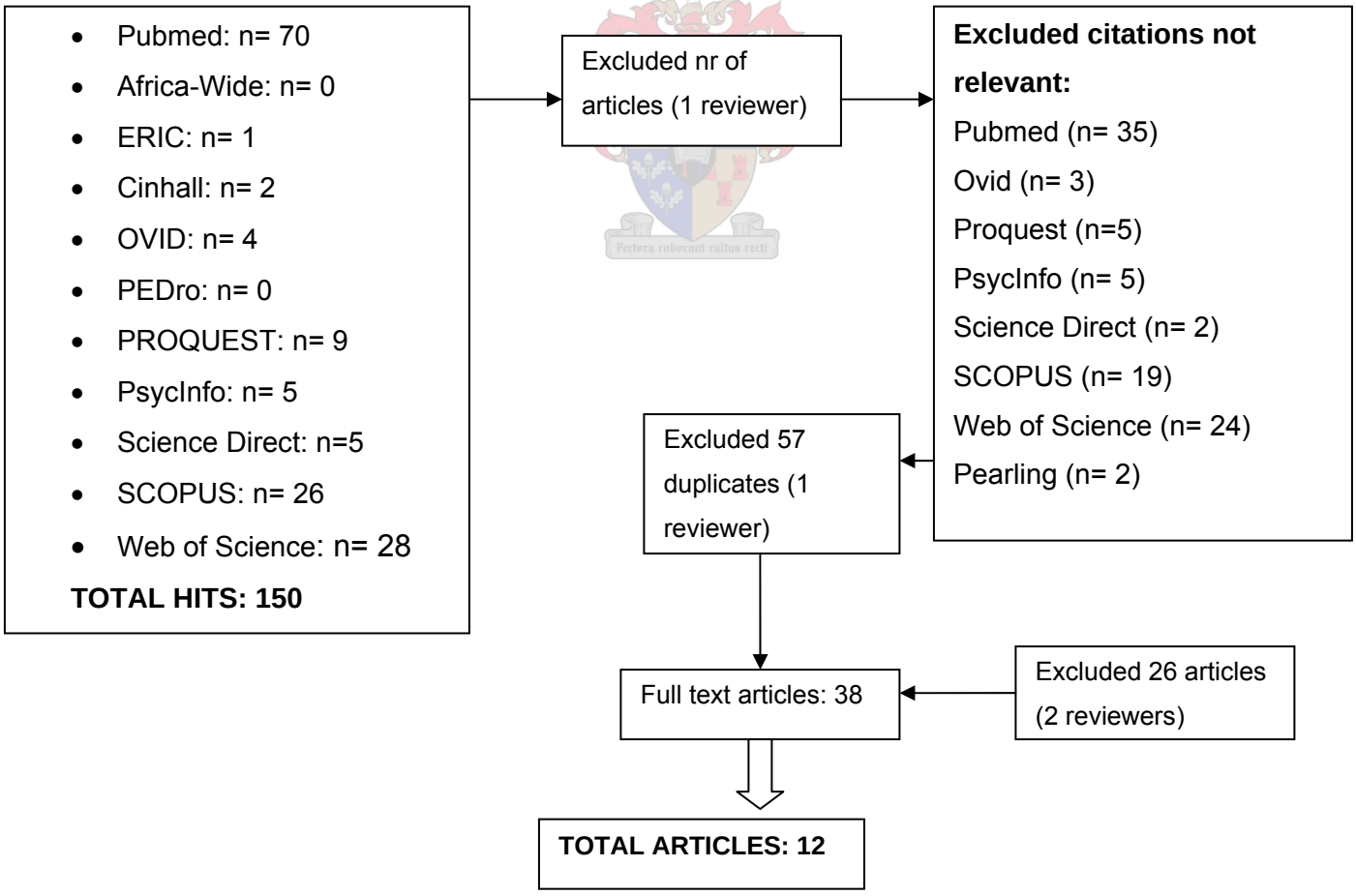
2.4 RESULTS

2.4.1 DESCRIPTION OF STUDIES

2.4.1.1 Search Results

A thorough search of the 11 databases delivered 150 hits (Table 2.4). Search strategies used in each database and the resultant hits are illustrated in Appendix 1. The assessment of the abstracts of the included articles and the number of duplicates reduced the articles to 55. The full text versions of the 55 potentially eligible articles were obtained. Assessment of these studies according to the inclusion criteria (i.e. participants, study design, etc), delivered 10 articles for the systematic review. Two articles were obtained via pearling. A total of 12 articles were thus retained for analysis in this systematic review (Table 2.4). These articles dated from 1998 to 2006 and the studies were conducted in the USA (5), Denmark (1), Scotland (1), Norway (1), The Netherlands (1), Australia (1), Finland (1) and Brazil (1).

Table 2.4: Search Results



2.4.1.2 Exclusion Criteria

A number of reasons for the exclusion of the articles at round 2 were identified (Appendix 2). One article was only available in Polish. A number of the articles' study design did not meet the inclusion criteria since they were not descriptive epidemiological studies. These articles were reviews (5), reports (2) or posters (1).

Three studies focused on populations not eligible for this review (adults and children younger than 6 years). The main aim of 8 articles was to determine the prevalence of musculoskeletal dysfunction among children and adolescents and did not assess the impact of computer use on the dysfunction.

The influence of other potential risk factors (e.g. physical activity, psychosocial issues and back packs) on the musculoskeletal dysfunction of children and adolescents were a major topic of 18 articles. However, the impact of computer use was not assessed in any of these articles.

The accessibility of computers in schools and the interaction of children with the equipment were investigated by 5 studies, but once again the prevalence of musculoskeletal dysfunction was not assessed.

The impact of computer use on the normal development of children's social, cognitive and behavioral skills was only assessed by one study, with no investigation into musculoskeletal dysfunction.

2.4.1.3 General description of included studies

The information of the remaining 10 articles was entered onto a Microsoft Excel (2003) database. Two more articles were obtained by searching the reference lists (pearling) of the selected articles at round 2. Table 2.5 presents a general description of the included studies in this review.

Table 2.5: Details of studies included in review

Author	Year	Country	Study Design	Measurement Tool
Jones & Orr	1998	USA	Not mentioned	Survey
Royster & Yearout	1999	USA	Not mentioned	Survey/ workstation assessment
Harreby et al.	1999	Denmark	Cross-sectional	Questionnaire
Harris & Straker	2000	Australia	Descriptive	Questionnaire & posture evaluation
Jacobs & Baker	2002	USA	Not mentioned	Questionnaire
Burke & Peper	2002	USA	Not mentioned	Questionnaire
Alexander & Currie	2004	Scotland	Not mentioned	Questionnaire
Sjolie	2004	Norway	Cross-sectional	Questionnaire
Ramos et al	2005	USA	Exploratory descriptive	Questionnaire
Diepenmaat et al	2006	Netherlands	Not mentioned	Questionnaire
Hakala et al.	2006	Finland	Not mentioned	Questionnaire
Zapata et al.	2006	Brazil	Cross-sectional	Questionnaire

2.4.2 CRITICAL APPRAISAL

2.4.2.1 Hierarchy of Evidence

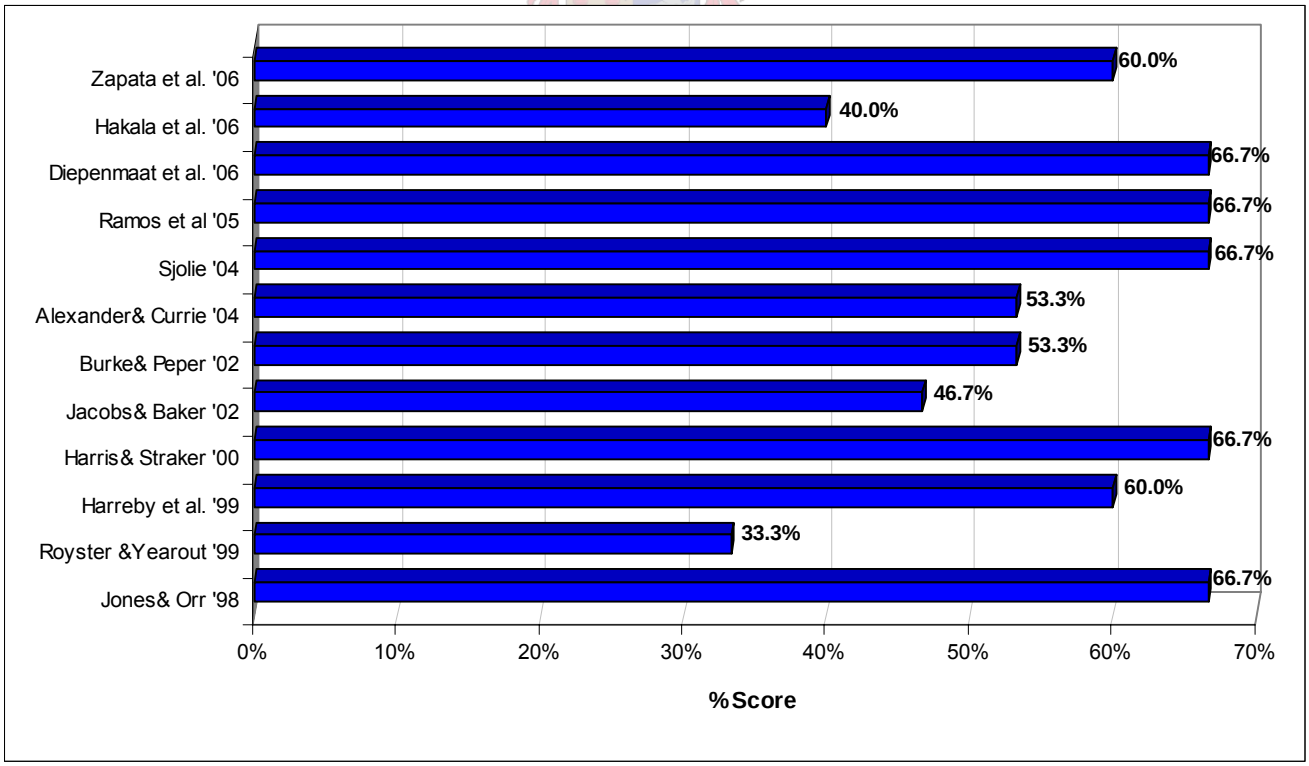
All the selected studies had a cross sectional study design (design not mentioned in some of the review articles) and scored low on the Hierarchy of Evidence (Level III-3). The second reviewer (QL) and main reviewer (LS) agreed 100% in terms of the study designs and level of placement on the Hierarchy.

2.4.2.2 Methodological appraisal

2.4.2.2.1 General

The reviewers reached consensus on the methodological quality of the included studies (Appendix 3). The average score of the selected studies was 60% out of a total of 15 (Figure 2.1). Five articles obtained a maximum score for this review of 66% (Diepenmaat et al. 2006, Ramos et al. 2005, Sjolie 2004, Harris & Straker 2000 and Jones & Orr 1998). The lowest score of 33.33% was obtained by study 2 (Royster & Yearout 1999).

Figure 2.1: Methodological assessment scores



2.4.2.2.2. Aim and Literature Review

The selected studies obtained high scores for criteria 1, 2 and 3. The purpose of the study was well described and the study design was appropriate for the type of investigation being conducted in 11 of the 12 articles. Only Royster & Yearout (1999) did not state the purpose of their study and did not clarify the selected study design. The literature review (criterion 2) was relevant and thorough in all the studies (100%).

2.4.2.2.3 Sampling

All the studies obtained 0% for criteria 4, 6 and 12. The potential for bias for the sample selection procedure existed in all the review studies. None of the selected articles used sample size calculation for the estimation of the sample size (criterion 6) and gave no reason for the selection of the sample size. The study sample was acknowledged as being a convenience sample in one study (Burke & Peper 2002), whilst the sample selection process in the other 11 studies was not described nor motivated. Six of the review studies did not report on whether informed consent (criterion 7) was obtained from the study participants (Hakala et al. 2006, Diepenmaat et al. 2006, Burke &Peper 2002, Harreby et al. 1999, Royster & Yearout 1999 and Jones & Orr 1998).

2.4.2.2.4 Biases

The potential for recall bias was high, as none of the studies motivated the use of the different recall periods for musculoskeletal dysfunction in their study samples. In two of the studies (Zapata et al. 2006 and Harreby et al. 1999) physical examinations of selected children were conducted. The potential for measurement bias existed as different investigators were responsible for the examination of the participants. No standard examination procedure or measurement tools to allow for uniform examination of the selected participants were described.

2.4.2.2.5 Measurement Tools

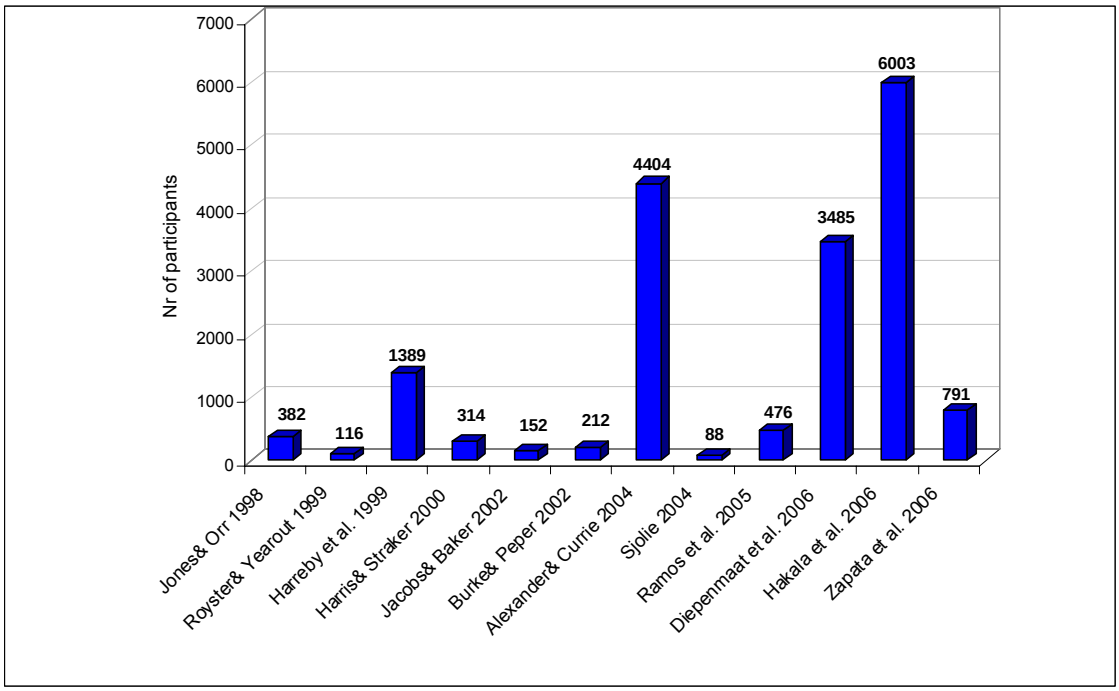
The potential for bias existed in the assessment of the outcomes in all the review studies as no information was provided on the reliability testing of the measurement tools (criterion 12). These measurement tools were either combinations of other questionnaires or were developed by the researchers. The validity testing of one questionnaire used as a measurement tool was reported (Sjolie 2004).

The other 11 studies did not mention any validity testing of their measurement tools. The clinical importance of the study results (criterion 10) was noted by six of the selected studies (Diepenmaat et al. 2006, Ramos et al. 2005, Harris & Straker 2000, Harreby et al. 1999, Royster & Yearout 1999 and Jones & Orr 1998).

2.4.2.3 Sample/Participants

The sample size in the selected studies ranged from N=88 (Sjolie 2004) to N=6003 (Hakala et al. 2006). The larger studies were conducted in Europe and Scandinavia (Figure 2.2).

Figure 2.2: Sample size in selected studies



2.4.2.3.1 Sample Description

- *Age*

The ages of the participants ranged from 5-18 years and these learners were in grades 1-12 at school. Two articles did not provide the ages of the sample participants and only the grades of these study participants were provided (Table 2.6)

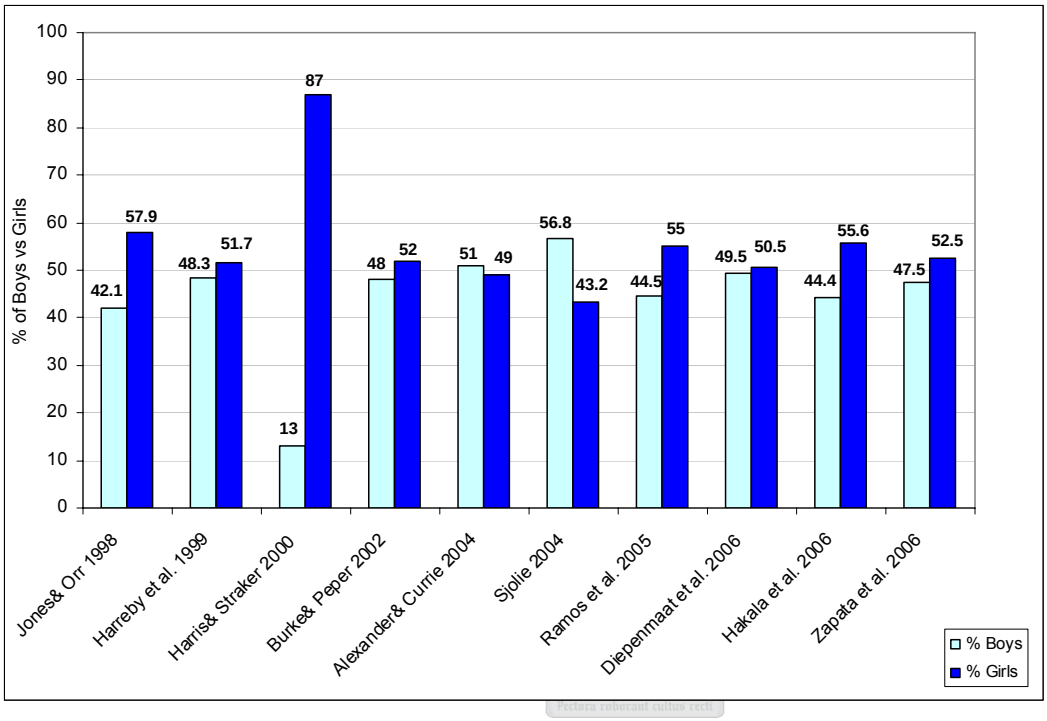
Table 2.6: Ages of participants

Study	Mean Age	Range of Age
Jones & Orr '98	16.7 years	
Royster & Yearout '99	No info	
Harreby et al. '99		13-16 years
Harris & Straker '00	13.2 years	10-18 years
Burke & Peper '02	12.4 years	5-18 years
Jacobs & Baker '02	No info	
Alexander & Currie '04		11, 13, 15 years
Sjolie '04	14.7 years	14.1-16.1 years
Ramos et al. '05	9.5 years	5-14 years
Diepenmaat et al. '06		12-16 years
Hakala et al. '06		14, 16, 18 years
Zapata et al. '06	14.17 ±1.99 years	

- *Gender*

Ten of the 12 articles indicated that both boys and girls participated in the study. Two studies gave no indication of the gender of the sample, while another did not provide the number of boys and girls respectively. A comparison of the percentage of boys versus girls for the review articles are provided in Figure 2.3.

Figure 2.3: Percentage of boys and girls in selected studies



2.4.2.4 Setting of study/ Areas of computer use

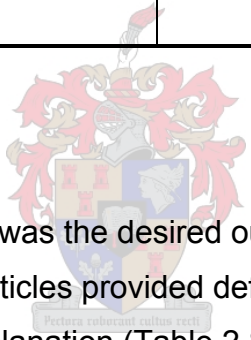
Ten of the 12 studies were conducted in schools and two studies at the participants' residences. Burke & Peper (2002) conducted home visits during which time children completed a questionnaire. In the case of younger children, interviews were conducted with the parents and child (Burke & Peper 2002). Postal surveys were used by Hakala et al. (2006).

2.4.2.5 Location of computer exposure

Eight of the studies reported the location where study participants were exposed to computers (Zapata et al. 2006, Ramos et al. 2005, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000, Harreby et al. 1999, Royster & Yearout 1999 and Jones & Orr 1998). Table 2.7 illustrates the areas of computer use.

Table 2.7: Location of computer use

Study	School	Home	Elsewhere	Work
Jones & Orr '98	X	X		
Royster & Yearout '99	X	X		
Harreby et al. '99		X		
Harris & Straker '00	X	X	X	
Jacobs & Baker '02		X		
Burke & Peper '02	X	X	X	
Ramos et al. '05	X	X		
Zapata et al. '06				X



2.4.2.6 Outcomes Assessed

Musculoskeletal pain or dysfunction was the desired outcome assessed in each of the 12 articles. The authors of four of the articles provided definitions for their assessed outcome, whereas the other eight gave no explanation (Table 2.8). No two articles' definition of musculoskeletal dysfunction corresponded within this systematic review.

Table 2.8: Definition of musculoskeletal dysfunction

Author	Definition
Harreby et al. '99	Lower back pain was defined as pain in the lower back and was illustrated by a text and drawing on the front page of the questionnaire
Jacobs & Baker '02	Musculoskeletal discomfort is a participant's self-reports of pain, numbness, or discomfort in five body parts (neck, back shoulder, elbow and wrist/ hand) experienced within the last year, but not due to trauma.
Sjolie '04	Lower back pain is defined as aching, pain or discomfort in the low back during the preceding year, not related to trauma or menstrual pain and measured as a confirmatory answer to question 4 in the questionnaire
Ramos et al. '05	Bodily discomfort

2.4.2.6.1 Musculoskeletal Dysfunction Classification

Various aspects of musculoskeletal dysfunction were assessed differently by the included articles. These included the location/ area of dysfunction, the severity of the dysfunction and the restriction of activities or disabilities due to musculoskeletal dysfunction.

- *Location*

The assessment of musculoskeletal dysfunction according to the affected area varied greatly between the selected studies (Table 2.8). Dysfunction affecting only the lower back was assessed by two studies (Harreby et al. 1999 and Sjolie 2004). The various areas of musculoskeletal dysfunction are presented in Table 2.9.

Table 2.9: Body areas affected by musculoskeletal dysfunction

Body Areas	Head	Neck	Back	Low Back	Shoulder	Arm	Wrist/ Hand	Elbow	Stomach	Eyes	Diffuse/ Other
Jones & Orr 1998		X	X				X				X
Royster & Yearout 1999	X	X					X			X	
Harreby et al. 1999				X							
Harris & Straker 2000		X		X	X	X					
Jacobs & Baker 2002		X	X		X		X	X			
Burke & Peper 2002	X	X	X				X			X	
Alexander & Currie 2004	X	X	X		X				X		X
Sjolie 2004				X							
Ramos et al. 2005		X	X				X				
Diepenmaat et al. 2006											
Hakala et al. 2006		X		X	X						
Zapata et al. 2006			X			X					X

- *Severity of Dysfunction*

Two review articles reported on the severity of participants' musculoskeletal dysfunction (Harreby et al. 1999 and Ramos et al. 2005). Harreby et al. (1999) distinguished between lower back pain and severe lower back pain (SLBP) according to learners' report of the incidence and referral pattern of lower back pain. Ramos et al. (2005) provided four categories for learners to choose from in order to indicate the severity of experienced symptoms. These categories were: just aches; enough to make mistakes; enough to make me take breaks and it makes me stop.

- *Frequency of Dysfunction*

The frequency of weekly musculoskeletal dysfunction was reported in two of the review studies (Hakala et al. 2006 and Alexander & Currie 2004). In the remaining articles, the frequency of musculoskeletal dysfunction was not documented. Alexander and Currie (2004) classified the musculoskeletal symptom frequency as infrequently (i.e. monthly or less) or frequently (weekly or more). Hakala et al. (2006) used four categories to illustrate the frequency of musculoskeletal dysfunction in the neck/ shoulder and lower back areas. The frequency categories in their study were: almost daily; about once a week; about once a month; seldom/ not at all.

- *Medical Treatment sought and restrictions with daily activities*

Two studies (Harreby et al. 1999 and Jones & Orr 1998) reported on children who had sought medical treatment for their musculoskeletal pain and/ or discomfort. Jones and Orr (1998) reported on 2.5% of their sample of 382 children seeking medical treatment and 12% of the sample (N=88) by Sjolie (2004). Jones and Orr reported on 5% of their sample participants with dysfunction seeking medical care for their hand discomfort. In terms of restrictions of activities, Harreby et al. (1999) reported on 8.9% of children suffering from lower back who had reduced their sporting activity because of the pain. A smaller number (4.2%) of this group of learners stopped all sporting participation.

2.4.2.7 Musculoskeletal Dysfunction Recall Period

The review articles varied greatly in the time period for learners' recall of musculoskeletal dysfunction. None of the studies corresponded in their provided recall periods (Table 2.10).

Table 2.10: Musculoskeletal dysfunction recall period

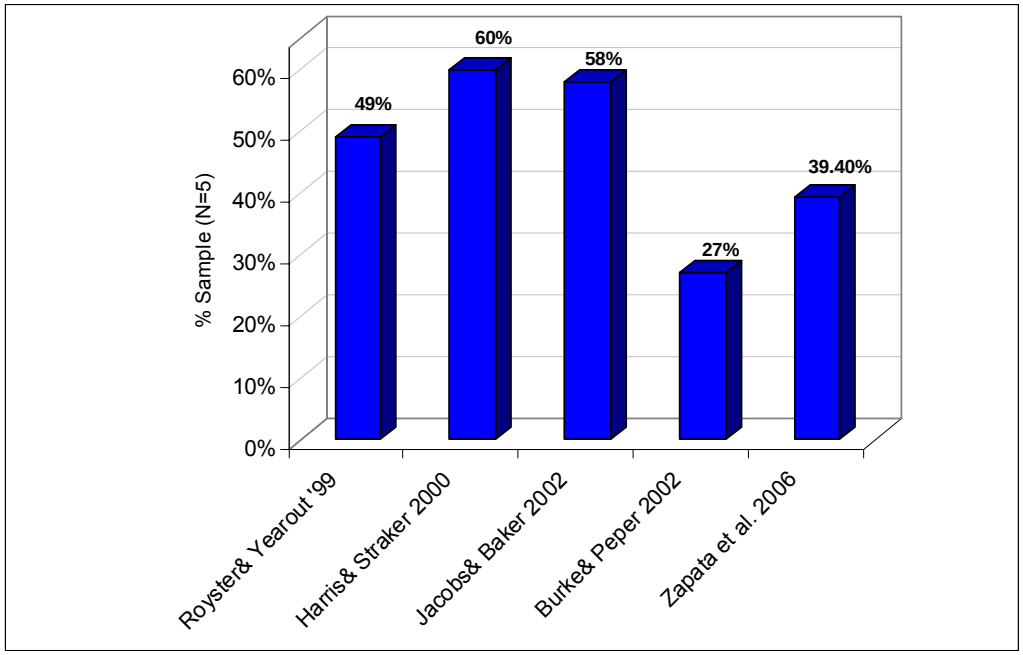
Recall Period	During computer use	Directly after computer use	Ever	Weekly or Monthly	Last Month	6 Months	Year	Last year, month, week, during that day
Jones& Orr 1998		X						
Royster & Yearout 1999	X							
Harreby et al. 1999								X
Harris & Straker 2000	X							
Jacobs & Baker 2002							X	
Burke & Peper 2002			X					
Alexander & Currie 2004				X				
Sjolie 2004							X	
Ramos et al. 2005	X							
Diepenmaat et al. 2006					X			
Hakala et al. 2006						X		
Zapata et al. 2006						X		

2.4.2.8 Prevalence of musculoskeletal dysfunction related to computer use

2.4.2.8.1 General Musculoskeletal Dysfunction

The prevalence of general musculoskeletal dysfunction was reported in five of the review studies (Zapata et al. 2006, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000 and Royster & Yearout 1999). The prevalence of musculoskeletal dysfunction ranged from 27% to 60% (Figure 2.4) (Note: different recall periods for musculoskeletal dysfunction were used in these studies as illustrated in Table 2.10).

Figure 2.4: Prevalence of computer-related musculoskeletal dysfunction



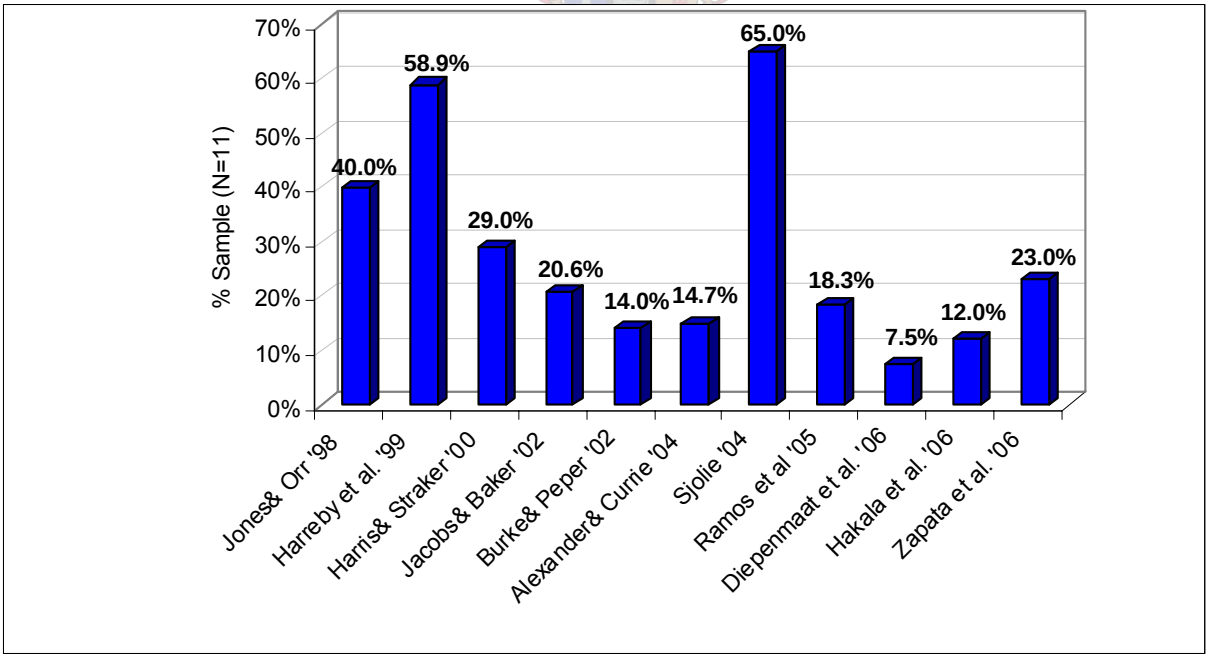
2.4.2.8.2 Specific Areas of Musculoskeletal Dysfunction

All the review studies reported on specific body areas affected by musculoskeletal dysfunction among children and adolescents. The most common areas affected by the dysfunction are the low back, neck, shoulder, arm, headaches and wrist/ hand. Only the three most common areas, namely the back, neck and shoulder regions, will be presented in the following section.

- *Low back pain*

The prevalence of low back pain varied greatly among the review studies, with reports of 7.5% up to 65%. Figure 2.5 illustrates the report of the prevalence of low back pain among the study samples. The time periods for recall of musculoskeletal dysfunction were different in all the studies (Table 2.10). The prevalence of 58.9% and 65% indicated for Harreby et al. (1999) and Sjolie (2004) was the life time prevalence of lower back pain among their study samples. Harreby et al. (1999) reported that computer use of more than three hours per day was not correlated to their sample's report of lower back pain. Sjolie (2004) found a positive correlation between computer use of more than 15 hours per week and lower back pain.

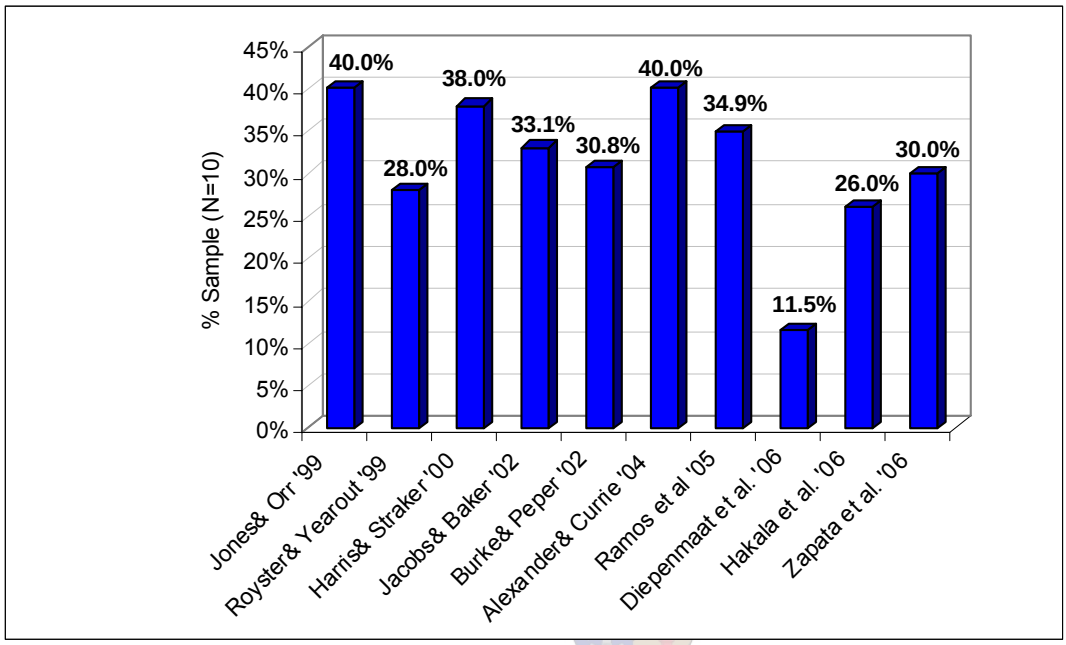
Figure 2.5: Prevalence of lower back pain among study samples



- *Neck and neck/shoulder pain*

The prevalence of neck and/ or neck and shoulder dysfunction was reported by 10 of the review articles. Figure 2.6 illustrates the prevalence of neck or neck/ and shoulder dysfunction. The mean prevalence for neck/ shoulder dysfunction was 31.2% among the 10 review studies listed.

Figure 2.6: Prevalence of neck/ shoulder pain among study samples



2.4.3 ASSOCIATION BETWEEN MUSCULOSKELETAL DYSFUNCTION AND COMPUTER USE

2.4.3.1 Computer exposure per day or week

The study participants' exposure to computers was assessed according to the number of hours per day, hours per week or number of days per week. The majority of review studies used the hours of computer use per day to assess learners' exposure to computers (Zapata et al. 2006, Hakala et al. 2006, Diepenmaat et al. 2006, Ramos et al 2005, Alexander & Currie 2004, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000, Harreby et al. 1999 and Jones & Orr 1998). One study assessed only the computer exposure per week (Sjolie 2004). Royster and Yearout (1999) did not provide data on computer exposure. Table 2.11 illustrates the maximum daily exposure to computer use of the review study samples.

Table 2.11: Computer exposure of study samples per day/ per week/ year

Computer Exposure	Estimated hours/ day	Mean hours/ day	Hours/ week	Nr of days/ week	Nr of years
Jones & Orr 1998		2.33 hr/ day			
Royster & Yearout 1999	None provided				
Harreby et al. 1999	>3hr/ day				
Harris & Straker 2000		3.2 hr/ day	16.9 hr/ week		
Jacobs & Baker 2002	½hr; ½ -1 hr; 1-1½ hr; 1½- 2hr; >2 hr				
Burke & Peper 2002		2hr/ weekday 2.4hr/ weekend			4.4 years
Alexander & Currie 2004	<3hrs or ≥3hrs				
Sjolie 2004			15 hr/ week		
Ramos et al. 2005			½ -1 hr		
Diepenmaat et al. 2006	0-½hr; ½ -1½ hr; 1½- 3hr; >3 hr				
Hakala et al. 2006	Not at all; <1hr; 2-3hr; 4-5 hr; >5hr				
Zapata et al. 2006		75 min / day		4.8 days/week	

2.4.3.2 Computer use as a risk factor for musculoskeletal dysfunction

2.4.3.2.1 General musculoskeletal dysfunction

Seven of the 12 review studies used odds ratios and logistic regression to determine whether computer use was a predictor for musculoskeletal dysfunction (Zapata et al. 2006, Hakala et al. 2006, Diepenmaat et al. 2006, Sjolie 2004, Burke & Peper 2002, Jacobs & Baker 2002 and Harreby et al. 1999). Harreby et al. (1999) reported the odds ratios of female gender, daily smoking and heavy work, but did not calculate the odds ratios for computer use and musculoskeletal dysfunction. Burke and Peper (2002) reported on negative associations between computer use and back discomfort (p=0.01; -0.27- -0.17) and eyestrain (p=0.03; -0.38- -0.10) respectively. According to Jacobs and Baker (2002), the design of the school furniture used during computing had an impact on the musculoskeletal pain experienced by children in their sample (OR 1.89; CI 95%: 0.94-3.84). The results of the other studies are presented in Table 2.12.

Table 2.12: Daily/weekly computer use as predictor for musculoskeletal dysfunction

Musculoskeletal dysfunction according to time exposure	**General television/ computer use**	**Daily hours of computer use**	**Weekly hours of computer use**
Jacobs & Baker 2002		r= 0.19; p=0.05 use per day/ week	
Sjolie 2004	OR 1.8 (1.2-2.6); p= 0.003		
Hakala et al. 2006		Daily use >5hrs: OR=2.3; CI= 1.2- 4.4	Weekly use >42 hrs: OR= 1.5; CI= 0.9-2.6

2.4.3.2.2 Computer use as predictor for specific body areas and gender

Diepenmaat et al. (2006) found insignificant results with stepwise logistic regression of their study sample's hours of computer use per day and the prevalence of musculoskeletal dysfunction. Zapata et al. (2006) reported that computer use of more than 2 hours per day was a predictor for back pain and the reported "pain triggered by the computer" (Table 2.8). With further mathematical regression models, they did however not find any clear association between musculoskeletal dysfunction and computer use. Alexander & Currie (2004) reported higher prevalence of low back-, neck- and shoulder pain and headaches for the younger participants in their sample (Table 2.13). Girls were predicted to have a greater risk of musculoskeletal dysfunction in the low back region and for headaches. Boys were predicted to experience greater neck and shoulder dysfunction.

Table 2.13: Predictor for musculoskeletal dysfunction: gender and body areas

Computer exposure/ day or week	**Exposure according to specific body areas**	**Exposure, specific body areas and gender**
Alexander & Currie 2004		Headaches: 11 year olds Girls: OR 19.2 (9.4-29.4) Boys: OR 9.2 (3.1-15.6) Neck/ shoulder pain: 11 yr Boys: OR 6.2 (0.7-12.0) Backache: 11 yr old Girls: OR 9.0 (2.4-17.7)
Zapata et al. 2006	Computer use > 2hr/ day: Back pain: OR 1.49 (1.04-2.12) Pain triggered by computer: OR= 2.47 (1.38-4.41) Computer use > 4x/week: Pain triggered by computer use: OR= 1.98 (1.17- 3.21)	

2.5 SUMMARY OF FINDINGS

- The selected studies in this systematic review were conducted in 8 countries on 4 continents.
- The mean methodological quality score of the review studies, as assessed by means of the Methodological Appraisal tool of Law et al. (1998), was low, ranging from 33.33% to 66.7%.
- All the review studies had a cross sectional study design (Level III-3) which does not allow for clear identification of risk factors.
- Sample sizes ranged from N=88 to N=6003, with girls forming a larger portion of the sample populations.
- The measurement tools used to assess the main outcome variable (musculoskeletal dysfunction) in the review studies were poorly described and only 1 of the 12 studies reported on validity testing of the tool (Sjolie 2004). None of the review studies reported on reliability testing of their questionnaires and the psychometric quality of the questionnaires are thus brought into question.
- The prevalence of general musculoskeletal dysfunction ranged from 27% to 60%. The range corresponds with prevalence rates in other epidemiological studies of musculoskeletal dysfunction among children and adolescents (Watson et al. 2002 and Mikkelsson et al. 1997).
- Higher prevalence rates were found for the neck and shoulder areas than for the lower back area.
- By means of logistic regression the daily and weekly hours of computer use has been identified as a predictive factor for musculoskeletal dysfunction in 3 of the review studies (Sjolie 2004, Hakala et al. 2006 and Zapata et al. 2006).
- A number of studies identified other risk factors for musculoskeletal dysfunction among children, e.g. psychosocial factors, heavy manual work and smoking (Diepenmaat et al. 2006, Harreby et al. 1999). In these studies computer use was not identified as a risk factor for the musculoskeletal dysfunction among their samples.

CHAPTER 3
METHODOLOGY

The methodology of the main study will be presented in this chapter. The study consisted of two phases and the methodology of theses two phases will be presented separately. The first phase entailed the completion of a questionnaire by high school learners in the Cape Metropolitan region. The development, reliability and validity testing of the questionnaire, the Computer Usage Questionnaire, will be presented in Chapter 4.

The second phase of the study involved the assessment of the ergonomic standards of computer laboratories in high schools of the Cape Metropolitan region. A detailed description of the measurement tool used in Phase 2 as well as the procedures of Phases 1 & 2 will be presented in this chapter.

3.1 RESEARCH QUESTION

Does computer usage have an impact on the musculoskeletal dysfunction of high school learners in the Cape Metropolitan region?

3.2 AIM of STUDY

The aim of the study was to investigate whether the musculoskeletal dysfunction of high school learners in the Cape Metropolitan region are related to computer usage.

3.3 OBJECTIVES of STUDY

The objectives of the study were to determine:

1. The frequency and duration of computer use by high school learners.
2. The prevalence of musculoskeletal complaints of high school learners.
3. The association between musculoskeletal complaints and computer use.
4. Associative and/ or predictive factors for musculoskeletal dysfunction among high school learners.
5. Whether computer laboratories in high schools of the Cape Metropolitan region adhere to published ergonomic guidelines.

The methodology for objectives 1-4 will be described in the following section as Phase 1, followed by the methodology for objective 5 as Phase 2.

PHASE 1

3.4 STUDY DESIGN

A case control study with a retrospective period of 30 days was conducted.

3.5 RESEARCH SETTING

The study was conducted during 2006 in eight randomly selected high schools in the Cape Metropolitan region of the Western Cape Province of South Africa.

3.6 SAMPLING

3.6.1 SAMPLE DESCRIPTION

The sample consisted of selected high schools that offered Computer studies and/or Compu-typing for curriculum delivery. Grade 10-12 learners, boys and girls, aged 14-18 years participated in this study.

3.6.2 SAMPLE RECRUITMENT

3.6.2.1 Recruitment of schools

The consent of the Western Cape Education Department (WCED) to conduct this study in schools was obtained prior to contacting schools to participate in this study (Appendix 4). The WCED is divided into Education Management and Development Centres (EMDC). The Cape Metropolitan region comprises four EMDC's. Two high schools were selected from each of the four EMDC's (Appendix 5). High schools that had fully-installed and functional computer laboratories and offered Computer studies and/or Compu-typing for curriculum delivery were eligible for inclusion in this study. The required information on the eligibility of high schools to participate in the selection process of this study was obtained from the school principal, Computer Application Technology (CAT) educator and the Khanya Project schools' coordinator. The list with the names of all eligible schools within each of the four EMDC's was statistically randomized. The two schools, within each EMDC, located first on the random list, were contacted and their participation sought in the research study. In the instance that a school refused participation in this study or their computer laboratories were not being used for curriculum delivery to learners, the next school on the random list was contacted. The process of selection of schools took approximately 2 months.

3.6.2.2 Recruitment of learners

At each selected school two groups of learners were recruited. Recruitment was based on whether they received certain subjects for curriculum delivery via the computer and the frequency of their weekly computer exposure at school. The two main curriculum subjects being delivered at schools via computers in 2006 were Computer studies and Compu-typing. The computer group comprised of learners who received either or both Computer studies and Compu-typing for curriculum delivery via the computer and/or learners who used the school computer three or more times per week for the delivery of other school subjects (e.g. Mathematics, Biology). The non-computer group comprised of learners who did not have Computer studies or Compu-typing as school subjects and/or did not receive curriculum delivery via the computer for another school subject more than twice a week.

3.6.3 SAMPLE SIZE

3.6.3.1 Sample size calculations

A statistician performed sample size calculations. It has been estimated that a sample of 1600 learners will be required to obtain 95% statistical power, based on a 40% prevalence rate as reported in the published literature (Harris & Straker 2000).

3.6.3.2 Expected sample size

In order to calculate the expected sample size, the principal and CAT educator at each school were contacted at the beginning of the 2006 school year to provide the number of learners using the school computer for curriculum delivery of Computer studies and / or Compu-typing. The educators could not provide exact numbers of learners who were receiving Computer studies and/ or Compu-typing for curriculum delivery at that time. Computer studies and Compu-typing are specialized subjects and chosen by a select number of learners at the beginning of their grade 10 school year and continued until grade 12. The final numbers would only be provided during the second school term. The recruitment of the non-computer group learners did not prove an obstacle, according to the educators, as more learners did not use the school computer for curriculum delivery of subjects.

Schools with a minimum of 80 grade 10-12 learners receiving Computer studies or Compu-typing for curriculum delivery via the computer were selected. A similar sized non-computer group was recruited from each school. The estimated minimum number of learners from each school was 160 to allow for an estimated sample size of 1280 learners for the study.

3.6.4 INCLUSION CRITERIA

Schools were included that complied with the following criteria: had fully-installed functioning computer laboratories and had been offering Computer studies or Compu-typing for at least one school year.

Learners were assigned to the computer group who had Computer studies or Compu-typing as a school subject and/ or received curriculum delivery for school subjects via the computer three or more times per week. Learners were selected to the non-computer group when they: did not have Computer studies or Compu-typing as a school subject and/ or used the school computer less than three times per week.

3.6.5 EXCLUSION CRITERIA

Schools were excluded if their computer laboratories were not in use for curriculum delivery of subjects to learners. Schools were excluded if less than 80 grade 10-12 learners used computers for curriculum delivery of school subjects. Schools offering Computer studies or Compu-typing as a pilot trial during 2006 were excluded. This trial period was used to identify problem areas in the implementation of computer based subjects at a specific school. Learners without parental consent to participate in the study were excluded. Grade 10-12 learners were excluded if they could not read or write Afrikaans, English or Xhosa languages.

3.7 MEASUREMENT TOOL

A new self-administered questionnaire, The Computer Usage Questionnaire (CUQ) (Appendix 6), was developed to serve as a measurement tool for assessing learners' musculoskeletal dysfunction in the Cape Metropolitan region and to identify associative factors. The development, reliability and validity testing of the CUQ, as well as the pilot study are discussed in Chapter 4.

3.8 MEASUREMENT PROCEDURE

3.8.1 DATA COLLECTION PERIOD

The Western Cape Education Department (WCED) granted a period of two months in 2006 for this study to be conducted in schools, but due to a number of public holidays, the study period was extended for a further month (Appendix 4). Data collection for the pilot study and main study was conducted between February to May 2006.

3.8.2 DATA COLLECTION PROCEDURE

3.8.2.1 Planning Phase

A letter explaining the aim and procedure of the study was sent to the principal of each eligible high school during January 2006 (Appendix 7). The principal of each school was contacted telephonically two weeks later to discuss their school's eligibility and willingness to participate in this study. Meetings were held with the principal and CAT teacher at each eligible and consenting school during February and March 2006. The requirements for the data collection procedure were discussed with the educators and their co-operation in the study process obtained. During subsequent communication with the CAT teacher at each school, the average number of learners in the computer and non-computer groups was obtained, as well as learners' language preference. Learners' preferred language of communication was required for the preparation of the letters of informed consent and the Computer Usage Questionnaire (CUQ).

3.8.2.2 Informed Consent

Informed consent letters for the learners and their parents/guardians in their choice of language, were delivered to the participating school one week prior to data collection was to take place (Appendix 8). The learners were instructed by their CAT educator to read the document carefully and return the signed form on the day of the questionnaire completion.

3.8.2.3 Data collection setting

Data collection took place on a day and time as agreed upon with the principal and CAT teacher to minimize disruption in the learners' schooling process. The venue for data collection depended on the availability of appropriately sized lecture rooms or halls.

At two of the eight schools the computer and non-computer groups completed the CUQ simultaneously, but separately, in halls at these schools. At the other six schools the researcher and an assistant rotated between classes of either computer or non-computer group learners. The researcher attended to the computer class groups and the assistant to the non-computer class groups.

3.8.2.4 Role of the assistant

A qualified physiotherapist was the assistant during this study. Her main role was to accompany the researcher to participating schools and assist with supervision of learners during the completion of the CUQ. Prior to the commencement of the study, the assistant was instructed on the procedure for the learners' completion of the CUQ. She also assisted with capturing of the obtained data of Phase 1 of the study onto an Excel sheet.

3.8.2.5 Data collection procedure

A short explanation of the purpose and procedure for completing the CUQ was given to the learners. The learners had a choice of the language in which they preferred to complete the questionnaire. The researcher and assistant were available to deal with any uncertainties of the learners related to the CUQ. Learners were instructed that a maximum of 20 minutes would be allowed for them to complete the questionnaire. The learners at two of the schools required more time for completing the questionnaire. Consulting the class teachers, it was reported that the learners had poor reading skills and that this factor influenced the speed of normal class lessons as well. The average time it took for the researchers to collect the data at the 8 schools varied from 40 minutes to 2 hours.

3.9 DATA MANAGEMENT

The researcher and two assistants had access to the data from phase 1 of the study during the electronic capturing of the information (CUQ). All collected data was entered on Excel data sheet designed by a statistician. The statistical analysis and ethical considerations applicable to phase 1 and phase 2 of this study will be discussed at sections 3.16 & 3.17.

PHASE 2

3.10 STUDY DESIGN

A descriptive cross-sectional study was conducted.

3.11 RESEARCH SETTING

The study was conducted in randomly selected high schools with functional and operational computer laboratories in the Cape Metropolitan region.

3.12 SAMPLE

3.12.1 SAMPLE DESCRIPTION AND RECRUITMENT

All the computer laboratories being used for curriculum delivery of school subjects within the 16 selected schools were assessed. The 8 schools from phase 1 of the study formed part of the sample in phase 2. A further two schools were selected from each of the four EMDC's of the Cape Metropolitan region according to the random list of eligible schools described in phase 1 (Section 3.6.2.1) (Appendix 9).

3.13 MEASUREMENT TOOL

3.13.1 EXISTING MEASUREMENT TOOL

The Computerized Classroom Environment Inventory (*CCEI*) (Zandvliet & Straker 2001) was adapted by the researcher and used for the assessment of the computer laboratories in the selected high schools (Appendix 10). The main developer of the *CCEI*, Dr David Zandvliet, gave permission for the use and adaptations to the instrument to be made by the researcher (Appendix 11).

The CCEI was developed for use in a descriptive study on the physical and psychosocial environments in computerized classroom settings in Canada and Australia (Zandvliet & Straker 2001). This measurement tool was found to be suitable for use in assessing the computer laboratories in the selected schools within the Cape Metropolitan region, as it addressed most of the ergonomic aspects within the computer laboratory.

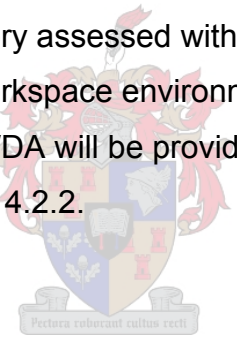
The CCEI has been used in similar school environments as the current study and would enable comparisons to be made between the school computer laboratories of the 3 countries (i.e. Canada, Australia and South Africa). *The CCEI* lacked the assessment of specific measurements of the chair and the input device (e.g. mouse) at the computer workstation, but information from other sources was used to supplement the *CCEI* (Workstation Ergonomics 2001, Ergonomic Checklist Computer Work 1997). Unfortunately, the reliability and validity testing of the *CCEI* was not documented by the authors and thus reduced the psychometric properties of the tool.

3.13.2 THE COMPUTER WORKSTATION DESIGN ASSESSMENT

The product of the adaptations to the *CCEI* was the Computer Workstation Design Assessment (CWDA) (Appendix 12).

3.13.2.1 Content of the CWDA

The aspects of the computer laboratory assessed within the CWDA included the working environment, spatial environment, workspace environment and visual environment. A short description of each section of the CWDA will be provided here, as an in-depth description of the tool will be provided at section 3.14.2.2.



- *Section 1: Working Environment*

The following criteria of the computer laboratory were included at this section: the temperature control within the computer laboratory, draughts at the level of learners' heads and knees and the noise quality within the laboratory.

- *Section 2: Spatial Environment*

This section entailed the assessment of the following criteria: the number of learners using the computer laboratory at one time, the width of the aisle between workstations, the available space for movement between desks and storage space for resource material and equipment.

- *Section 3: Workspace Environment*

This section entailed the assessment of the size, dimensions, position and adjustability of the equipment used by the learners at the computer workstation.

The assessment included the chair, desk, computer screen, keyboard and input device.

- *Chair*

The following assessments were conducted for the chair at the computer workstation: seat height from the floor, seat pan depth of the chair, the presence of rolling coasters on the chair as well as an adjustable back rest and adjustable arm rests.

- *Desk*

Assessment of the computer desk involved the following criteria: the adjustability of the desk's height, the desk's width from left to right sides, the desk's depth from the front to rear edge, the width, depth and height underneath the desk for the learners' legs when in a seated position and the presence, size and adjustability of a foot rest for the support of learners' feet.

- *Computer Screen*

The computer screen was assessed according to the following criteria: the depth of the screen's position from the front edge of the table, the height of the centre of the computer screen from the floor, the viewing monitor's length and width measurements, the ability of the viewing monitor's inclination to be adjusted from the horizontal level and the presence of a manuscript holder attached to the computer screen.

- *Keyboard*

The following criteria of the keyboard was assessed: the keyboard's position on the desk or on a separate tray, the adjustability of the keyboard angle from the horizontal level, the presence of a gel wrist support for learners' use, the keyboard's height from the floor to the home row and the height of the home row to the desk level.

- *Input Device*

The input device was assessed according to the following criteria: the use of a mouse as an in-put device, the adjustability of the mouse's position, use of the input device by both left and right handed learners and the presence of a mouse pad.

➢ *Section 4: Visual Environment*

The following criteria of the computer laboratory were assessed at this section: the stability and legibility of screen characters, the presence of brightness and contrast regulator controls at the computer screen, the light quality and glare control by positioning of overhead lights, equipment positioning and the use of blinds or curtains and the quality of the natural and indirect lighting sources used.

3.13.2.2 The CWDA Scoring

The CWDA consisted of 4 sections evaluating different aspects of the computer workstation and laboratory. A total of 40 items were assessed for their presence/absence. An item obtained either a score of 1 denoting 100% compliance or a score of 0 denoting 0% compliance with a given standard. The accumulated score of the CWDA was 40.

3.13.3 CWDA CONTENT VALIDITY

The content validity of the CWDA was assessed during September 2005 by an international researcher in the field of ergonomics, Dr Wendy Macdonald.

3.13.3.1 The reviewer

Dr Wendy Macdonald is the Director of the Centre for Ergonomics and Human Factors and Associate Professor at LaTrobe University, Melbourne, Australia. The Centre for Ergonomics and Human Factors at LaTrobe University was established in 1987 and offers contract research, consulting and industry training projects to ergonomics staff at undergraduate and post-graduate levels. Dr Macdonald is an experienced researcher in the field of ergonomics. She has published numerous peer-reviewed articles (118 in total for conferences and publications) and has attended several conferences (Appendix 13).

3.13.3.2 Recommendations

Dr Macdonald made a number of recommendations for changes to the CWDA.
These changes included formatting the CWDA in the form of a checklist with dichotomous options at a question. She emphasised that the expected ergonomic requirements in the computer laboratory had to be specific and clear.
At section 1 (working environment), specific expectations in terms of temperature control in the computer laboratory had to be stated, e.g. the presence of a functional air conditioner.
At section 2 (spatial environment), the reviewer noted that the number of learners utilising the computer laboratory may not necessarily include all the learners in the laboratory at a specific time. This factor needed to be taken into account due to large class groups using the computer laboratory at a time and frequently two learners working on one computer simultaneously. Another comment from Dr Macdonald was concerning the resource areas available in the computer laboratory. She stated that the term “resource areas” was non-specific and vague and could rather be re-termed as “book cases and shelves”.

At section 3 (workspace environment: chair) the measurement of the seat angle was excluded on recommendation of the reviewer. Dr Macdonald stated that although the seat angle was adjustable, it was unclear whether learners used this chair function or had the knowledge of the correct seat angle to promote better posture. The measurement of the seat pan depth was included in section 3, as learners in different grades and of varying heights had to use the same chair.

The precise measurements for the volume of the learners' legs underneath the desk, was encouraged by Dr Macdonald (workspace environment: desk). These measurements include the height, width and depth available for the learners' legs underneath the desk when in a seated position. Subsequent changes were made to the structure and content of the CWDA at sections 1-3.

3.13.4 PILOT STUDY

A pilot study was conducted in February 2006 at a conveniently situated high school in the Cape Metropolitan region. The purpose of the pilot study was to review and refine the assessment tool and the procedure of the data collection. The computer laboratories at the high school were assessed by the researcher. Minor changes were made to the CWDA following the pilot study. In order to improve data capturing and prevent contamination of results between schools, a front page was added to the CWDA. The following data was recorded on the front page: the school's name, number of the computer laboratories assessed and date of assessment. The measurement of the depth of the computer screen from the front edge of the table was adjusted to improve the reliability of the measurement. The depth of the computer screen was subsequently assessed as the distance measured perpendicularly from the centre of the computer screen to the top of the desk surface combined with the distance between the top of the desk and the floor measured perpendicularly.

3.14 MEASUREMENT PROCEDURES

3.14.1 DATA COLLECTION PERIOD

The assessment of the 29 computer laboratories took place from 18 April until 18 May 2006. In order to minimize disruption to the schooling process, the day and time of day of the assessment was arranged with the CAT educator at each school two weeks prior to the assessment. The computer laboratories of the schools forming part of both Phase 1 and Phase 2 of the study were assessed on the same day as the data collection of Phase 1 of the study.

3.14.2 DATA COLLECTION PROCEDURE

3.14.2.1 Assessment Procedure

The assessment of the computer laboratories at the selected schools took place during recess or after school, when the laboratories were not in use by learners or educators. All the computer laboratories being used for curriculum delivery of school subjects were assessed at each school.

The researcher conducted the workstation assessment at all the participating schools to ensure consistency in measurement procedures. Within each laboratory, the results of the assessment of criteria of one workstation were documented. In order to assess the reliability of the researcher's measurements, a second workstation within the same laboratory was assessed (intra-rater reliability). The assessment entailed indicating the presence ("yes") or absence ("no") of a specific ergonomic criterion.

All measurements of the computer laboratory and workstations were done by means of one standard steel tape measure and the measurements were recorded in millimetres (mm) (Accent brand, 3m X 16mm tape measure, code: 30-0193).

Twenty minutes were required to complete the assessment. The researcher photographed the computer laboratories at each school with prior consent from the CAT educator and school principal.

3.14.2.2 Specific assessment of criteria

The following measurements and information were documented at each section:

- *Section 1: Working Environment*
  - The presence of a functional air conditioner.
  - Open/ broken windows or open doors at the level of learners' heads and/ or knees.
  - Excessive noise causing distraction from task.

- *Section 2: Spatial Environment*
  - The number of learners using the laboratory at one time was obtained from the CAT educator.
  - The aisle width was measured as the distance between two adjacent desks/ workstations. The measurement was taken from the edge of one desk to the edge of the desk directly opposite to it.
  - Free and unhampered movement between workstations and entrances/exits to and from the computer laboratory.
  - The availability of book cases and shelves in the computer laboratory was documented.

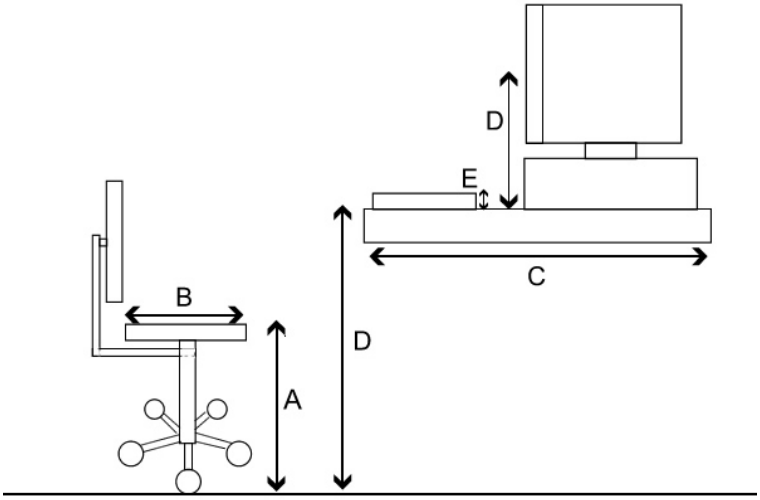
- *Section 3: Workspace Environment*

This section involved the assessment of the chair, desk, computer screen, keyboard and mouse/ input device (refer to section 3.13.2.1). Figure 3.1 illustrates a computer workstation and some of the main criteria that were assessed by means of the CWDA.

The following ergonomic criteria in terms of **the chair** were assessed:

- The presence of 5 moving rolling coasters on the chair (Figure 3.1).
- The height of the chair from the floor was measured as the distance from the floor to the front edge of the seat pan (Figure 3.1: A).
- The seat pan depth was measured from the front edge to the rear edge of the seat (Figure 3.1: B).
- The presence of functional levers to adjust the height of the back rests and arm rests.

Figure 3.1: Criteria at the computer workspace environment



The following ergonomic criteria in terms of **the desk** were assessed:

- The presence of functional levers which could alter the desk height.
- The width of the desk was measured as the distance from the left to right edges of the top surface of the desk. The distance from the front to rear edges of the desk was documented as the desk depth (Figure 3.1: C).
- The width of the space for the learners' legs underneath the desk was documented as measured from the left to right edge of the desk.
- The depth available for the learners' legs underneath the desk was documented as the distance between the front edge of the desk and the rear edge of the desk underneath the desk surface.
- The space available for learners' legs underneath the desk when they were seated on the provided chair was measured with the chair positioned underneath the desk. The measurement was done from the top surface of the chair extending perpendicularly to the bottom of the desk surface.
- The foot rest's length and width was measured from the top to bottom surface and the left and right edges respectively. The presence of a functional lever for adjusting the angle of the foot rest was documented.

The following ergonomic criteria in terms of **the computer screen** were assessed:

- The depth of the computer screen was documented as the distance from the centre of the computer screen extending perpendicularly to the top surface of the desk; combined with the distance measured perpendicularly from the top of the desk surface to the floor (Figure 3.1: D).
- The length and width of the computer screen was measured from the top to bottom edges and the left to right sides of the screen respectively.
- The adjustability of the angle of the viewing monitor was assessed by the ability of the computer screen to move in an anterior-posterior direction.
- The presence of a usable manuscript holder attached to the left or right side of the computer screen was documented.

The following ergonomic criteria in terms of **the keyboard** were assessed:

- A separate extendable tray for the keyboard.
- The height of the keyboard was measured from the floor to the home row of the keyboard (keyboard placed at the front edge of the desk).
- The height of the home row of the keyboard was measured as the distance between the desk surface and the home row of the keyboard (Figure 3.1: E).
- A functional lever for adjusting the angle of the keyboard and a usable gel wrist support at the edge of the keyboard surface.

The following ergonomic criteria in terms of **the input device** were assessed:

- The use of a mouse as an input device.
- The adjustability of the mouse position on the left or right sides.
- The use of the mouse by both left- and right- handed learners.
- The presence and use of a gel pad for the movement of the input device.

➢ Section 4: *Visual Environment*

The following requirements for the visual environment were documented:

- The stability and legibility of the screen characters.
- The presence of functional brightness and contrast controls at the viewing monitor.
- The presence of blinds or curtains to control glare from the sun and the positioning of the equipment at right angles to the lighting sources.
- The quality of the natural and artificial lighting sources in the computer laboratory.

3.15 DATA MANAGEMENT

The data capturing of phase 2 of the study was conducted by the researcher on a separate Excel sheet developed by a statistician. The total time period required to complete the data capturing of both Phase 1 and 2 of the study was 2 months (end-May to mid-July 2006).

3.16 STATISTICAL ANALYSIS

Descriptive statistics were used to analyze the data. Statistica 7 was used to analyze the data. Statistical significance was calculated at p=0.05.

SAS programs were written to accommodate the multiple responses provided by the learners. SAS program 9.1 was used. Probability calculations (odds ratios) were calculated and significant risk was identified by 95% confidence limits around odds ratios where neither 95% confidence limits encompass the value of 1.

3.17 ETHICAL CONSIDERATIONS

The proposal of this study was approved by the Committee for Human Research at Stellenbosch University (Study nr: N05/09/164) (Appendix 14).

Written, informed consent was obtained from the Western Cape Education Department to conduct the study in schools (Appendix 4). An extension of the initial period for conducting the study was obtained by formal request (Appendix 4). Written or oral consent of the principals of the selected schools to participate in the study was obtained.

Written, informed consent was obtained from each participating learner and his/her parent or legal guardian (Appendix 8). A child or his/her parents was informed that they could withdraw from the study at any time.

The researcher and assistants strived at all times to conduct this study according to internationally accepted ethical standards and guidelines (Medical Research Council Ethical Guidelines for Research).

Members of the WCED, Khanya Project, school principals and educators were invited to a meeting held during November 2006 at the Faculty of Health Science, Stellenbosch University. At this meeting feedback on the results obtained in this study, was provided and discussed among the present parties. Follow-up meetings were arranged to continue discussions and plan possible interventions in schools.

CHAPTER 4

DEVELOPMENT AND TESTING OF A NEW MEASUREMENT TOOL FOR ASSESSING MUSCULOSKELETAL DYSFUNCTION AMONG SCHOOL LEARNERS

INTRODUCTION

Computer use is one of the identified risk factors for the development of musculoskeletal dysfunction among school learners (Hakala et al. 2006 and Alexander & Currie 2004). Learners in the Western Cape province of South African are increasingly being exposed to computers in school (Khanya Project 2006). No published research on the impact of computer exposure on the health of the musculoskeletal system of South African school learners could be retrieved during a literature review in 2005 and 2006. The current research study was thus initiated to determine whether there is a relation between the prevalence of musculoskeletal dysfunction among school learners and their computer use.

A lack of suitable and valid tools for assessing learners' musculoskeletal dysfunction was identified. A review of the literature and personal correspondence with authors delivered 5 potential questionnaires for use in the proposed study (Straker 2005, Burke & Peper 2002, Shinn et al. 2002 and Jacobs & Katz 2001). The obtained questionnaires did not address the objectives of the main study which included determining the frequency and duration of computer use and the association between learners' musculoskeletal complaints and their computer use. Most of the standardized and well-known questionnaires focused on adult populations (Kuorinka, Jonsson, Kilbom, Vinterberg, Biering-Sorensen, Andersson, & Jorgenden 1987).

The limitations of the existing measurement tools encouraged the researcher to develop a new tool for assessing the health of the musculoskeletal system of learners, namely the "Computer Usage Questionnaire (CUQ)". The CUQ was specifically designed to determine the prevalence of musculoskeletal dysfunction and identify associative and risk factors among a school learner population. The aim of this chapter is thus to discuss the development, reliability and validity testing of this new measurement tool (CUQ).

The development, validity and reliability testing procedures of a new measurement tool for assessing the musculoskeletal dysfunction of children and adolescents will be presented in this chapter (Refer to section 3.7).

4.1 STUDY DESIGN

A descriptive study was conducted.

4.2 AIM OF STUDY

The main aim for developing the Computer Usage Questionnaire was to gain a reliable and valid tool for assessing musculoskeletal dysfunction among South African children and adolescents and to determine whether computer use was a risk factor.

4.3 DEVELOPMENT OF THE INSTRUMENT

A statistician was consulted prior to the design of the questionnaire for advice on format and structure. The objectives of the research study and a review of available questionnaires guided the formulation of questions (Straker 2005, Jacobs and Katz 2001, Kuorinka et al. 1987). Sections within the questionnaire were used to group questions together in one field. These included sections on computer use at school, computer use elsewhere, musculoskeletal dysfunction, sport and hobbies and demographic details. Open ended questions were used as well as closed questions with restricted options related to the theme of the question.

4.3.1 CONTENT OF THE CUQ

The draft CUQ consisted of 5 sections. Learners were guided by written instructions on the questionnaire on how to complete questionnaire.

Section 1 assessed learners' exposure to computers at school. The following criteria was assessed namely: the frequency and duration of weekly computer use, the number of years of school computer use, the type of activities and subjects the computer were used for and whether posture and exercise instruction were given to learners during school computer use.

Section 2 assessed learners' computer exposure outside of school. The following criteria was assessed namely: the frequency and duration of weekly computer use elsewhere, the number of years using the computer outside of school, the location of computer use, the

postures assumed during computer use elsewhere and other activities engaged in during computer use elsewhere.

Section 3 assessed learners' musculoskeletal dysfunction in the past month. Learners' had to indicate the body area/s where they experienced their musculoskeletal symptoms and also indicate the severity of these symptoms. The activity/activities during which learners experienced their symptoms were assessed as well as the utilization of medical services for their musculoskeletal complaints in the past 3 months.

Section 4 assessed learners' participation in sporting activities, and the frequency and duration of such activities per week. The weekly frequency and duration of playing musical instruments were also assessed.

Section 5 contained the demographic details of learners, e.g. age, gender, grade level and which school they were attending. In this section, learners' current and previous medical history was assessed. The use of visual aids, e.g. spectacles or contact lenses by learners was assessed in this section as well.

4.4 VALIDITY TESTING OF THE INSTRUMENT

4.4.1 PEER REVIEW

The face and content validity of the Computer Usage Questionnaire (CUQ) was assessed through peer evaluation and a learner focus group. The panel of reviewers consisted of five national and four international members (Appendix 15). The reviewers were researchers on the field of ergonomics and children (2), ergonomists (2), physiotherapists (2), occupational therapists (2) and a member of the Khanya team. The latter was the coordinator of the Khanya Project's E-schools program.

The reviewers were contacted via e-mail or by telephone and their participation in the review process obtained. The panel members were asked to complete a checklist which was provided by the researcher (Appendix 16). The checklist was compiled based on published literature (Ergonomics4schools 2006 and Gross Portney & Watkins 2000), with the aim to guide the reviewers in the assessment of all aspects of the face and content validity of the CUQ.

The checklist consisted of 11 dichotomous questions as well as space for extra comments by the reviewer. Questions that were asked included: “Is the format of the questionnaire easy to follow?”; “Does the structure of the questionnaire follow a logical lay-out?”; “Are the questions in this questionnaire direct and clear enough? If not, which questions are ambiguous?”
A letter explaining the procedure was sent with the checklist to the reviewers by post or via e-mail (Appendix 17). Two weeks were allocated to the panel to complete the review of the questionnaire. Data were returned via the e-mail or postal service.

4.4.2 LEARNER FOCUS GROUP

The aim of the learner focus group was to clarify any uncertainties in connection to the CUQ as well as to determine the time required by learners to complete the CUQ.
The learner focus group consisted of a convenience sample of 4 grade 11 girls from 2 schools in the Cape Metropolitan region. The small number of learners made the atmosphere relaxed and learners were free to ask questions and make remarks. The purpose of the focus group and the CUQ was explained to the learners and they were asked to complete the CUQ in the presence of the researcher. After completion of the questionnaire, an informal interview was conducted with each learner to determine whether the learners had any difficulties completing the CUQ. The questions asked of the learners were: “Did you find the questionnaire easy/difficult to complete?”; “Please motivate your answer.”; “Were there any question that were unclear to you?”; “Did you find enough options at each question for you to choose from?”; “Are there any other options you would like to add?”; “Do you have other comments about the CUQ?”.

4.5 INSTRUMENT RELIABILITY TESTING

4.5.1 PILOT STUDY SETTING

The reliability of the CUQ was estimated through stability (test-retest). A pilot study was conducted at a conveniently situated school within the Northern EMDC. A meeting was held with the school principal and his consent was obtained to conduct the pilot study at this school. This school offered Compu-typing as a school subject for curriculum delivery via computers.

4.5.2 SAMPLE

The pilot study sample comprised of two grade 11 class groups. The one class group received Compu-typing for curriculum delivery via computers, whereas the other class group did not have Compu-typing and were using computers for delivery of school subjects less than three times a week.

4.5.3 PILOT STUDY PROCEDURE

Written informed consent was obtained from learners prior to completion of the CUQ (Appendix 8). The two class groups completed the questionnaire at the same time, but in different class rooms. Learners were informed that their participation in this pilot study was voluntary and that they could withdraw from the study at any time. The researcher and an assistant supervised the two class groups respectively during completion of the CUQ. The purpose of the questionnaire was explained to the learners and the researcher and assistant were available if learners had any questions concerning the CUQ. Both the researcher and assistant were fluent in English and Afrikaans. Uncertainties expressed by learners in connection with the CUQ were explained by the researcher and assistant and documented. The time period it took learners to complete the questionnaire was documented for guidance of the time period in the main study.

4.5.4 RE-TEST

A week later the same two class groups of grade 11 learners were asked to complete the questionnaire again. In order to verify that the same learners completed the questionnaire on the two testing occasions, their names were correlated on the Excel sheet used for data capturing.

4.6 DATA MANAGEMENT

The obtained data was stored on an Excel data sheet. The researcher and an assistant entered the questionnaire data on the Excel sheet. The data obtained from the pilot study (test-retest) were analyzed statistically to determine the stability of the CUQ.

4.7 QUESTIONNAIRE TRANSLATION

The CUQ was available in all 3 official languages of the Western Cape, namely English, Afrikaans and Xhosa. The services of a professional translator at the Language Center of Stellenbosch University were obtained to translate the CUQ in the Afrikaans and Xhosa languages and then translated back into English.

4.8 ETHICAL CONSIDERATIONS

The proposal of this study was approved by the Committee for Human Research at Stellenbosch University (Study nr: N05/09/164) (Appendix 14). The consent and approval of the Western Cape Education Department (WCED) was obtained to conduct this study in high schools of the Cape Metropolitan region (Appendix 4). All participating learners and their parents/guardians had to complete an informed consent document prior to participating in the study (Appendix 8). The learners were informed that they could withdraw from the study at any time. The completion of the questionnaire was confidential and only the researcher and one assistant had access to the information from the learners during the data capturing of the data.

4.9 STATISTICAL ANALYSIS

Descriptive statistics were used to analyze the results of the reliability testing of the instrument. Percentage conformances, i.e. the percentage of respondents who gave the same answer for a question from week 1 to week 2, were calculated to determine the reliability of the instrument.

The validity testing of the data from the peer evaluation and learner focus group was grouped into themes and reported qualitatively.

4.10 RESULTS

4.10.1 INSTRUMENT VALIDITY ANALYSIS

4.10.1.1 Peer Review

All nine members of the expert panel evaluated the validity of the CUQ (Appendix 15). Feedback from the reviewers was provided on the checklist (6), telephonically (1) or by written comments on the questionnaire (2).

The evaluation of the face and content validity of the CUQ will be discussed qualitatively around three main themes, namely positive feedback, negative feedback and recommendations

- *What was good/positive about the CUQ?*

Reviewer 1 reported that in general the CUQ was simple and easy to understand. She stated that all aspects related to the content and face validity was covered through the checklist. The CUQ is straightforward and researchers would be able to gain reliable information from a school learner population (Nr 5). Reviewer 6 stated that the CUQ could be suitable for use in all grades of school learners. The evaluation of the ergonomic design and physical measurements of the computer workstation in the CUQ was encouraged by Reviewer 6 & 7.

- *What was perceived as negative/bad about the CUQ?*

The introduction and instructions to the CUQ were found to be confusing and ambiguous by a number of reviewers (Nr 1, 2 & 6). The statement of the study aims could create possible bias among the learner study sample (Nr 1 & 3). The draft CUQ sent to the reviewers was available in only one language, namely English (Nr 7). The CUQ was translated into all 3 official languages of the Western Cape namely: Afrikaans, English and Xhosa.

The use of closed questions was criticized as the learners were restricted in their description and interpretation of these questions (Nr 9). Some questions (e.g. Section C, Question1.1) and terms (e.g. ergonomics) were described as “too complex” for school learners and could cause misinterpretation (Nr 3, 6, 7, 8 & 9).

The report of the presence of muscle or joint pain by learners resulted in a number of comments by reviewers. The method of indicating the area and the pain intensity separately was repetitive information, as the reported intensity indicated the affected area as well (Nr 3 & 4).

The use of “pain” as the only description of musculoskeletal dysfunction was criticized, as various other symptoms may also be indicative of musculoskeletal dysfunction (Nr 8).
Reviewer 5 commented on the absence of information on the learners’ use of musical instruments. Published literature has reported an association between musculoskeletal dysfunction and playing of a musical instrument (Zaza, 1998)
Five of the reviewers commented strongly about the lack of posture assessment during the study (Nr 2, 3, 4, 6 & 8). These reviewers stated that the CUQ alone would be too weak to make a clear association between the learners’ musculoskeletal reports and their computer use.
Another point that came across strongly was the lack of questions on the “Quality of Life” of school learners due to the association made in the available literature between psychosocial factors and musculoskeletal dysfunction of learners (Diepenmaat et al. 2006 and Siivola et al. 2004) (Nr 2 & 5).
Reviewer 4 found the distance between the tick box and the related information too far. It was thought to possibly create confusion among the learners about which tick box is applicable to which text.

- *Recommendations by Reviewers*

A learner instruction sheet was compiled to be used as an addendum to the CUQ (Appendix). Sentence construction was revised by the researcher and more simplistic and explanatory words were used. Tick boxes were adjusted to be smaller with bigger spaces between follow-up texts.
A body chart with the front and back images of a human body was included. The learners could thereby indicate on the provided chart exactly where they experienced their symptoms. Adjacent to the chart, a table was provided for learners to indicate the intensity of the symptomatic areas by indicating one of two options (slight discomfort versus high discomfort).
The assessment of the computer workstation would not be dealt with in this questionnaire, but as a separate part of the research study (refer to section 3.10). Ergonomic aspects of the computer workstation and –laboratory will be assessed in selected high schools of the Cape Metropolitan region according to international ergonomic guidelines (Zandvliet & Straker 2001).
On request of Reviewer 2 & 5, a section on learners’ psychosocial status was included based on published validated research (Goodman, Meltzer & Bailey 1998).

4.10.1.2 Learner Focus Group Feedback

The 4 learners of the focus group required approximately 10 minutes to complete the CUQ. Two of the learners asked questions relating to the third section of the CUQ dealing with aches and pains. The questions related to clarifying aspects of the table defining the areas and the severity of the musculoskeletal symptoms. The learners were told that they only had to indicate the area/s which was applicable to them. After completion, the learners reported that the questions were clear and that the instructions at each question were sufficient. The learners also commented that each closed question had sufficient and appropriate options to choose from.

4.10.2 INSTRUMENT RELIABILITY ANALYSIS

4.10.2.1 Sample characteristics

The pilot study to assess the reliability of the CUQ was conducted during February 2006 at a high school within the Northern EMDC of the Cape Metropolitan region. A total of 53 learners completed the CUQ over the 2 collection periods. Table 4.1 presents the characteristics of the study participants in each of the computer and non-computer groups. Girls formed the largest part of the study sample.

Table 4.1: Characteristics of the pilot study sample

	Computer group	Non-Computer group	Total
Nr of learners	26	27	53
Nr of girls	14	21	35
Nr of boys	12	6	18
Average age of learners	16,2±0,5 years	15,8±0,5 years	

4.10.2.2 Repeatability Correlation of the CUQ

Correlation analysis was done to determine the repeatability between the first and second questionnaire results. As demonstrated in table 4.2, the CUQ had good stability as 75% of the questions had 80-100% repeatability correlation. A total of 24.5% (27/110) of the questions had repeatability correlation of less than 80%. The majority (49%, 54/110) of the questions in the CUQ had repeatability correlations of between 91-100%. Question 4 of the section on “Computer use elsewhere” had the poorest repeatability correlation (58%). This question dealt with the duration of use of the computer outside of school.

Table 4.2: Analysis of Repeatability Correlation of CUQ

Spread of % Correlation	Number of questions (/110)	% Questions
58-68%	5	4,5%
70-79%	22	20%
80-89%	29	26%
90-100%	54	49%

4.10.2.3 Correlation of responses between study groups

The repeatability correlation of the results for the two study groups (computer group versus non-computer group) delivered stable results, with no meaningful difference between the two groups' results over the two sessions. The responses for boys showed a 78% correlation in comparison to the girls' 88% correlation.

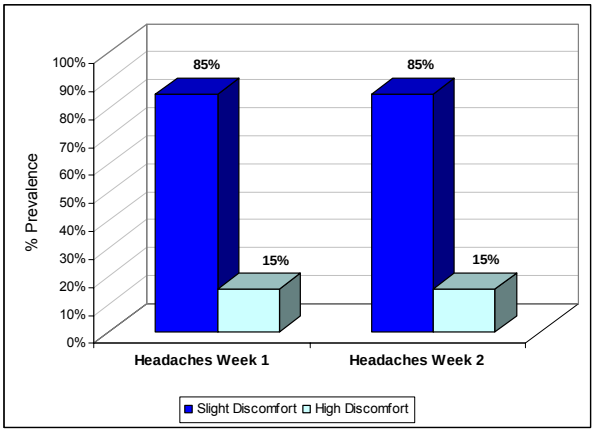
4.10.2.4 Correlation of symptomatic areas

A comparison of the symptomatic areas as reported by the learners in the two study groups, showed good correlation with no significant variance between the two data collection sessions (Figure 4.1 & Figure 4.2).

- *Headaches*

The prevalence of headaches among this pilot sample was 65.6% (21/32). The intensity of the symptoms was graded between "slight discomfort" and "high discomfort". The report on the intensity of headaches remained the same over the two data collection sessions (Figure 4.1).

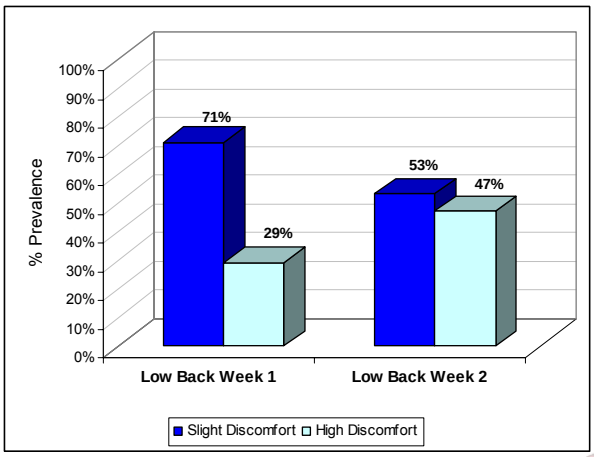
Figure 4.1: Prevalence and intensity of headaches over 2 assessments



- *Lower Back Dysfunction*

Learners' report of the intensity of symptoms for the lower back showed the greatest variance over the two weeks (Figure 4.2). At the first session, 71% (12/17) of learners reported "slight discomfort" in comparison to 53% who reported "slight discomfort" for lower back pain the following week.

Figure 4.2: Prevalence and intensity of lower back symptoms over 2 assessments



4.11 SUMMARY

The main summary points pertaining to the development and testing (reliability and validity) of the Computer Usage Questionnaire, dealt with in this chapter, were:

- The lack of a standardized, reliable and valid measurement tool for assessing learners' musculoskeletal dysfunction motivated the researcher to develop The Computer Usage Questionnaire (CUQ).
- The Computer Usage Questionnaire (CUQ) was developed to determine the prevalence of musculoskeletal dysfunction among South African school learners and to identify potential risk and associative factors e.g. computer use.
- The CUQ was assessed for its face and content validity and reliability (stability).
- The validity of the CUQ was assessed by means of a peer review panel and a learner focus group. The peer panel consisted of nine national and international members.
- The stability of the CUQ was tested by means of test-re-test over two sessions one week apart.
- The review panel gave valuable feedback on issues pertaining to the face and content validity of the CUQ. Recommended adaptations were made to the CUQ. The learner focus group stated that the CUQ was clear and easy to understand.
- The stability testing of the CUQ delivered good results, as 75% of the learners' responses to the CUQ, had 80% or more correlation over the two data collection sessions. The responses for boys showed a 78% correlation in comparison to the girls' 88% correlation.
- The repeatability correlation of the results for the 2 study groups (computer users versus non-computer users) delivered stable results, with no meaningful difference between the two groups' results over the two sessions.
- A comparison of the symptomatic areas, as reported by the learners in the two study groups, showed good correlation with no significant variance between the two data collection sessions.
- It is believed that the CUQ is a stable, reliable and a valid tool for assessing musculoskeletal dysfunction among South African school learners and to determine associative factors related to the dysfunction.
- In the following chapter, the results obtained through the completion of the CUQ by a learner sample from the Cape Metropolitan region will be presented.

CHAPTER 5
RESULTS of STUDY

The aim of the main study was to determine the prevalence of musculoskeletal dysfunction among high school learners using computers (Chapter 3). This chapter presents the results of the main study which was conducted in two phases. Phase 1 refers to the results of the Computer Usage Questionnaire (Appendix 6) and phase 2 refers to the results of the Computer Workstation Design Assessment (Appendix 12).

PHASE 1

Phase 1 (CUQ) reports the general description of the participants who completed the CUQ; the computer use at school and elsewhere of the participants; the prevalence of musculoskeletal dysfunction and associated factors; and predictors/ risk factors for musculoskeletal dysfunction related to computer usage.

5.1 DEMOGRAPHIC DESCRIPTION OF THE SAMPLE

5.1.1 SAMPLE RESPONSE FROM EACH EMDC

Eight schools, two from each of the four EMDC's, in the Cape Metropolitan region was randomly selected for the study, as described in Chapter 3. The sample comprised of 1073 grade 10-12 learners in the Cape Metropolitan region of the Western Cape Province, South Africa. The number of learners from each of the four EMDC's is presented in Table 5.1.

Table 5.1: Number of participants from each EMDC

EMDC	Frequency	Percentage
East	252	23.6%
Central	280	26.2%
North	206	19.3%
South	329	30.8%
Missing data	6	0.56%
Total:	1073	100%

It was initially calculated that a minimum of 1280 learners (160 from each school) would participate in this study (Chapter 3). Due to logistical difficulties at schools and unforeseen circumstances, a sample of 1073 learners participated in this study. Those learners (according to computer and non-computer groups), who, on the day of data collection, were present at school, consented to participate and had written informed consent forms for themselves and from their parents, participated in the completion of the questionnaire. Due to the abovementioned reasons a sample response rate could not be determined. The sample responses (N) will differ for each section as certain questions required multiple responses from learners and as all the learners did not complete each section of the CUQ.

5.1.2 GENDER AND AGE DESCRIPTION IN RELATION TO COMPUTER USAGE

The sample comprised of a computer group and a non-computer group according to the criteria described in Chapter 3. The computer group consisted of 512 learners, i.e. learners using computers for curriculum delivery more than three times per week. The non-computer group consisted of 561 learners (Table 5.2).

The sample consisted of 690 girls and 373 boys (Table 5.2). Girls constituted 59.7% (304/509) of the computer group and 69.7% (386/554) of the non-computer group. The computer group consisted of a larger percentage of boys (40.3%), than the non-computer group (30.3%).

Table 5.2: Characteristics of the sample

	Computer Group	Non-computer Group	Totals
Females	304	386	690 (64.31%)
Males	205	168	373 (34.76%)
Missing data	3	7	10 (0.93%)
Totals	512	561	1073

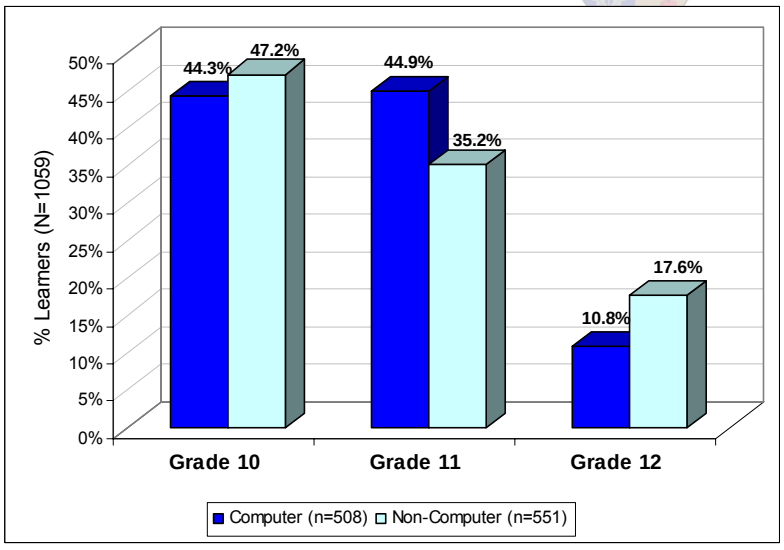
The mean age of the total learner group (N=1026) was 16.3±1.1 years. The learners in the computer group and non-computer group were comparable in terms of their mean ages as illustrated in table 5.3.

Table 5.3: Mean age of learners (N=1026)

	Computer Group	**Non-Computer Group**
Female Age (Mean ± SD)	16.2±1.0	16.4±1.1
Male Age (Mean ± SD)	16.3±1.1	16. 6±1.3
Total Mean Age	16.2±1.1	16.5±1.2

The distribution of the study participants according to their school grade is presented in figure 5.1. Less grade 12 learners in comparison to grade 10 and 11 learners participated in the study.

Figure 5.1: Grade level of study participants (N=1059)

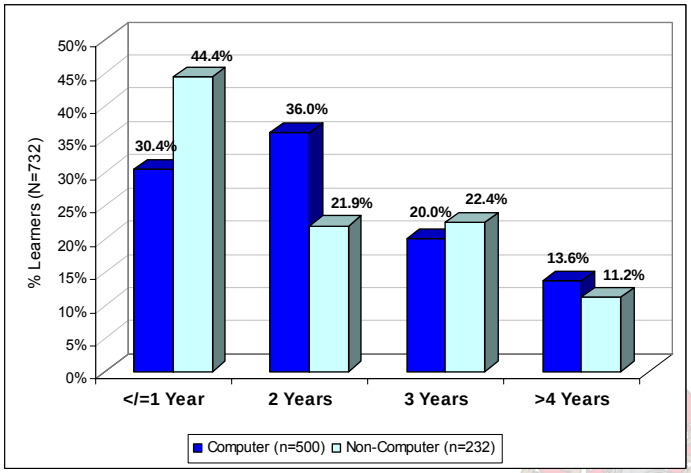


5.2 SCHOOL COMPUTER USE

5.2.1 YEARS OF USING THE SCHOOL COMPUTER

A total of 732 learners indicated for how many years they have been using the school computer. The information on the duration of learners' computer use at school is summarized in Figure 5.2.

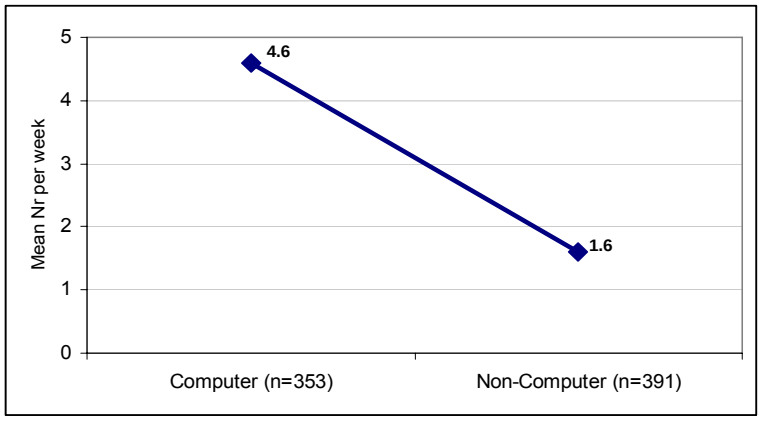
Figure 5.2: Number of years of school computer use (N=732).



5.2.2 WEEKLY NUMBER OF COMPUTER LESSONS

Learners had to indicate how many times per week they used the school computer, ranging from less than once to more than five times per week. The computer group used the school computer on average 4.6 times per week and the non-computer group 1.6 times per week. A significant difference ($p<0.001$) were found in terms of the frequency of weekly school computer use between the computer and non-computer groups (Figure 5.3).

Figure 5.3: Computer lessons per week (N=744).



5.2.3 AVERAGE NUMBER OF HOURS USING THE SCHOOL COMPUTER PER WEEK

Study participants had to indicate how many hours per week they used the school computer for. A total of 695 learners, 172 from the non-computer group and 481 from the computer group, responded to this question. The computer group spent a mean of 4.8±1.55 hours and the non-computer group 2.5±1.37 hours per week using the school computer.

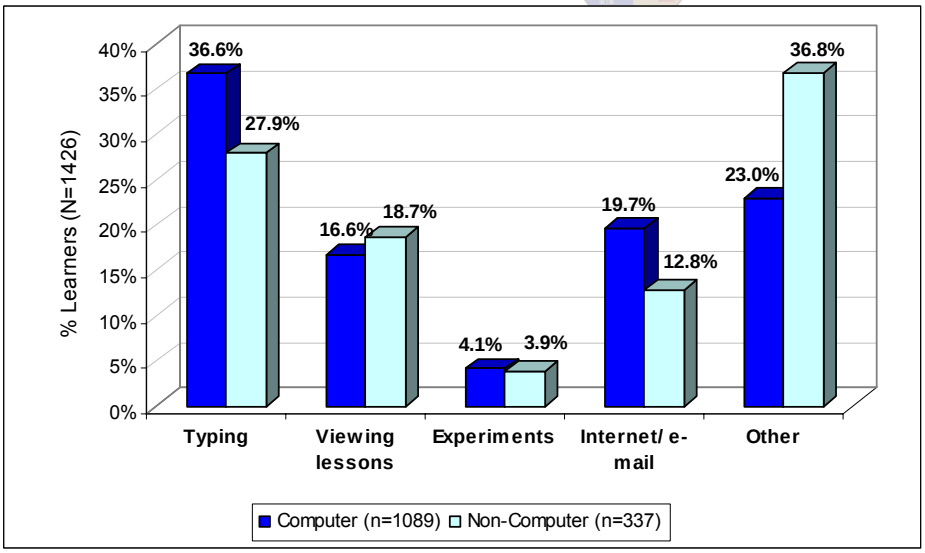
5.2.4 DURATION OF SCHOOL LESSON ON COMPUTER

Learners indicated that the average duration of a school lesson conducted on the computer was 45 minutes. The participants in the computer group (n=501) indicated a mean time of 45.12±6.2 minutes and the non-computer group (n=232) 44.54±13.70 minutes.

5.2.5 ACTIVITIES WHILE USING THE SCHOOL COMPUTER

Learners were asked to nominate one or more activities that they used the school computer for. A total of 1089 responses were obtained from the computer group and 337 responses from the non-computer group. Figure 5.4 illustrates the activities the participants used the school computer for. The “other” option indicated by learners included using educational programs, research projects and games.

Figure 5.4: Activities on school computer (N=1426)



5.2.6 PREVENTATIVE INSTRUCTION RECEIVED AT SCHOOL

5.2.6.1 Posture education during computer use at school

Participants were asked to indicate whether they had received instruction on their posture during computer use. A total of 740 learners completed this question, of which 55.14% (408/740) indicated that they had received such instruction. Of the learners who received instruction, 75.98% (310/408) were in the computer group and 24.02% (98/408) were in the non-computer group.

5.2.6.2. Rest breaks during computer use at school

When asked whether they took regular rest breaks during computer work at school, 736 learners completed this question, with a total of 51.22% (377/736) indicating that they took rest breaks. Of the learners who indicated that they took rest breaks, 71.88% (271/377) were in the computer group and 28.12% (106/377) were in the non-computer group.

5.2.6.3 Stretches and exercises during rest break from computer work

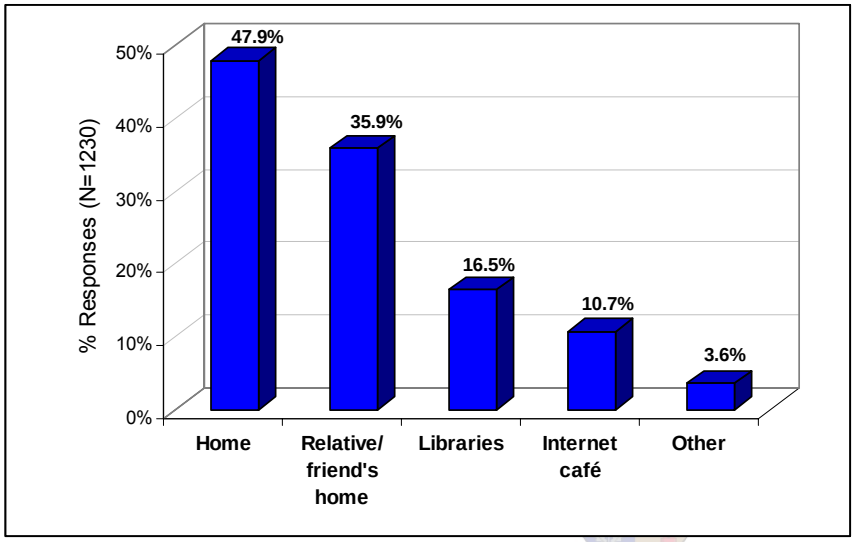
Of the 721 learners who answered the question regarding instruction on exercises/stretches during computer work, 23.86% (172/721) of the learners had received such instruction. Of this group who had received exercise instruction, 70.93% (122/172) were in the computer group and 29.07% (50/172) were in the non-computer group.

5.3 COMPUTER USE ELSEWHERE

5.3.1 PLACES OF USING THE COMPUTER ELSEWHERE

The learners could indicate where they used a computer outside of school, by nominating one or more options. A total of 1230 responses were obtained from the participants and figure 5.5 illustrates the different areas where participants used the computer. Almost 50% of the respondents had access to a computer at their homes.

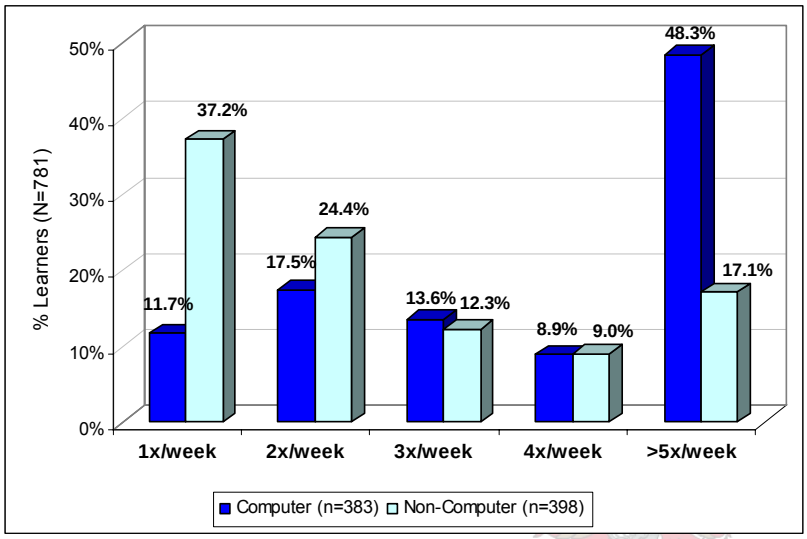
Figure 5.5: Venues for computer use outside of school (N=1230)



5.3.2 FREQUENCY OF COMPUTER USE OUTSIDE SCHOOL

Learners had to indicate how many times per week they used the computer outside of school. The computer group participants used the computer outside school more frequently per week than the non-computer group participants (Figure 5.6).

Figure 5.6: Frequency of computer use outside school (N=781)



5.3.3 TOTAL WEEKLY EXPOSURE TO COMPUTERS

The duration of weekly computer exposure of learners was calculated according to the frequency and duration of their computer use at school and elsewhere. Table 5.4 illustrates the mean weekly computer exposure for the total sample, gender groups and the computer and non-computer groups. The computer group participants had almost twice as much weekly computer exposure in comparison to the non-computer group.

Table 5.4: Total weekly computer exposure

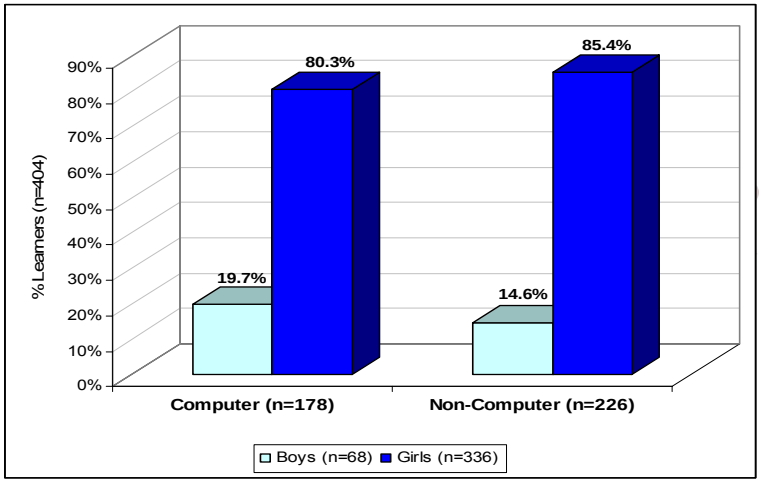
	Total Sample	Boys	Girls	Computer Group	Non-Computer Group
Group	488	212	274	358	130
Mean hours	10.64 hrs	12.35 hrs	9.24 hrs	12.08 hrs	6.65 hrs
Standard Deviation	±6.77	±7.24	±6.02	±6.75	±5.05

5.4 SPORT AND MUSIC

5.4.1 PARTICIPATION IN SPORT

A total of 1014 learners responded to the question on sport participation, with 60.16% (610/1014) participating in sport and 39.84% (404/1014) that did not participate in sport. Eighty three percent (336/404) of girls in comparison to 17% (68/404) of boys did not participate in sport (Figure 5.7). Soccer (35.57%, 217/610) and athletics (19.18%, 117/610) were the most common sporting types indicated by learners. Among the computer group 63.6% (311/489) and among the non-computer group 56.95% (299/525) of learners participated in sport. More girls in the non-computer group (57.86%, 173/299) participated in sports compared to girls in the computer group (46.62%, 145/311).

Figure 5.7: No participation in sport (n=404)



5.4.2 PLAYING OF MUSICAL INSTRUMENTS

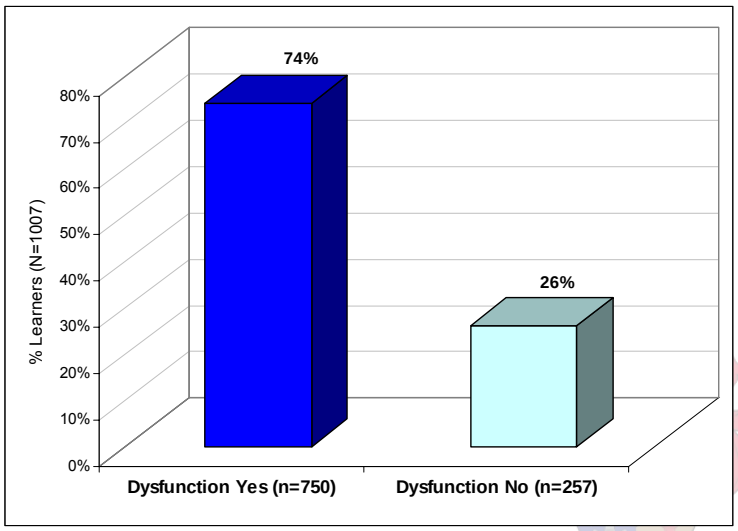
Of the 923 learners who answered the question, only 21.67% (200/923) played a musical instrument. Slightly more girls (56.5%, 113/200) than boys (43.5%, 87/200) played a musical instrument, whereas no meaningful difference was found between the number of computer (48.5%, 97/200) and non-computer (51.5%, 103/200) group participants who played a musical instrument.

5.5 PREVALENCE OF MUSCULOSKELETAL DYSFUNCTION

5.5.1 GENERAL PREVALENCE OF MUSCULOSKELETAL DYSFUNCTION

Learners were asked in the third section of the CUQ, whether they had experienced any musculoskeletal dysfunction (i.e. pain, discomfort, stiffness, pins and needles) in the previous month. A total of 74% (750/1007) of those 1007 learners that responded to this question indicated that they had experienced musculoskeletal dysfunction (Figure 5.8).

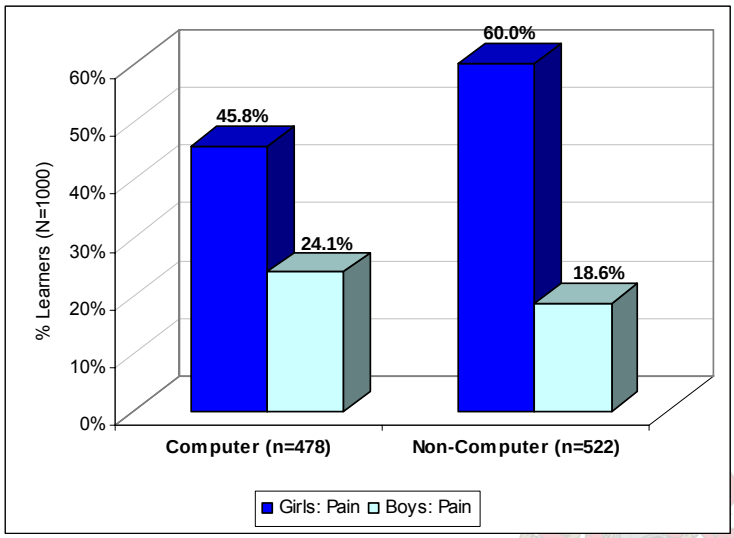
Figure 5.8: Prevalence of musculoskeletal dysfunction among total sample (N=1007)



5.5.2 PREVALENCE OF MUSCULOSKELETAL DYSFUNCTION IN RELATION TO THE COMPUTER AND NON-COMPUTER GROUPS

The prevalence of musculoskeletal dysfunction among boys and girls within the computer and non-computer groups is illustrated in Figure 5.9, depicting a higher prevalence among girls than boys.

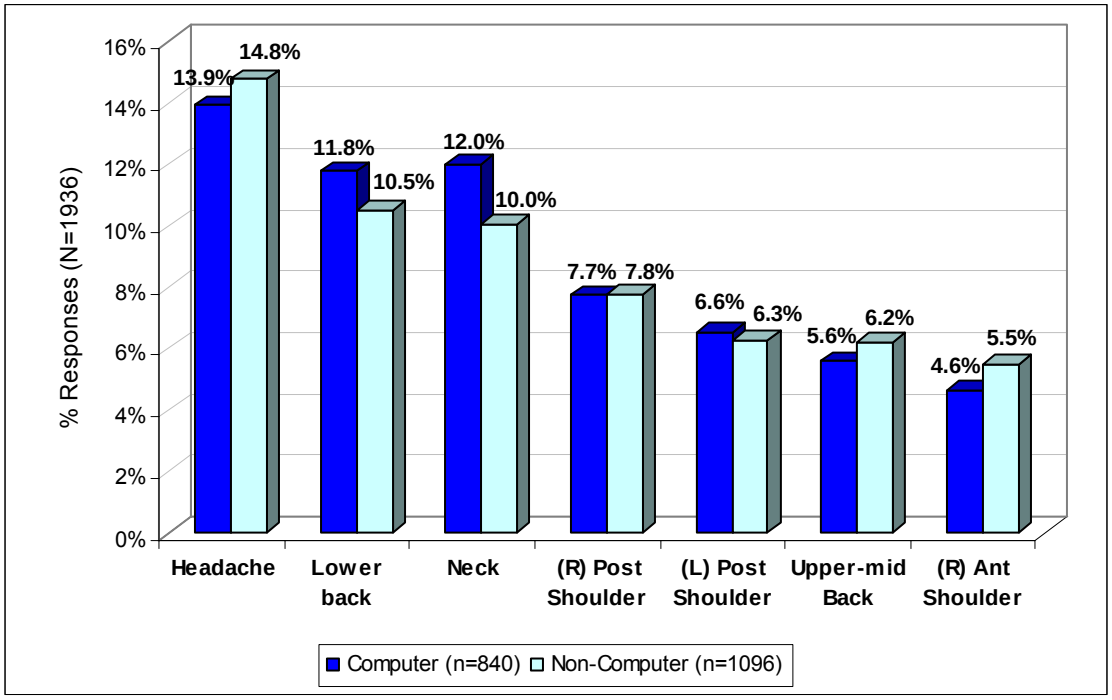
Figure 5.9: Prevalence among the computer and non-computer groups (N=1000)



5.5.3 AREAS OF MUSCULOSKELETAL DYSFUNCTION

Learners could indicate one or more body areas, on a provided body chart, where they had experienced their musculoskeletal symptoms in the past month. A total of 1936 responses were obtained, with the computer group participants reporting a total of 840 body areas of dysfunction, with a mean of 2.49 areas per learner. The non-computer group participants reported a total of 1096 body areas of dysfunction, with a mean of 2.65 areas per learner. Figure 5.10 illustrates the areas of musculoskeletal dysfunction between the computer and non-computer groups. The combined "other areas" nominated by learners in the computer group totaled 33.09% and in the non-computer group 33.58%. These other 35 body areas are excluded from this figure as their percentage value was less than 4%.

Figure 5.10: Areas of dysfunction among computer and non-computer groups (N=1936)



5.6 COMPUTER EXPOSURE AND ASSOCIATED MUSCULOSKELETAL DYSFUNCTION

5.6.1 DEFINITION OF COMPUTER EXPOSURE

5.6.1.2 Computer Exposure and Musculoskeletal Dysfunction

In order to define exposure to computer usage, subgroups of the computer and non-computer users were defined according to frequency and duration of total computer usage (i.e. computer use at school and elsewhere) (Alexander & Currie 2004). The six subgroups were classified as follows:

- Subgroup 1: Non-computer group: computer usage less than 6 hrs per week
- Subgroup 2: Non-computer group: computer usage of 6-10 hrs per week
- Subgroup 3: Non-computer group: computer usage of more than 10 hrs per week
- Subgroup 4: Computer group: computer usage less than 6 hrs per week
- Subgroup 5: Computer group: computer usage of 6-10 hrs per week
- Subgroup 6: Computer group: computer usage of more than 10 hrs per week

There was a similar representation of learners in the three subgroups of the computer group, whereas the majority of learners in the non-computer group were in subgroup 1. This group had less than 6 hours weekly computer exposure and constituted 90.73% (509/561) of the non-computer group (Table 5.5).

Table 5.5: Weekly computer exposure of subgroups (N=1073)

Study Group	Sub-Group	Computer Exposure/ Week	Nr of Learners	Percentage of Learners
Non-Computer	1	<6hrs/ week	509	47.4%
	2	6-10hrs/ week	23	2.1%
	3	>10hrs/ week	29	2.7%
Computer	4	<6 hrs/ week	198	18.5%
	5	6-10hrs/ week	152	14.2%
	6	>10 hrs/ week	162	15.1%
Total:			1073	100%

5.6.2 COMPUTER EXPOSURE IN RELATION TO BODY AREAS

The head, low back and neck were the three most common body areas nominated as affected by dysfunction among the computer and non-computer groups (Figure 5.10). Analysis to ascertain if the most common body areas were associated with computer usage was thus conducted. The prevalence of musculoskeletal dysfunction increased as computer exposure increased among the computer group (Subgroups 4, 5 & 6). The same trend was not evident among the non-computer groups (Subgroups 1, 2 & 3) (Figures 5.11, 5.12 & 5.13).

Figure 5.11: Prevalence of headache among the subgroups (n=279)

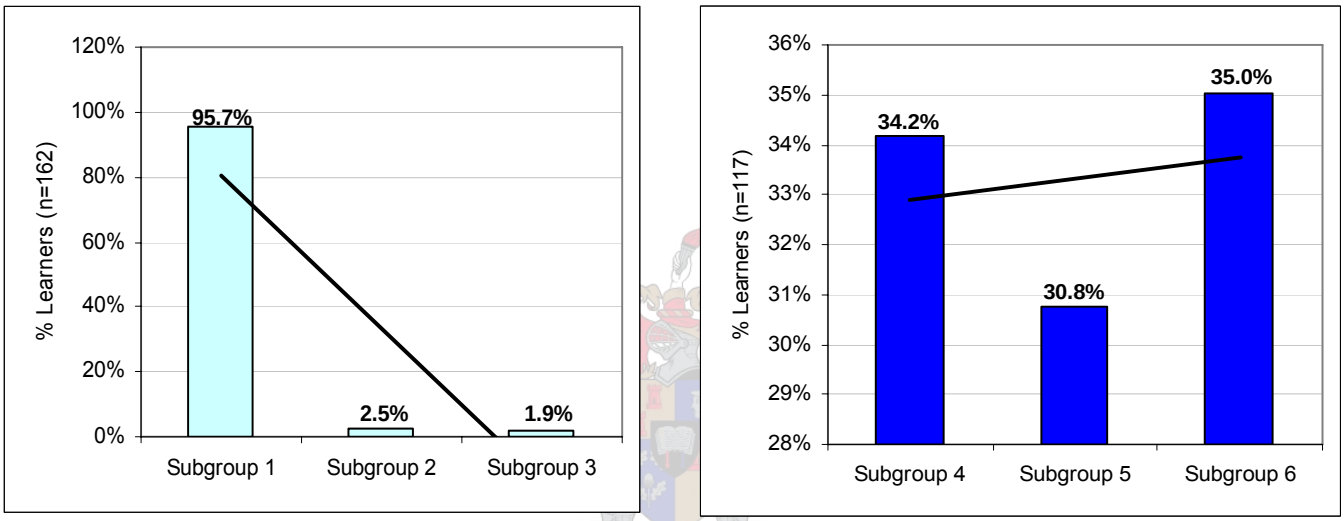
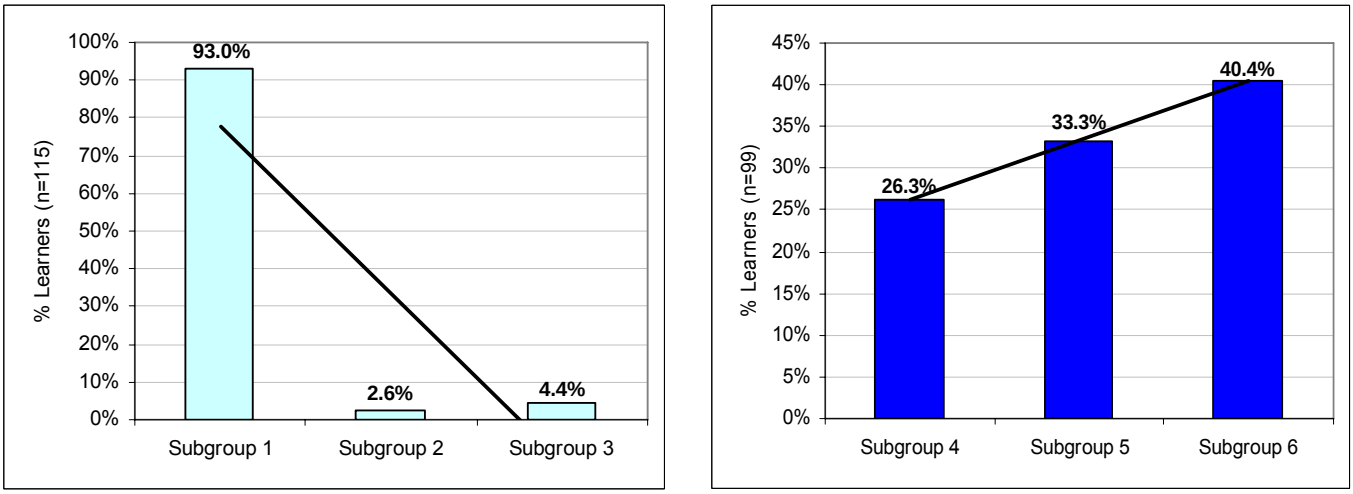
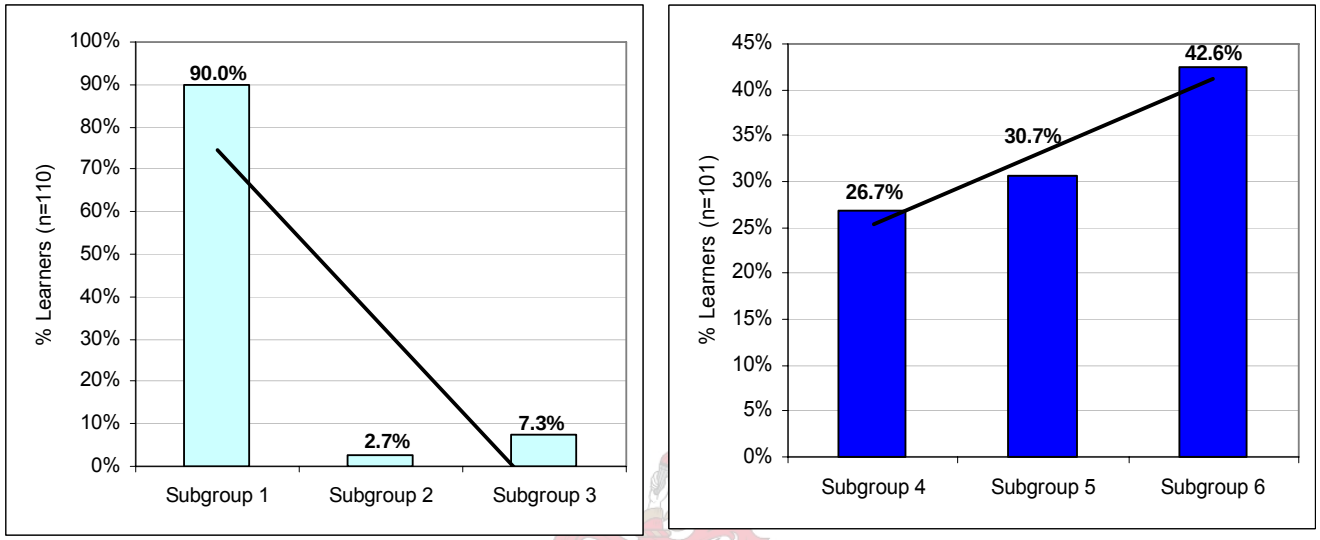


Figure 5.12: Prevalence of low back pain among the subgroups (n=214)



The prevalence of low back and neck pain (Figure 5.12 & Figure 5.13) demonstrated a linear increase among the computer group as computer exposure within the subgroups increased, whereas a decrease in the prevalence of headaches were noted in subgroup 5 of the computer users (Figure 5.11).

Figure 5.13: Prevalence of neck pain among the subgroups (n=211)



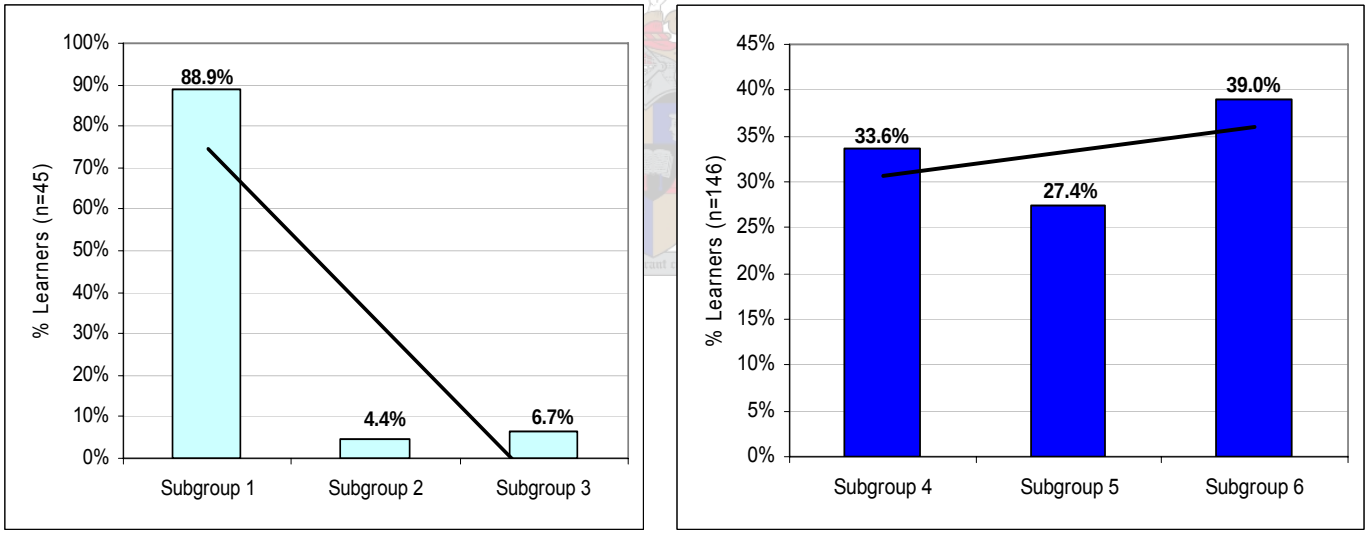
5.6.3 ACTIVITIES DURING WHICH MUSCULOSKELETAL SYMPTOMS WERE EXPERIENCED

When participants were asked to indicate during which activity they felt their musculoskeletal symptoms, they could indicate one or more of the following options: writing at the school desk, sitting at the school desk, computer use at school, during or after sport, computer use elsewhere and an option for “other”, where learners could indicate another activity.

5.6.3.1 Musculoskeletal dysfunction during computer use at school

Almost 18% (191/1073) of learners indicated that they experienced musculoskeletal dysfunction while using the computer at school. A total of 76.4% (146/191) of the computer group reported dysfunction during computer at school compared to 23.6% (45/191) of the non-computer groups (Figure 5.14).

Figure 5.14: Musculoskeletal dysfunction during **school computer use** (n=191)

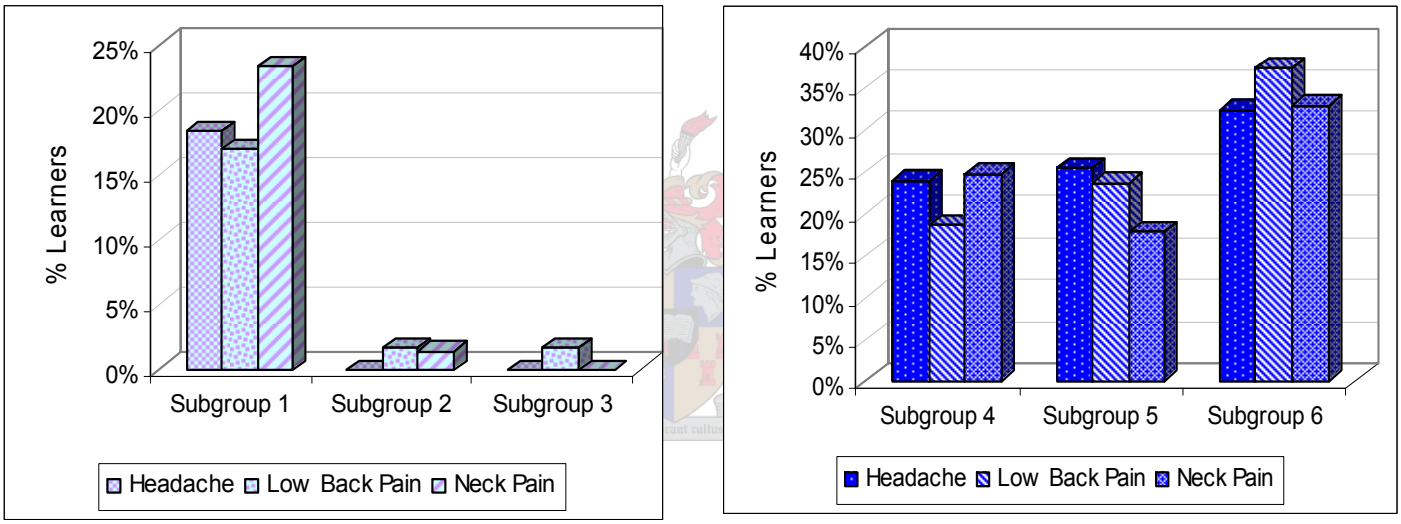


It appears that the musculoskeletal dysfunction experienced by the non-computer group may not have been related to computer usage, as the low computer exposure group (subgroup 4) reported a higher prevalence of musculoskeletal dysfunction, compared to the high exposure group (subgroup 3) of the non-computer group. Other activities that may have been responsible for the non-computer group’s symptoms include sports participation, sitting at and/or working at the school desk.

5.6.3.1.1 Specific areas of dysfunction during ***computer use at school***

The body areas that received the most nominations by the study participants as affected by musculoskeletal dysfunction were the head, low back and neck (refer figure 5.10). The learners were asked to indicate during which activities they had experienced their musculoskeletal symptoms. In order to illustrate the impact of increasing computer exposure on the report of the abovementioned areas of dysfunction, the same sub-groups were used as described in table 5.5. Figure 5.15 depicts the prevalence of musculoskeletal dysfunction among the subgroups of the computer and non-computer groups who indicated headaches, low back pain and neck pain during computer use at school.

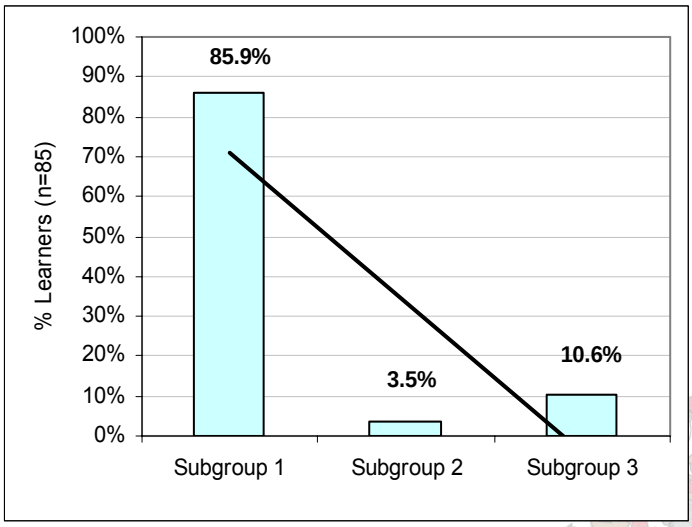
Figure 5.15: Prevalence of musculoskeletal dysfunction during **computer use at school** (Headaches: n=71; Low back pain: n=59; Neck pain: n=73)

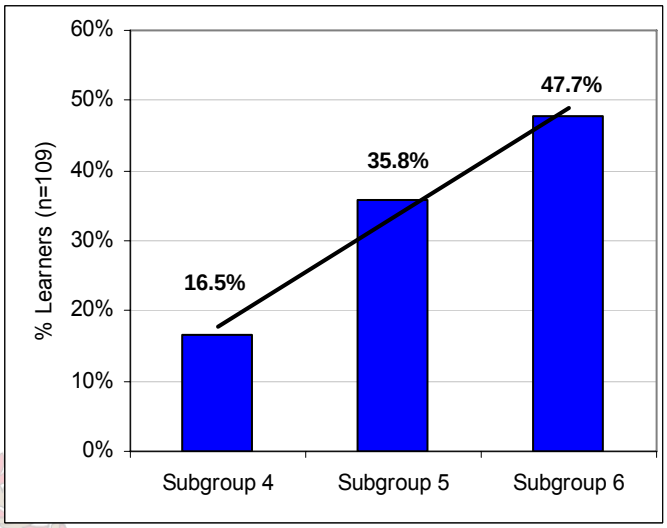


5.6.3.2 Prevalence of musculoskeletal dysfunction during computer use elsewhere

A total of 194 (18.08%; 194/1074) learners reported that they experienced their symptoms of musculoskeletal dysfunction during computer use outside of school. The prevalence of musculoskeletal dysfunction increased among the computer group as the weekly exposure to computers increased (Figure 5.16).

Figure 5.16: Musculoskeletal dysfunction during **computer use elsewhere** (n=194)

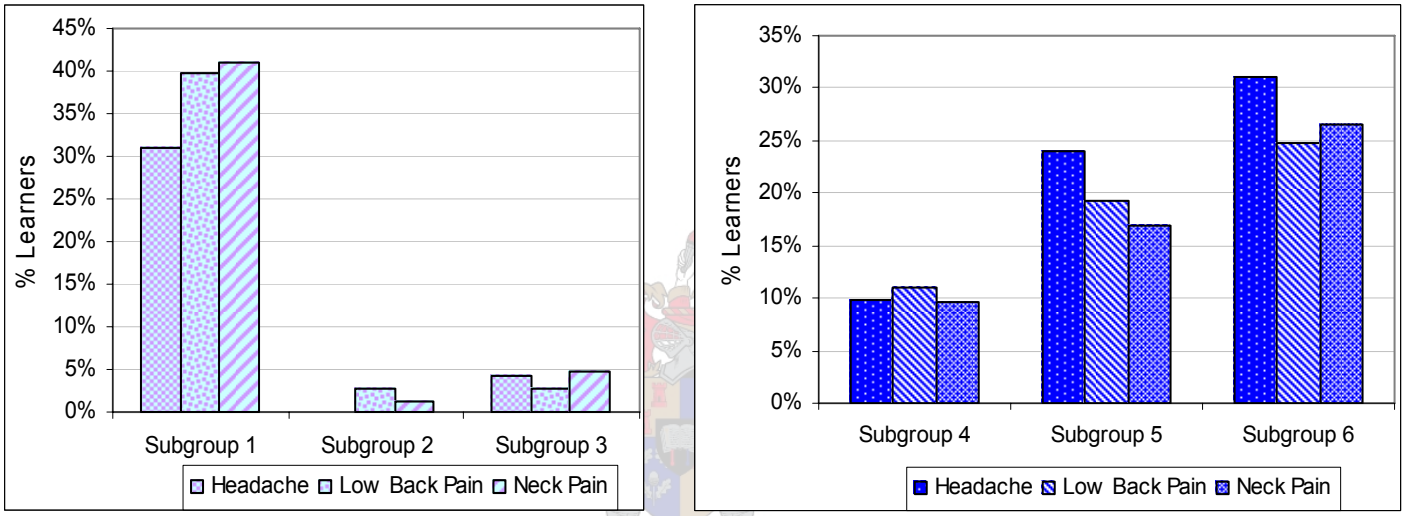




5.6.3.2.1 Specific areas of dysfunction during ***computer use elsewhere***

The prevalence of musculoskeletal dysfunction in the main nominated areas (head, neck and low back) during computer usage at other venues showed the same tendency as with computer use at school (refer section 5.6.3.1.1). The differences between the computer and non-computer subgroups showed similar findings as that found during computer use at school. Figure 5.17 illustrates the prevalence of headaches, low back and neck dysfunction during computer use outside of school

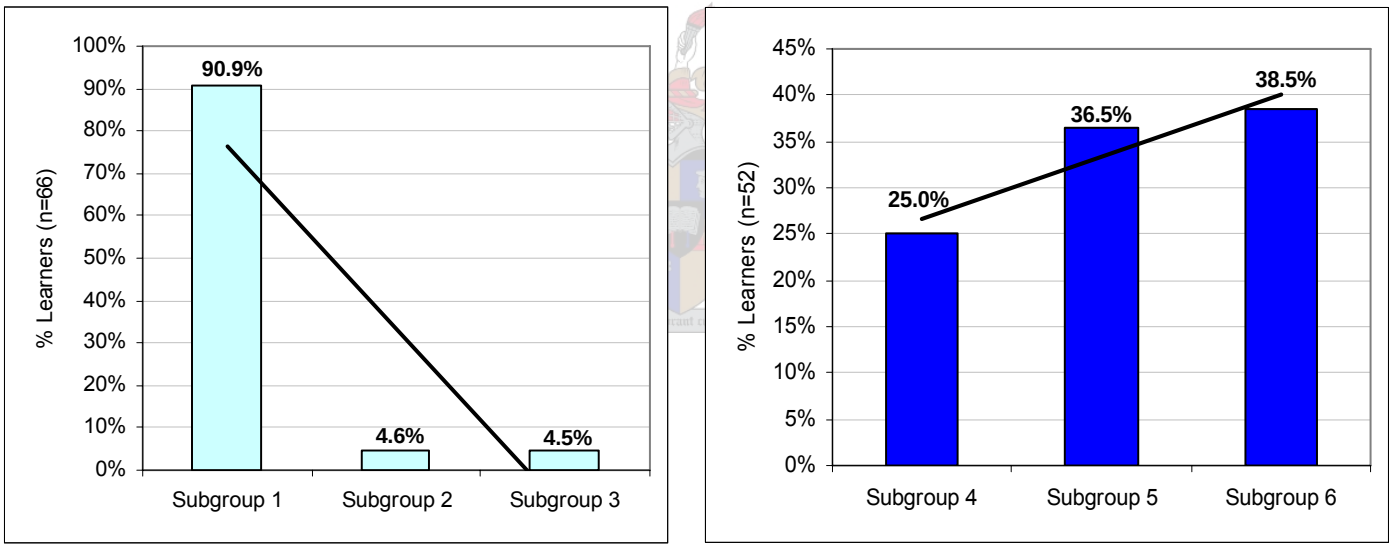
Figure 5.17: Musculoskeletal dysfunction during **computer use elsewhere** (Headache: n=71, Low back pain: n=73; Neck pain: n=83)



5.6.4. MULTIPLE AREAS OF DYSFUNCTION

Learners could indicate more than one body area where they had experienced their musculoskeletal symptoms (refer section 5.5.3). According to published literature some children may experience musculoskeletal dysfunction in more than one body area (Petersen et al. 2006 and Mikkelson et al. 1997). In order to ascertain whether computer exposure was related to multiple areas of dysfunction, the responses of participants were divided into 2 groups. The first group comprised of learners with less than four body areas affected by dysfunction. The second group comprised of learners with four or more body areas affected (Mikkelson et al. 1997). The prevalence of multiple areas of dysfunction among the computer subgroups increased as the weekly computer exposure increased, whereas the same trend was not evident among the non-computer subgroups (Figure 5.18).

Figure 5.18: Report of multiple areas of dysfunction in the study groups (n=119)



5.7 EDUCATION ON COMPUTER USE ASSOCIATED WITH MUSCULOSKELETAL DYSFUNCTION

In order to determine the impact of education on the prevalence of musculoskeletal dysfunction, the body areas most commonly affected by computer use was investigated namely the head, low back and neck. The total learner group with musculoskeletal dysfunction (74%; 750/1007) rather that the computer and non-computer groups separately, was used in order to establish the impact of these educational interventions.

5.7.1 POSTURE AT THE COMPUTER WORKSTATION

When learners were asked whether they had received instruction on their posture during computer use at school, 55.14% (408/740) of the responding learners indicated that they had received such instruction (refer section 5.2.6.1). Table 5.6 illustrates that posture education did not have an impact of the prevalence of headaches, low back pain and neck pain among these study participants.

Table 5.6: Posture education related to specific areas musculoskeletal dysfunction (N=740)

	Headaches (n=157)		**Low back pain (n=127)**		**Neck pain (n=133)**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Instruction Yes (408)	89	319	64	344	64	344
55.14%	21.81%	78.19%	15.69%	84.31%	15.69%	84.31%
Instruction No (332)	68	264	63	269	69	263
44.86%	20.48%	79.52%	18.98%	81.02%	20.78%	79.22%

5.7.2 REST BREAKS DURING COMPUTER WORK

A total of 736 learners indicated whether they took rest breaks or not from their computer work at school (refer section 5.2.6.2). A total of 51.22% (377/736) of the learners took rest breaks. Table 5.7 illustrates that taking of rest breaks did not impact on the prevalence of headaches, low back pain and neck pain among the study participants.

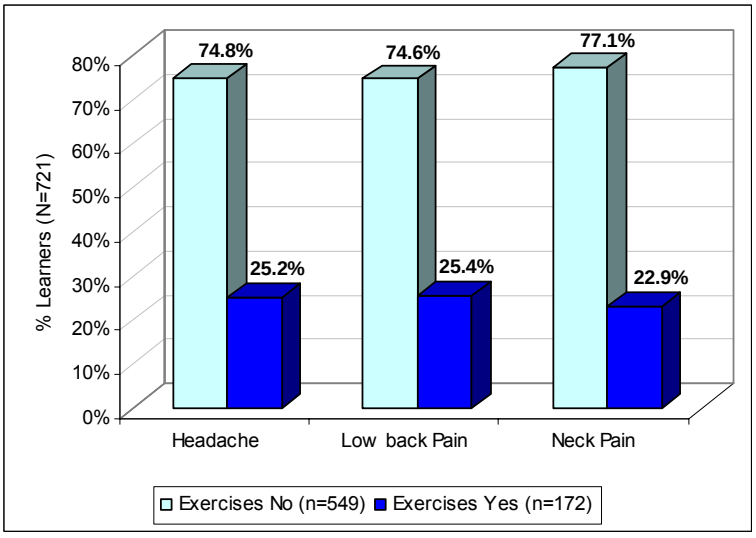
Table 5.7: Posture education related to specific areas of musculoskeletal dysfunction

	Headaches (n=152)		**Low back pain(n=129)**		**Neck pain (n=135)**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Rest Breaks Yes (377)	81	296	73	304	74	303
51.22%	21.49%	78.51%	19.36%	80.64%	19.63%	80.37%
Rest Breaks No (359)	71	288	56	303	61	298
48.78%	19.78%	80.22%	15.60%	84.40%	16.99%	84.01%

5.7.3 EXERCISES AND/OR STRETCHES DURING COMPUTER WORK

Learners were asked to indicate whether they were instructed on exercises/stretches to do during their rest breaks from computer work (refer section 5.2.6.3). Of the 721 responding learners, 23.86% (172/721) indicated that they had received such exercise instruction. This learner group reported less musculoskeletal dysfunction than the learners who did not receive such exercise instruction (Figure 5.19).

Figure 5.19: Musculoskeletal dysfunction associated with exercises/stretches (N=721)



5.8 PREDICTORS FOR MUSCULOSKELETAL DYSFUNCTION

5.8.1 ODDS RATIOS

Among this sample, female gender, playing sport (more than once a week) and school computer use for more than three years, were associated with musculoskeletal dysfunction. The adherence of computer laboratories to ergonomic standards was not associated with musculoskeletal dysfunction among this learner sample. The results of the Computer Workstation Design Assessment (CWDA) will be presented in phase 2 of the results chapter. Table 5.8 illustrates the odds ratios and upper and lower confidence intervals obtained for each assessed variable.

Table 5.8: Odds Ratios for musculoskeletal dysfunction (**indicate significant values)*

	OR	UL 95% CI	LL 95% CI
Female Gender	2.59	1.91	1.43*
Playing Sport	1.79	2.44	1.31*
Inactivity	0.56	0.41	0.76
School computer use more than 3 years	2.04	1.12	3.76*
CWDA score < or equal16	0.90	0.66	1.21

5.8.2 PREDICTIVE FACTORS FOR MUSCULOSKELETAL DYSFUNCTION

5.8.2.1 Weekly computer exposure

In order to determine whether associative factors are predictive of the development of musculoskeletal dysfunction, weekly computer exposure was classified into two groups. The time period was estimated according to the results of the weekly computer exposure of learners (section 5.3.3) in this study and among international samples (Alexander & Currie 2004). The two groups were formulated as follows:

Group 1: Exposure to computer usage for less or equal to 7 hours per week

Group 2: Exposure to computer usage for more than 7 hours per week

Weekly exposure to computers for more than seven hours was predictive factor of general musculoskeletal dysfunction, lower back pain and neck pain among this study sample (Table 5.9). Exposure to computers for more than seven hours per week was associated with, but not predictive of multiple body areas of dysfunction (>4 body areas), right shoulder pain, right wrist pain and left wrist pain due to high odds ratios and insignificant confidence interval levels.

Table 5.9: Computer exposure as predictive factor for musculoskeletal dysfunction *(significant findings indicated by **; significant odds ratios indicated by *)*

Predictive Factor: >7hours weekly computer use leads to:	**OR**	**UL 95% CI**	**LL 95% CI**
General musculoskeletal dysfunction	2.5	1.81	3.44**
More than 4 body areas of musculoskeletal dysfunction	1.18*	0.76	1.80
Headaches	0.84	0.58	1.2
Lower back pain	1.5	1.03	2.20**
Neck pain	1.76	1.21	2.58**
Right shoulder pain	1.24*	0.80	1.93
Right wrist pain	1.69*	0.87	3.29
Left wrist pain	1.19*	0.74	1.94

Weekly computer exposure of more than seven hours and high scores on the psychosocial section were associated with musculoskeletal dysfunction, but was not predictive of musculoskeletal dysfunction because of insignificant confidence interval levels (Table 5.10).

Table 5.10: Computer exposure and psychosocial factors as predictive for musculoskeletal dysfunction *(significant odds ratios indicated by *)*

Predictive Factor:	**OR**	**UL 95% CI**	**LL 95% CI**
>7hours weekly computer use and high psychosocial scores leads to musculoskeletal dysfunction	1.23*	0.79	1.93

Weekly computer exposure exceeding seven hours was predictive for right and left shoulder pain among boys and for left wrist pain among girls. This factor increased the likelihood for the following, but was not predictive due to insignificant upper confidence interval levels: multiple areas of dysfunction among boys and girls; lower back and neck pain among boys; left and right shoulder pain among girls and left wrist pain among boys (Table 5.11).

Table 5.11: Computer exposure as predictive factor of musculoskeletal dysfunction among gender groups *(significant findings indicated by **; significant odds ratios indicated by *)*

Predictive Factor: >7hours weekly computer is associated with:	**OR**	**UL 95% CI**	**LL 95% CI**
More than 4 body areas of musculoskeletal dysfunction	Girls: 1.54*	0.84	2.84
	Boys: 1.72*	0.72	4.14
Lumbar pain	Girls: 1.19*	0.72	1.99
	Boys: 2.13*	1.13	4.03
Headaches	Girls: 0.8	0.52	1.5
	Boys: 1.30	0.66	2.56
Neck pain	**Girls: 2.38**	**1.45**	**3.91****
	Boys: 1.20*	0.66	2.20
(L) Shoulder pain	Girls: 1.16*	0.65	2.08
	Boys: 2.56	**1**	**6.7****
(R) Shoulder pain	Girls: 1.31*	0.77	2.25
	Boys: 2.22	**2.9**	**5.34****
(L) Wrist pain	**Girls: 2.45**	**1.09**	**5.54****
	Boys: 1.29*	0.38	4.28

5.9 IMPACT OF MUSCULOSKELETAL DYSFUNCTION ON ACTIVITIES AND MEDICAL TREATMENT SOUGHT

5.9.1 RESTRICTIONS IN ACTIVITIES

5.9.1.1 Computer use

Learners were asked whether they had felt like not using the computer because of their musculoskeletal complaints. A total of 667 learners responded to this question, with 35.68% (238/667) in the affirmative responses. Similar number of learners from the computer (53.36%, 127/238) and non-computer (46.64%, 111/238) groups indicated that they had felt like not using the computer.

5.9.1.2 Reduced activities

An inquiry was made to ascertain how learners' musculoskeletal dysfunction was affecting their daily lives and whether learners had stopped participating in certain activities due to their musculoskeletal symptoms in the past three months. A total of 349 responses were obtained, with 31.23% (109/349) of the participants indicating that they had stopped playing sport and 29.23% (102/349) indicating that they had stopped working on the computer in the past 3 months.

5.9.2 MEDICAL TREATMENT SOUGHT

Learners had to indicate whether they had consulted a doctor or allied health professional in the previous three months for their complaints of musculoskeletal dysfunction. Fourteen percent (96/679) of the learners had sought medical treatment, with slightly more learners from the computer group (56%; 54/96) than the non-computer group (43.8%; 42/96) who had sought medical treatment.

RESULTS PHASE 2

The aim of phase 2 of this study was to determine whether the computer laboratories within schools of the Cape Metropolitan region adhered to published ergonomic guidelines. An existing measurement tool was adapted and used for the assessment of the computer laboratories. The results of the Computer Workstation Design Assessment (CWDA) will be presented in this section

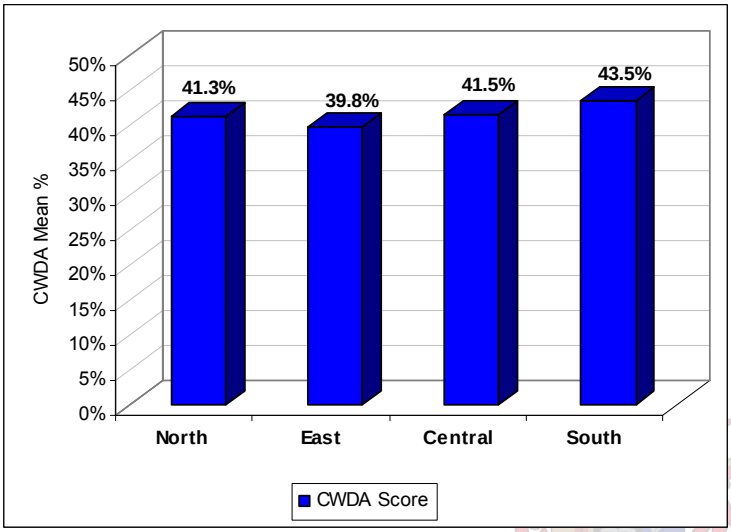
5.10 DEMOGRAPHICS

The assessment of computer laboratories by means of the CWDA was conducted at 16 high schools in the Cape Metropolitan region. The eight schools from phase 1, plus a further two randomly selected high schools from each of the four EMDC's of the Cape Metropolitan region formed the sample (Chapter 3). In total 29 computer laboratories were assessed. Six computer laboratories in the Northern EMDC, ten in the East EMDC, five in the Central EMDC and eight in the South EMDC. Seven of the schools had only one functioning computer laboratory, five schools had two computer laboratories and four schools had the use of three functional computer laboratories.

5.11 CWDA SCORES PER EMDC

The CWDA consisted of four sections which assessed various aspects of the computer laboratory and workstation. The maximum score of the CWDA equaled 40. The mean scores for each of the four EMDC's are illustrated in figure 5.20, indicating less than 45% adherence to the ergonomic guidelines.

Figure 5.20: Mean scores per EMDC according to the CWDA (N=29)



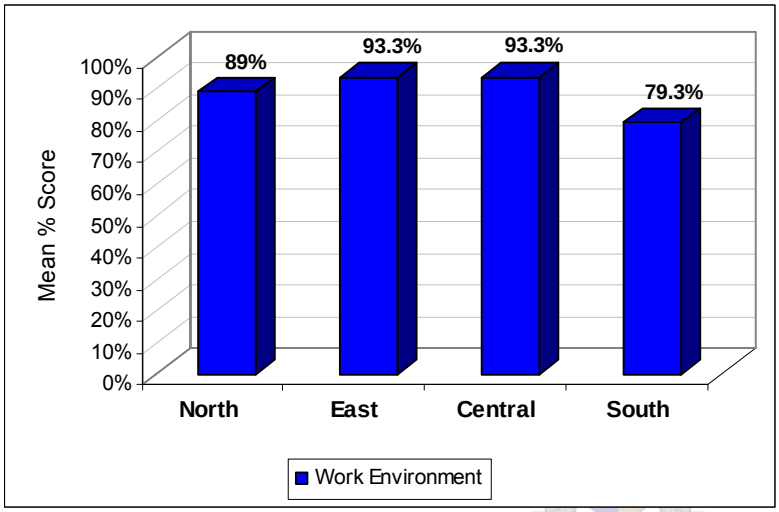
The highest score of 50% were obtained by two computer laboratories, one from a school in each of the East and South EMDC. The poorest score was 32.5% which was obtained by two computer laboratories, from two different schools within the East EMDC.

5.12 ENVIRONMENTAL ASSESSMENT

5.12.1 WORKING ENVIRONMENT

The selected computer laboratories within the Cape Metropolitan region obtained good scores for the working environment section of the CWDA. Figure 5.21 illustrates the mean scores per EMDC for the working environments within the computer laboratories. The East and Central EMDC's obtained the highest score of 93.3% each, whereas the South EMDC obtained the lowest score at 79.3%.

Figure 5.21: Computer laboratory working environment per EMDC (N=29)



The criteria for the assessment of the working environment section of the CWDA as well as the adherence to these criteria are illustrated in Table 5.12. The majority of the computer laboratories had an installed air conditioner (69%, 20/29).

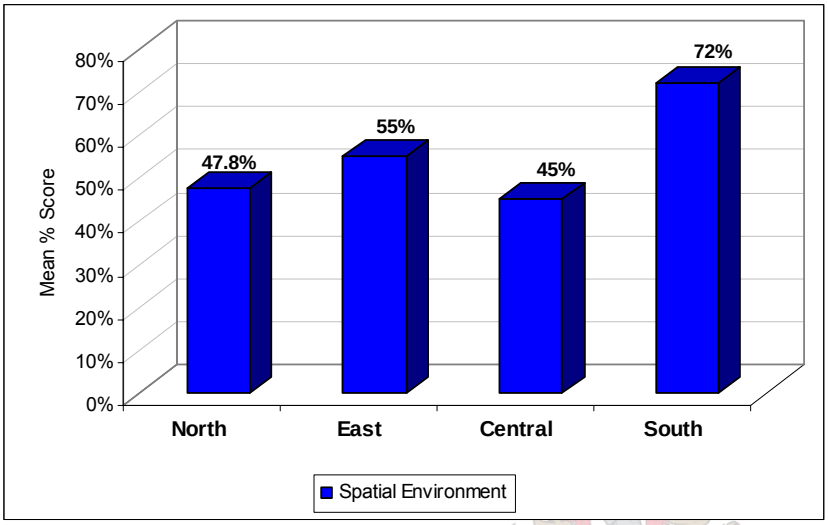
Table 5.12: Adherence to working environment criteria (N=29)

Working Environment Criteria	Computer labs adhering to criteria
Climate control by air conditioner	20 (69%)
No draughts at head/ knee level	28 (93%)
Noise level not interfering with concentration	29 (100%)

5.12.2 SPATIAL ENVIRONMENT

The mean scores for the spatial environment section of the CWDA for the four EMDC's ranged between 45% and 72% (Figure 5.22). Both the North and Central EMDC have scored less than 50% on this section, while the South EMDC obtained the highest score of 72%.

Figure 5.22: Computer laboratory spatial environment (N=29)



The number of learners using the computer laboratory at one time exceeded the number recommended by the CWDA criteria in 19 of the 29 computer laboratories assessed. Table 5.13 provides the results for the other criteria whereby the spatial environment of the 29 computer laboratories were assessed.

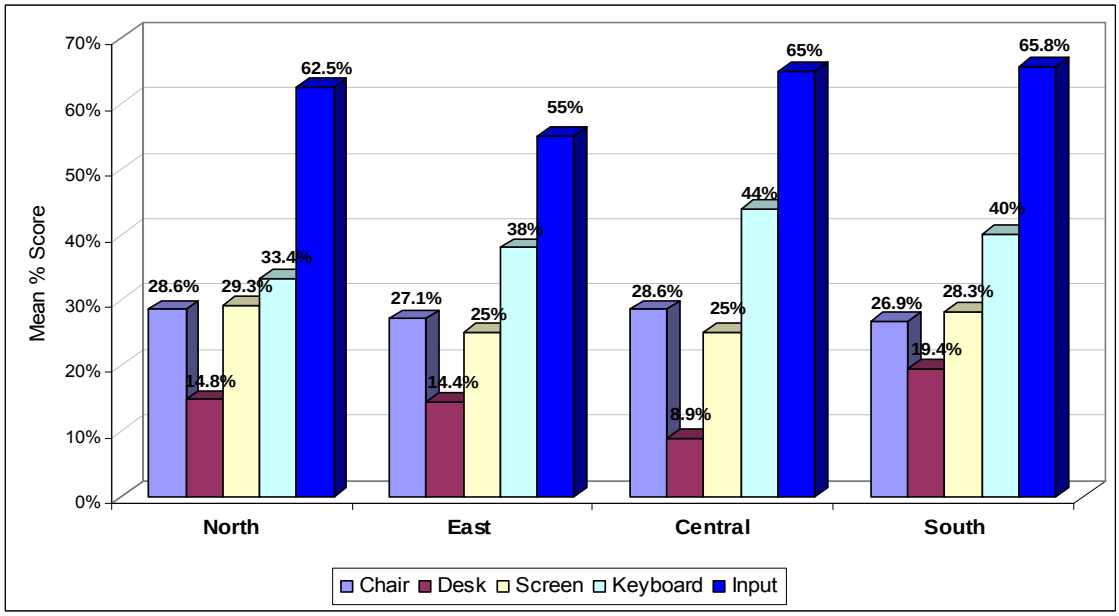
Table 5.13: Adherence to spatial environment criteria (N=29)

Spatial Environment Criteria	Computer labs adhering to criteria
Nr of learners in computer lab <30	10 (34%)
Aisle width: 152-183cm	20 (69%)
Adequate space for movement	26 (90%)
Book cases and shelves for storage and display	10 (34%)

5.12.3 WORKSPACE ENVIRONMENT

The evaluation of the specific equipment around the workstation, e.g. the chair, desk, computer screen, keyboard and input device, delivered the poorest results (Figure 5.23). Many of the standard ergonomic requirements for safe computing was absent in the 29 computer laboratories. The results of the assessment of the input device (mouse) were more satisfactory, ranging from 55% to 65.8% between the computer laboratories of the four EMDC'S.

Figure 5.23: Computer workspace environment per EMDC (N=29)



The various aspects of the workspace environment, as depicted in figure 5.23, will be presented in more detail in the following sections. The assessed equipment will be presented in the order from least to most compliance with ergonomic guidelines.

5.12.3.1 Desk

The assessment of the desks in the computer laboratories provided the poorest results of the computer workspace equipment (Figure 5.23). The mean scores for the assessment of the desks was less than 20% in all four EMDC's. Table 5.14 provides the obtained results for the assessment of the desks in the computer laboratories. The width and depth of the top surface of the desks was limited as well as space underneath the desk for learners' legs when in a seated position.

Table: 5.14: Criteria for the computer workstation desk (N=29)

Workspace Environment: Desk Criteria	Computer labs adhering to criteria
Height adjustable	0 (0%)
Width: 1500mm minimum	0 (0%)
Depth: 900mm minimum	6 (21%)
Width of leg space under desk: 800mm minimum	5 (17%)
Depth of leg space: 550mm	28 (97%)
Height of leg space when seated: 580mm minimum	0 (0%)
Footrest provided	0 (0%)
Footrest area: 300X375mm	0 (0%)
Footrest angle adjustable	0 (0%)

5.12.3.2 Computer Screen

Overall, the computers were positioned very close to the front edge of the desk which decreased the eye to computer screen distance (Table 5.15). The size and brand of the computer screens varied greatly between computer laboratories and schools. The average size of the computer screen was 35cm x 38cm and the most common brand of computer screen was Samsung.

Table 5.15: Criteria for the computer screen (N=29)

Workspace Environment: Computer screen	Computer labs adhering to criteria
Screen depth: 500-750mm	0 (0%)
Screen height: 900-1150mm	29 (100%)
Inclination of viewing monitor adjustable	1 (3%)
Usable manuscript holder attached to screen	0 (0%)

5.12.3.3 Chair

The chairs assessed within the entire 29 computer laboratories adhered to less than 30% of the ergonomic requirements (refer to figure 5.23). All the chairs assessed had fixed heights; fixed back rests and absent elbow rests for the support of learners' arms during computing. The scores for the other criteria whereby the chairs were assessed are depicted in Table 5.16.

Table 5.16: Criteria for the computer workstation chair (N=29)

Workspace Environment: Chair Criteria	Computer labs adhering to criteria
Movable rolling coasters	0 (0%)
Chair height: 380-510mm	29 (100%)
Seat pan depth: 330-430mm	27 (93%)
Back support height adjustable	0 (0%)
Back support angle adjustable	0 (0%)
Arm supports present	0 (0%)
Arm support height adjustable	0 (0%)

5.12.3.4 Keyboard

The keyboards in the 29 laboratories (100%) were positioned on the desk and did not have a separate sliding tray. The angle of the keyboards in all the assessed computer laboratories was adjustable. The results of the assessed criteria of the keyboard are presented in Table 5.17.

Table 5.17: Criteria for the computer keyboard (N=29)

Workspace Environment: Keyboard Criteria	Computer labs adhering to criteria
Positioned on separate tray	0 (0%)
Height from floor to home row: 700-850mm	28 (97%)
Height from desk level to home row: 100-260mm	0 (0%)
Angle adjustable	27 (97%)
Gel wrist support available	1 (3%)

5.12.3.5 Input Device

The evaluation of the input devices at the 29 computer laboratories delivered substantially better results than the results of the other components of the computer workstation, e.g. desk, chair and keyboard (Figure 5.23). A mouse was the input device used in all the computer laboratories. It must be noted that optical mice were used in a number of laboratories and thus did not require a mouse pad (Table 5.18).

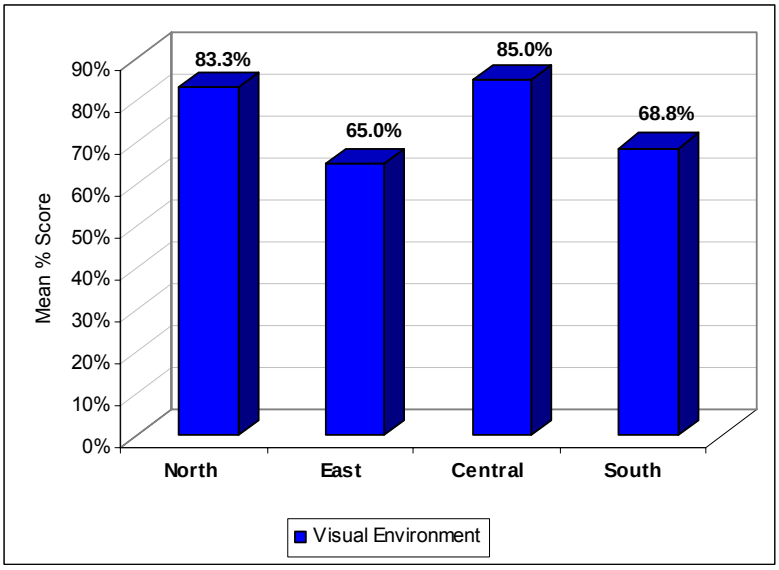
Table 5.18: Criteria for the input device (mouse) (N= 29)

Workspace Environment: Input device	Computer labs adhering to criteria
Mouse used as input device	29 (100%)
Mouse has adjustable position	29 (100%)
Can be used ambidextrously	0 (0%)
Mouse pad available	13 (45%)

5.12.4 VISUAL ENVIRONMENT

The assessment of the visual environment within the computer laboratories within the four EMDC's, obtained scores of more than 65%. Figure 5.24 illustrates the mean scores obtained by the computer laboratories within the four EMDC's.

Figure 5.24: Mean score for visual environment per EMDC (N=29)



In 48% (14/29) of the laboratories poor control of glare from lighting sources (sun or overhead lights) on the computer screens, were noted. All the computer screens in the assessed computer labs had stable screen images (Table 5.19).

Table 5.19: Criteria for the visual environment within the computer labs (N=29)

Visual Environment Criteria	**Computer labs adhering to criteria**
Stable screen image	29 (100%)
Adjustable brightness and contrast controls	28 (93%)
Control of glare	15 (52%)
Good quality of lighting sources	14 (48%)

5.13 SUMMARY OF RESULTS

Phase 1:

- Phase 1 of the study entailed the completion of a questionnaire, the Computer Usage Questionnaire (CUQ), by grade 10-12 learners from eight randomly selected high schools in the Cape Metropolitan region.
- A total sample of 1073 learners, 690 girls and 373 boys, with a mean age of 16.3±1.1 years completed the CUQ.
- The sample was divided in a computer and a non-computer group depending on their school subjects and weekly school computer exposure.
- The computer group used the school computer on average 4.6 times per week whereas the non-computer group used the computer only 1.6 times per week. Learners used the school computer predominantly for educational activities and less for communication and games.
- More learners in the computer group had received instruction on posture and exercises to do during computer use than the non-computer group. Learners in the computer group also took more regular rest breaks from computer work.
- Almost 50% of learners had access to computers in their homes.
- Weekly computer exposure (at school and elsewhere) for the total group was 10.64±6.77 hours. The computer group had weekly computer exposure of 12.08±6.75 hours in comparison to 6.65±5.05 hours for the non-computer group.
- Slightly more learners in the computer group participated in sport compared with learners in the non-computer group. Girls formed the largest percentage (83.17%) of the total sample not participating in sport.
- The prevalence of musculoskeletal dysfunction amongst this sample of learners was 74%. Prevalence of musculoskeletal dysfunction was higher among the non-computer group and higher among girls in comparison to boys.
- The most common areas of musculoskeletal dysfunction were the head, low back and neck. Learners in the computer group reported a mean of 2.49 areas of dysfunction in comparison to 2.65 areas by the non-computer group.
- Three subgroups in each of the computer and non-computer groups were defined according to weekly computer exposure in order to determine the impact of computer use.

- A trend of increasing prevalence of headaches, low back pain and neck pain was noted among the subgroups of the computer group as the weekly computer exposure increased. Among the non-computer group, the prevalence of headaches, low back pain and neck pain decreased and did not follow the same trend with increasing weekly computer exposure as within the computer group.
- More learners in the computer group indicated that they experienced their musculoskeletal dysfunction during computer use both at school and elsewhere. The prevalence increased among these computer group subgroups, as their weekly computer exposure increased. The majority of the non-computer group, who indicated their dysfunction during computer use at school and elsewhere, were in the low computer exposure subgroup.
- Headaches, low back and neck pain were the most prevalent areas of dysfunction during computer use at school and elsewhere, with trends of increased prevalence noted with increasing computer exposure among the computer subgroups.
- Learners, who had received instruction on exercises and/or stretches to do during computer work at school, reported less musculoskeletal dysfunction.
- Odds ratios were calculated to determine associations of various factors with musculoskeletal dysfunction. The female gender and school computer use for more than three years was associated with musculoskeletal dysfunction.
- Logistic regression analysis was done to determine predictive factors of musculoskeletal dysfunction among this learner sample. Weekly computer exposure of more than seven hours was predictive for general musculoskeletal dysfunction, lower back pain and neck pain among this learner sample.
- More than seven hours of weekly computer exposure, was predictive for neck pain and left wrist pain among girls and left and right shoulder pain among boys.
- Thirty one percent and 29%, respectively of learners, indicated that they have stopped playing sport and working on the computer due to their musculoskeletal dysfunction.
- Only a small percentage of learners had consulted a medical professional for their complaints of musculoskeletal dysfunction in the past three months.

Phase 2:

- A total of 29 computer laboratories were assessed by means of an adapted assessment tool, The Computer Workstation Design Assessment (CWDA).
- These computer laboratories were located within 16 high schools; four from each of the four EMDC's the Cape Metropolitan region. The schools within the East EMDC had the most computer laboratories, namely ten.
- The maximum score of the CWDA equaled 40. The average score according to the CWDA for the 29 computer laboratories was less than 45%. The lowest score of 32.5% was obtained by two computer laboratories within the East EMDC.
- In terms of the working environment within the computer laboratory, scores of 79% to 93% were obtained.
- The scores of the spatial environment within the computer laboratory showed a great variation between the four EMDC's, with scores ranging from 45% to 72%
- The assessment of the workspace environment involving the desk, chair, computer screen, keyboard and mouse delivered the poorest results among all four of the EMDC's, with a mean score of 33.99%.
- The desk with scores ranging from 8.9% to 19.4% obtained the poorest results, thus indicating poor adherence to ergonomic guidelines.
- The chair and desk assessment also obtained scores of less than 30%, whereas the mouse (input device) obtained better results, ranging from 55-66%.
- The assessment of the visual environment within the computer laboratories of the four EMDC's obtained scores above 65% for adherence to the ergonomic guidelines.

CHAPTER 6
DISCUSSION

The main objective of this study was to determine the prevalence of and associative factors for musculoskeletal dysfunction among high school learners in the Cape Metropolitan region of the Western Cape Province of South Africa.

6.1 SAMPLE

The sample population comprised of a total of 1073 adolescent school learners in grades 10-12. Ten out of a total of 12 studies in a recent systematic review conducted on computer-related musculoskeletal dysfunction among children and adolescents (Chapter 2) were also conducted in schools (Zapata et al. 2006, Ramos et al. 2005, Alexander & Currie 2004, Sjolie 2004, Jacobs & Baker 2002, Harris & Straker 2000, Harreby et al. 1999, Royster & Yearout 1999 and Jones & Orr 1998). The remaining 2 review studies were conducted at learners' residences (Hakala et al. 2006 and Burke & Peper 2002). The setting of the majority of the review studies in schools may be an illustration of the changing school environment from a previously teacher-centered learning environment to a more technology-driven learning environment. Thus, learners may be more exposed to computers in schools.

Girls comprised a larger portion of this sample than boys, with an average ratio of 6.5:3.5. The average ratio of girls to boys among international study samples was 5:5 (Zapata et al. 2006, Hakala et al. 2006, Ramos et al. 2005, Sjolie 2004, Alexander & Currie 2004, Jacobs & Baker 2002, Burke & Peper 2002, Harreby et al. 1999, Royster & Yearout 1999 and Jones & Orr 1998). Only one study reported a larger representation of female participants to their study sample (87% girls versus 13 % boys) compared to the present study (Harris & Straker 2000). The average age of the participants in the current study indicated that these learners were in the adolescent phase of their development. Puberty is characterized by major changes in various body systems of adolescents, especially the musculoskeletal system (Neinstein 1996). According to Neinstein (1996) the biggest changes in the musculoskeletal system occur during the puberty growth spurt, which occurs among girls at 12-13 years and among boys at 13-15 years.

The mean age of the study participants correlated with American and Finnish study samples on the same topic of computer-related musculoskeletal dysfunction (Hakala et al 2006 and Jones & Orr 1998). Sample participants were younger in similar studies conducted in Australia, the USA, Norway and Brazil (Zapata et al. 2006, Sjolie 2004, Burke & Peper 2002 and Harris & Straker 2000).

6.2 COMPUTER EXPOSURE

The current study evaluated learners exposure to computers at school and at other locations e.g. home, a friend/relative's home and internet cafes. Several authors have also investigated learners' computer exposure both at school and elsewhere (Ramos et al. 2005, Burke & Peper 2002, Harris & Straker 2000, Royster & Yearout 1999 and Jones & Orr 1998). In the current study more than two thirds of the sample indicated that they used computers at school. Learners used the computers at school for structured classes and delivery of curriculum subjects more than for entertainment and communication purposes (Figure 5.4). A number of authors in the USA and Hong Kong reported that learners used computers at school and elsewhere predominantly for research, communication and entertainment (Burke & Peper 2002, Jacobs & Baker 2002 and Ho & Lee 2001). Ramos et al. (2005) found that their sample indicated use of the home computer more for school homework and play.

The difference in computer activities between the current study's learner sample and international learner samples, illustrates the unique circumstances in the Western Cape and South Africa, where learners use computers more in the formal delivery of the school curriculum than for entertainment and communication purposes. South African learners are therefore compelled to use computers at school as this form part of their curriculum delivery. Due to financial limitations, learners may not have access to computers at home, and thus be mostly exposed to computers at school (Figure 5.5).

In the current study learners spent approximately 11 hours per week using a computer. School lessons lasted for approximately 45 minutes, and the computer and non-computer groups used the school's computers 4.6 and 1.6 times per week respectively (Figure 5.3).

The duration of learners' computer exposure corresponds to international learner samples' weekly computer exposure (Hakala et al. 2006, Sjolie 2004, Burke & Peper 2002, Harris & Straker 2000, Harreby et al. 1999 and Jones & Orr 1998).

Similar to trends among international learner samples, boys in the current study had higher levels of weekly computer exposure in comparison to girls (Alexander & Currie 2004, Burke & Peper 2002, Subrahmanyam et al. 1998). This finding illustrates the gender differences between boys and girls in terms of the purpose of computer use. Boys tend to approach computers more as tools for play, whereas girls approach computers as tools for communication and performing academic tasks (Colley 2003 and Burke & Peper 2002). It is thus possible that due to their greater exposure to computers, boys in the current study may also be more adept at using the various functions of computers.

6.3 BENEFITS OF COMPUTER EXPOSURE

The exposure to Information Technology at schools benefits learners as they become computer literate at an early age and gain valuable skills they can use in their future education and careers (Becker 2000). Children gain access to a large resource of information via the computer and internet that can serve as knowledge and reference tools. One of the main reasons parents acquire household computers, is for enhancement of their children's education (Subrahmanyam et al. 2001). Computers and the internet allow for fast and easy access to information that can be used for school projects and assignments (Subrahmanyam et al. 2001). It has been reported that learners who have access to home computers, obtain better overall grades at school for subjects such as English and Mathematics (Subrahmanyam et al. 2001). In the current study, however, only half of the sample had access to computers in their homes (Figure 5.5), whereas among international learner samples, 90% to 100% of these learners had access to one or more computers in their homes (Burke & Peper 2002 and Jacobs & Baker 2002). For this reason, learners may not be able to practice their computer skills at home after school and in their free time and may fare poorer in the school subjects delivered via computers.

6.4 NEGATIVE EFFECTS OF COMPUTER EXPOSURE

Computer use has been identified as a risk factor for musculoskeletal dysfunction among the adult working population (Gerr, Marcus, Monteilh, Hannan, Ortiz & Kleinbaum 2006, Juul-Kristensen, Sogaard, Stroyer & Jensen 2004 and Cook et al. 2000). Musculoskeletal disorders among the adult work force have been identified as the main cause of work related health problems among adults (European Labour Force Survey 1999 and Morse et al. 1998). These disorders lead to reduced worker productivity and increased financial strain due to medical expenses and disability claims (Morse et al. 1998 and Boden & Galizzi 1999). The high computer exposure of learners in the current study may lead to similar patterns of dysfunction and disability as noted among the adult population (Sjolie 2004 and Barrero & Hedge 2002). Early identification of musculoskeletal dysfunction among the learner population, coupled with treatment and rehabilitation by medical professionals is crucial in preventing chronic disabling musculoskeletal disorders in adulthood (Leboeuf-Yde & Kyvik 1998).

Learners appear reluctant to seek medical advice and/or treatment for their complaints of musculoskeletal dysfunction (Sjolie 2004, Puckree et al. 2004, Royster & Yearout 1999 and Jones & Orr 1998). Royster & Yearout (1999) reported that 73% of their learner sample who experienced pain during computer work, did not report their pain to their parents, but continued working on the computer. In the current study only 14% (96/679) of the learner sample reported that they had consulted a doctor or allied health professional for their complaints of musculoskeletal dysfunction (Section 5.9.2). The failure of learners to report their musculoskeletal complaints to their parents/guardians and medical personnel, may have serious repercussions. It has been stated that musculoskeletal pain experienced during adolescence is the single most important predictor of chronic musculoskeletal pain during adulthood (Brattberg 2004 and Leboeuf-Yde & Kyvik 1998). Early identification of risk factors and implementation of intervention strategies may prevent the progression of adolescent musculoskeletal dysfunction into chronic musculoskeletal disorders in adulthood (Trevelyan & Legg 2006, Barrero & Hedge 2002, Balague et al. 1999 and Leboeuf-Yde & Kyvik 1998).

6.5 IMPACT ON QUALITY OF LIFE AND DISABILITY

According to Roth-Isigkeit, Thyen, Stoven, Schwarzenberger & Schmucker (2005) and Watson, Papageorgiou, Jones, Taylor, Symmons, Silman & Macfarlane (2003), musculoskeletal dysfunction has a negative impact on the functional activities of learners and quality of life of children and adolescents. In the current study 31% (109/349) of the sample indicated that they had stopped playing sport and 29% (102/349) had discontinued working on a computer in the past 3 months due to their musculoskeletal symptoms (Section 5.9.1). The negative impact of musculoskeletal dysfunction on the activity level and daily lives of children and adolescents has been well reported in the literature (Roth-Isigkeit et al. 2005, Sjolie 2004, Jones, Stratton, Reilly & Unnithan 2004, Watson, Papageorgiou, Jones, Taylor, Symmons, Silman & Macfarlane 2002 and Harreby et al. 1999). Harreby et al. (1999), Jones et al. (2004) and Sjolie (2004) reported that 4%, 30.8% and 24% respectively of their study samples, reduced or stopped their participation in physical activities and sports due to their musculoskeletal complaints. An even more worrisome phenomenon is that 23% to 48% of learners reported being absent from school due to their musculoskeletal complaints (Bejia et al. 2005, Roth-Isigkeit et al. 2005 and Jones et al. 2004).

The current study is the first known study assessing computer-related musculoskeletal dysfunction, which found that learners had ceased computer use due to their musculoskeletal dysfunction. Literature sources have stated that musculoskeletal dysfunction impacts negatively on the work performance of adults (Liao & Drury 2000 and Morse et al. 1998). The avoidance of computer use or the reduction in computer use may have a number of implications for learners of this study sample. Learners who are unwilling to use or avoid computer use, might be influencing their school performance negatively as some of their school subjects are only being delivered through the computer medium. The learners' poorer performance in computer based subjects may influence their further education including choice of tertiary educational institution.

A second implication of learners' avoidance of computers, involves their choice of a future career. Learners' may choose their future careers based on whether they will be required to use a computer or not. Currently South Africa requires highly skilled technological workers.

The promotion of Science and Technology is endorsed by science counsels such as the Medical Research Council of South Africa (MRC) as well as the National Department of Science and Technology. Science campaigns have been launched in schools to encourage learners to pursue technological careers (MRC 2006). A trend of learners not to pursue the use of computers may reduce the impact of science promotion and may diminish the efforts of promoting scientific careers. Therefore prompt intervention and treatment of the musculoskeletal dysfunction of learners is recommended.

6.6 PREVALENCE OF MUSCULOSKELETAL DYSFUNCTION

Statistics on the prevalence of musculoskeletal dysfunction among South African school learners is of utmost importance in order to determine the need to identify potential risk and/or associative factors. The prevalence of musculoskeletal dysfunction among this sample of learners was 74% (Section 5.5.1). This prevalence was less than reported by Puckree et al. (2004) among a school learner sample in Kwa-Zulu Natal, South Africa. A prevalence of 86.9% for musculoskeletal pain was reported for their sample of 176 learners, with a mean age of 12.2 years. In comparison to other African study populations, the pain prevalence reported in the current study, was higher. Low back pain prevalence of 28.4% was reported for a sample of Tunisian children and adolescents (Bejia et al. 2005). Prista et al. (2004) reported a prevalence of 13.5% recurrent low back pain among Mozambican adolescents.

Internationally, only one study (Roth-Isigkeit et al. 2005) reported a higher prevalence of pain (83%) among their learner sample when compared to the current study. These authors, however, investigated all the types of pain perceived by learners and did not specifically assess musculoskeletal pain. The prevalence of musculoskeletal dysfunction among all the other international studies assessing computer-related musculoskeletal dysfunction was less than the reported prevalence in the current study (Zapata et al. 2006, Hakala et al. 2006, Sjolie 2004, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000 and Jones & Orr 1998). As most of the other factors were similar in this and the other studies, it is possible that the poor ergonomic design of computer laboratories found in the current study, may have contributed to the high prevalence of musculoskeletal dysfunction (Figure 5.20).

The prevalence of musculoskeletal dysfunction was higher among girls than boys in the current study (Figure 5.9). This finding corresponds with the results among international learner samples (Zapata et al. 2006, Hakala et al. 2006 and Alexander & Currie 2002).

6.7 RISK FACTORS

In order to address the high prevalence of learners' musculoskeletal dysfunction, it is essential to identify associative and risk factors (Burke & Peper 2002 and Barrero & Hedge 2002). These associative and risk factors include psychosocial factors, competitive sports, physical inactivity, poor ergonomic school furniture and computer use.

6.7.1 PSYCHOSOCIAL FACTORS

In the present study the impact of psychosocial factors such as stress, depression and anxiety on the prevalence of learners' musculoskeletal dysfunction were investigated. Learners with underlying psychosocial issues in this study were not more likely to suffer from musculoskeletal dysfunction than learners with less psychosocial issues (Table 5.10). Strong evidence exists for the association between psychosocial factors (e.g. stress and depression) and musculoskeletal dysfunction among international child and adolescent samples (Diepenmaat et al. 2006, Siivola et al. 2004, Watson et al. 2003, Jones et al. 2004, Burke & Peper 2002, Niemi, Levoska, Rekola & Keikanen-Kiukaanniemi 1997). In large epidemiological studies, stress and depressive symptoms, have been associated with general musculoskeletal dysfunction, as well as dysfunction in specific body areas.

Common body areas related to psychosocial factors include the neck, shoulders and low back (Diepenmaat et al. 2006, Watson et al. 2003, Jones et al. 2003 and Niemi et al. 1997). In a prospective longitudinal study, Siivola et al. (2004) reported that stress-related neck and shoulder pain, experienced during adolescence, persisted into adulthood.

Although international studies found that psychosocial factors are predictive for the musculoskeletal pain among children and adolescents, the developing pathways of musculoskeletal pain among these South African adolescents may have been different. The differences in etiology of pain between this current study sample and international learner samples may be linked to differences in sporting participation, activity levels, computer exposure, and workstation design.

6.7.2 PARTICIPATION IN SPORT/INACTIVITY

Current literature is divided on whether participation in sport plays a role in the etiology of musculoskeletal pain among learners (Andersen, Wedderkopp & Leboeuf-Yde 2006, Grimmer & Williams 2000, Harreby et al. 1999, Balague et al. 1999). A large cross sectional study on Danish adolescents, did not find any association between physical fitness or self-reported physical activity and back pain (Andersen et al. 2006). Boys participating in competitive sports have been reported to be at risk for low back pain (Harreby et al. 1999), whereas participating in organized sports was reported to be protective for low back pain among an Australian learner sample (Grimmer & Williams 2000). It has however been stated that the association between low back pain and competitive sport depended greatly on the type of sporting activity and the level of participation (Balague et al. 1999). In the current study playing sport more than once a week was associated with musculoskeletal pain (Table 5.8).

Children and adolescents may be more prone to develop musculoskeletal injuries, as sporting codes are played according to adult rules, e.g. in terms of duration of sports games, number of training sessions per week, etc. Modified rules are used in countries such as Australia to prevent or protect learners from sustaining injuries. In developing countries, such as South Africa, a lack of appropriate sporting equipment, poorly-maintained sport facilities and inexperienced coaches may increase the risk of sports injuries among children and adolescents (Louw, Grimmer & Vaughan 2003).

A lack of physical activity in turn, has been associated with increased reports of low back pain (Harreby et al. 1999 and Sjolie 2004). Especially among girls, increased levels of physical activity have been encouraged in order to improve back health (Cardon, De Bourdeaudhuij, De Clercq, Philippaerts, Verstraete & Geldhof 2004). However, in the current study, inactivity or no participation in sport was protective for general musculoskeletal dysfunction among the learner sample (Table 5.8).

6.7.3 ERGONOMIC DESIGN OF WORKSTATIONS: IMPACT OF POSTURE ON PAIN

Ergonomic assessment of the various aspects within the computer laboratory is required to enable safe interaction of learners with computers (Zandvliet & Straker 2001). In the current study, the assessment of the computer laboratories in the Cape Metropolitan region, delivered results indicating poor adherence to ergonomic guidelines.

Literature sources concur that the design of school furniture and computer workstations have an impact on the musculoskeletal dysfunction experienced by school learners (Milanese & Grimmer 2004, Murphy et al. 2004, Straker et al. 2002 and Laeser et al. 1998). However, in the current study, poor adherence to ergonomic guidelines of computer laboratories was not associated with learners' musculoskeletal dysfunction (Table 5.8). The reason for this insignificant finding could be attributed to the fact that all the computer laboratories had poor ergonomic designs and hence no comparisons between good and poor ergonomic computer laboratories could be made.

6.7.3.1 Spatial Environment

The two sections of the ergonomic assessment (CWDA) of the computer laboratories which obtained the poorest scores were the spatial environment and the workspace environment (Sections 5.12.2 & 5.12.3). The findings of the spatial environment assessment illustrated that the majority of the computer laboratories had decreased space for moving between computer workstations as well as a lack of storage facilities for resource materials and learners' bags. Reduced spatial environment within the computer laboratories seems to be a world-wide phenomenon as similar findings were reported by Zandvliet & Straker (2001). These authors evaluated computer classrooms in schools in Canada and Australia. Providing facilities for increasing numbers of learners may be one of the reasons for the poor lay-out and organization of the spatial environments within computer laboratories. The input of ergonomists may therefore be helpful in addressing the issue of restricted space within computer laboratories, while still ensuring safe interaction between learners and the computer environment.

6.7.3.2 Workspace Environment

The results of the workspace environment within the computer laboratory demonstrated the least adherence to ergonomic guidelines in the current study. These findings are slightly less compared to the workspace environment assessment at schools in Australia and Canada, where scores of more than 30% adherence to ergonomic guidelines were reported (Zandvliet & Straker 2001). The workspace environment involves the equipment and furniture that the school learners mainly interact with and that will influence their posture the most. These include the chair, desk, computer screen, keyboard and mouse. In the current study, each laboratory had a set design and lay-out with the same brand of furniture at all workstations. As learners with different anthropometrics were compelled to use the same workstation, it may have led to adaptive postures and the positioning of the spine and related joints in awkward and constraint positions (Milanese & Grimmer 2004 and Straker et al. 2002).

All the chairs assessed in the computer laboratories of the Cape Metropolitan region, had a fixed shape and height and could therefore not be adjusted to enable learners of different heights to assume a comfortable posture at the workstation. Learners using a chair that is too low for them, may compensate by sitting with increased thoracic flexion, lumbar flexion and a forward chin position (Milanese & Grimmer 2004 and Twomey & Taylor 2000). This posture was encouraged due to the limited depth space of the desks assessed in the current study leading to the placement of the computer screen too close to the front edge of the table (Straker et al. 2002 and Szeto & Lee 2002).

Increased cervical extension and forward chin posture have been associated with work-related neck and upper limb disorders (Szeto & Lee 2002). These authors advocate the prevention of excessive cervical extension to enhance learners' musculoskeletal health. It has also been postulated by Burgess-Limerick, Plooy, Fraser & Ankrum (1999), that a downward angle of 45º should be formed between the user's eyes and the computer screen. Increased thoracic flexion may predispose the development of low back pain (Milanese & Grimmer 2004 and Murphy et al. 2004), which was one of the most common areas nominated by learners as being affected by dysfunction in the current study (Figure 5.10). Increased flexion of the thoracic spine is associated with stretching of the posterior soft tissue structures (e.g. posterior ligamentous structures) and increased compression of anterior vertebral structures (e.g. intervertebral discs) (Norkin & Levangie 2005).

Maintaining awkward constraint postures for prolonged periods may strain muscular, tendonous and ligamentous structures, resulting in pain and should therefore be prevented (Kumar 2001).

Placement of the keyboard below elbow level and with the arms supported is associated with reduced risk of neck and shoulder dysfunction and greater comfort during computer work (Gerr, Monteilh & Marcus 2006 and Laeser et al. 1998). In the current study, the keyboards of all the workstations were placed on the desk. This placement of the keyboard on the desk leads to a posture with shoulder flexion, abduction and elevation, which increases the resting activity in the Upper Trapezius muscle (Szeto, Straker & O'Sullivan 2005, Straker et al. 2002 and Laeser et al. 1998). The flexed, abducted and elevated shoulder position may lead to imbalances around the gleno-humeral joint and cervical spine (Straker et al. 2002 and Szeto et al. 2005). Prolonged static contractions of muscles cause their tendons to stretch, which in turn compresses the vascular microstructure. Continuing compression within the structure, leads to ischaemia, tearing and inflammation of the affected tendon, with resultant experience of pain and decreased functional ability of the muscle (Kumar 2001).

6.8 SPECIFIC AREAS OF MUSCULOSKELETAL DYSFUNCTION

6.8.1 HEADACHES, NECK AND SHOULDER PAIN

Maintaining postures for prolonged periods can have detrimental effects on the musculoskeletal health of learners (Barrero & Hedge 2002). The vertebral column is especially vulnerable to the development of dysfunction during adolescence and the fast growth spurt of puberty due to the changes in the musculoskeletal system (Neinstein 1996). The current study sample, as well as international learner samples, has indicated the vertebral column as the most commonly affected body area of dysfunction (Hakala et al. 2006, Ramos et al. 2005, Sjolie 2004, Alexander & Currie 2004, and Burke & Peper 2002).

The report of headaches was the highest among this study sample, with more than 28% prevalence reported (Figure 5.10). This prevalence correlates with findings among international learner samples (Alexander & Currie 2004 and Harris & Straker 2000). The etiology of headaches among children involves numerous factors (Grimmer, Nyland & Milanese 2006). One such factor is the close anatomical position of the neck, shoulder and head as well as the shared musculature and nerve supply (Drake, Vogl & Mitchell 2005). Neck dysfunction obtained the third highest report of dysfunction among the current study sample with a prevalence of more than 20%.

The prevalence of shoulder pain ranged from 12% to 15% among this sample. These findings were less than the prevalence of neck, or neck and shoulder pain reported among international child and adolescent samples which ranged from 11.5% to 40% (Figure 2.6) (Zapata et al. 2006, Hakala et al. 2006, Diepenmaat et al. 2006, Ramos et al. 2005, Alexander & Currie 2004, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000, Royster & Yearout 1999 and Jones & Orr 1998). Seven of the 12 studies reviewed in Chapter 2 reported a prevalence of 30% or more for neck and shoulder pain among their learner samples (Zapata et al. 2006, Ramos et al. 2005, Alexander & Currie 2004, Burke & Peper 2002, Jacobs & Baker 2002, Harris & Straker 2000, and Jones & Orr 1998).

These three areas of dysfunction, namely the head, neck and shoulders have been associated with work-related musculoskeletal disorders among adults (Cook et al. 2000, Evans & Patterson 2000). The rapid rise in the prevalence of work-related musculoskeletal disorders among the adult workforce has been associated with the exposure to information technology devices, especially computers. These disorders are frequently referred to as “repetitive strain injuries”, “cumulative trauma disorders” or “upper limb disorders” (Alexander & Currie 2004 and Cook et al. 2000). Children and adolescents using computers appear to be affected in a similar way as adults in terms of the areas of musculoskeletal dysfunction (Ramos et al. 2005 and Harris & Straker 2000).

The underlying etiology of neck and shoulder dysfunction during computer use, are more complex due to the anatomical make-up of this region (Drake et al. 2005 and Norkin & Levangie 2005). The cervical facet and intervertebral joints and the gleno-humeral joint have less muscular support than the low back region and are dependent on ligamentous structures for their stability (Norkin & Levangie 2005 and Hess 2000).

The neuro-musculoskeletal structures of the head, neck and shoulders are compact and interlinked in close proximity in the compromised surface area (Drake et al. 2005). Awkward positions maintained for prolonged periods place strain on vulnerable tissues and causes abnormal loading of structures (Kumar 2001). According to the “differential fatigue theory” by Kumar (2001), unequal loading of muscle groups leads to altered patterns of muscle fatigue. Repetitive activities involving unequal loading of muscles, may in the long term result in changes in the joint kinetics and kinematics and result in pain and dysfunction. Learners from the current study may thus develop musculoskeletal dysfunction and have impaired quality of life due to the awkward postures that they would have to assume during work at the poor ergonomic computer workstations.

6.8.2 SITTING AND LOWER BACK PAIN

The impact of prolonged static postures during computer use may be compounded when these postures are maintained at poorly fitting workstations and may place the musculoskeletal system at an increased risk of dysfunction (Barrero & Hedge 2002). The sitting posture is the most commonly assumed posture during computer use, especially with the use of desktop computers at school, home and places of work (Barrero & Hedge 2002 and Harris & Straker 2000). Sitting for prolonged periods has been associated with complaints of lower back pain (Trevelyan & Legg 2006, Barrero & Hedge 2002 and Balague et al. 1999). In the present study, the prevalence of low back pain was more than 20% (Figure 5.10).

The etiology of this phenomenon can be explained according to the “Cumulative Load Theory” by Kumar (2001). This theory states that repeated loading of structures may result in fatigue of loaded tissues and reduce their stress bearing capabilities (Kumar 2001). Structures of the lower back such as the intervertebral discs and facet joints are particularly vulnerable during sitting (Twomey & Taylor 2000). Repeated loading of these structures may reduce their threshold level and lead to tissue failure, with resultant pain experience and impaired functional ability (Kumar 2001).

6.9 MULTIPLE AREAS OF DYSFUNCTION

Musculoskeletal dysfunction among learners is not always isolated to only one body area, but may involve multiple body areas (Petersen et al. 2006, Watson et al. 2002 and Mikkelsson et al. 1997). Almost 16% of learners in the current study reported more than 2 body areas affected by dysfunction (Section 5.5.3). The exposure to computers may be influential in reports of multiple body areas of dysfunction among the current study sample. A trend of increasing prevalence of multiple areas of dysfunction was noted among this study's computer group as their weekly computer exposure increased (Figure 5.18). In contrast, this same trend of increasing prevalence of multiple areas of dysfunction with increasing computer exposure was not noted among this study's non-computer group.

It has been found in longitudinal studies that, except for increased prevalence of multiple areas of musculoskeletal dysfunction at follow-up assessments, study participants also reported an increase in the frequency and intensity of dysfunction (Brattberg 2004, Siivola et al. 2004, Stahl, Mikkelsson, Kautiainen, Hakkinen, Ylinen & Salminen 2004, Leboeuf-Yde & Kyvik 1998 and Mikkelsson et al. 1997). Multiple areas of musculoskeletal dysfunction may thus have a greater impact on the levels of dysfunction and disability among computer users (Roth-Isigkeit et al. 2005, Sjolie 2004 and Watson et al. 2002). This factor may lead to severe chronic musculoskeletal disorders in adulthood and may limit adults' participation in work environments and community involvement (Morse et al. 1998). The prevalence of multiple areas of musculoskeletal dysfunction among this current study sample should thus be addressed.

6.10 PREDICTORS OF MUSCULOSKELETAL DYSFUNCTION

6.10.1 GENDER

In the present study, as in numerous published sources, the female gender is predictive of musculoskeletal dysfunction among a learner sample (Hakala et al. 2006, Zapata et al. 2006, Watson et al. 2002, Harreby et al. 1999 and Viry, Creveuil & Marcelli 1999). Widhe (2001) stated that the normal spinal curvatures of girls, from childhood to adolescence, undergo greater change when compared to the spinal curvature changes among boys. During puberty, the difference in the angle between the thoracic kyphosis and lumbar

lordosis of girls are greater. He argues that this structural change leads to a stiffer thoracic spine which may increase the loading of the lumbar spine with consequent development of pain.

During puberty, girls commence their growth spurt about 2 years earlier than boys (12-13 years versus 13-15 years) (Neinstein 1996). Considering the mean age of the current study sample, girls at 16 years would have completed their growth spurt. Pubertal status of girls and the timing of puberty onset have been closely associated with various symptoms, such as headaches and musculoskeletal pain (Rhee 2004). Wedderkopp, Andersen, Froberg & Leboeuf-Yde (2005) reported that lower back pain increased in frequency among girls during puberty until maturity is reached.

The increased prevalence of musculoskeletal dysfunction among the female gender continues into adulthood (Juul-Kristensen et al. 2004, Szeto & Lee 2002 and Evans & Patterson 2000). The musculoskeletal dysfunction among the current study's girl sample may persist into adulthood with resultant negative impact on their roles as mothers, wives and their participation in the work force. Therefore, both preventative and rehabilitative strategies should be put in place for this learner sample.

6.10.2 HOURS OF COMPUTER USE PER WEEK

Weekly computer exposure exceeding 7 hours was predictive of general musculoskeletal pain, low back and neck pain among this learner sample (Table 5.9). This finding correlates with the findings of Hakala et al. (2006) and Zapata et al. (2006). The former group of authors reported that computer use of more than 2-3 hours per day was predictive of neck and shoulder pain. Computer use of more than 5 hours per day was predictive of lower back pain among the Finnish learner sample (Hakala et al. 2006). Zapata et al. (2006) reported that computer use of more than even 2 hours per day was predictive of back pain among their learner sample.

6.10.2.1 Specific areas of dysfunction

Headaches were the most prevalent dysfunction among this current study sample (Figure 5.10). Computer exposure increased the likelihood of headaches among boys, but it was not associated with headache reports among girls (Table 5.11). These findings are in contrast to the findings reported by Alexander & Currie (2004) where high frequency computer use among both genders was associated with headaches. As reported by Rhee (2004), girls' headaches may be more influenced by the puberty status.

Computer exposure of more than seven hours per week was predictive of neck pain among girls in the current study (Table 5.11). Similar findings were reported by Alexander & Currie (2004) for girls in their study sample. Taller learners have been reported to have higher prevalence of neck, thoracic and low back pain (Milanese & Grimmer 2004 and Murphy et al. 2004) and as most of the girls in the current sample have finished their puberty growth spurt, may be taller.

Lower back pain among both gender groups, neck pain among boys and multiple areas of dysfunction was associated with computer use of more than 7 hours per week (Table 5.11). Interestingly, weekly computer exposure for more than 7 hours was predictive of left and right shoulder pain among boys, but only associated with left and right shoulder pain among girls. This finding is in contrast to findings of Alexander & Currie (2004) who reported equal prevalence between girls and boys in their high computer user groups and cannot be explained.

6.11 CLINICAL IMPLICATIONS

6.11.1 SECONDARY PREVENTION

Education of children, their parents and medical personnel is essential to identify early signs of musculoskeletal dysfunction among children and adolescents. Through early identification of dysfunction, the progression into chronic disabling conditions can be prevented (Brattberg 2004). The high prevalence of musculoskeletal dysfunction among this learner sample indicates that medical intervention may be required. Studies in which high musculoskeletal dysfunction was found, reported increased utilization of medical services (Bejia et al. 2005 and Roth-Isigkeit et al. 2005).

Physiotherapists have extensive knowledge of the musculoskeletal system and may play a valuable role in the treatment and rehabilitation of musculoskeletal conditions. Unfortunately, no enquiries were made in the CUQ (Appendix 6) on learners' utilization of physiotherapy services for treatment of their musculoskeletal complaints.

It was thus impossible to determine the extent of the use of physiotherapy services among the current learner sample. The high prevalence of musculoskeletal dysfunction among the current study sample and the need for medical intervention may place increased economic strain on the limited health service system in South Africa. It would thus be appropriate to develop and evaluate preventative strategies for primary and secondary prevention.

6.11.2 PRIMARY PREVENTION

As the current learners will be the future work force, it is imperative to promote healthy musculoskeletal systems by means of education and preventative strategies. The first priority would be to prevent the onset of musculoskeletal dysfunction among children and adolescents and thus prevent chronic musculoskeletal conditions which are associated with high medical expenditure (Boden & Galizzi 1999 and Morse et al. 1998).

Education is an important tool for preventing disabling musculoskeletal dysfunction related to computer use (Cardon et al. 2002 and Shinn et al. 2002). Education on the proper/safe posture to assume during computer use can also be of value for the learners (Cardon et al. 2002 and Shinn et al. 2002). In the current study, posture education during computer use at school, did not prove to be very effective in reducing the musculoskeletal dysfunction among learners (Table 5.6). This can be due to a number of factors. One of the factors is that the "proper posture" education during computer use, given to learners might have been incorrect. Evaluation of the instruction methods was beyond the scope of this study, but should be addressed in future.

Learners' understanding of the reasons and benefits of correct posture during computer use is very important, both for short and for long term impact. In the short term, good posture during computer use can prevent the onset of musculoskeletal symptoms. It is believed that good postural habits instilled among children during school years, may persist into adulthood (Barrero & Hedge 2002). It is also possible that although the posture instruction during school computer use to the current study sample was appropriate, the school furniture did not allow for the instructed posture to be assumed and/or to be maintained (Figure 5.20). Therefore, ergonomic consideration during the planning and installation phase of computer laboratories and computer workstations are essential to ensure a safe environment for learners. These environments should stimulate and enhance learners' computer knowledge and school education and not deter them from computer use due to experienced musculoskeletal dysfunction.

In the present study, learners who were instructed on stretches and/ or exercises to do during their rest breaks from computer use, had less reports of musculoskeletal dysfunction (Figure 5.19). Exercises, stretches and postural changes were also reported by a learner sample in Australia, to relief discomfort during computer use (Harris & Straker 2000).

The exercise and/ or stretching activities by learners may relieve pressure on musculoskeletal structures held in static positions for prolonged periods during computer use (Kumar 2001). The activities allow for changes in positions of the affected structures and aid removal of noxious toxins via the lymphatic system (Kumar 2001).

In order to design effective and sustainable implementation programs in the South African context, consultation with all relevant parties is necessary to identify specific needs, problems and lacks related to the implementation of safe computer education programs. The parties that need to be consulted include the Education Department, educators, learners, parents/guardians, IT providers and health professionals. Consensus between these parties on problem areas and subsequent interventions is essential to enable durable change that can impact positively on learners and reduce the prevalence of musculoskeletal dysfunction among this vulnerable section of the community. Recommendations in this regard are made in the next chapter.

CHAPTER 7

CONCLUSION, LIMITATIONS and RECOMMENDATIONS

7.1 CONCLUSIONS

7.1.1 PREVALENCE OF MUSCULOSKELETAL DYSFUNCTION AND ASSOCIATIVE FACTORS

A sample, representative of the learner population of the four Education Management and Development Centers of the Cape Metropolitan region, participated in this study. The average weekly computer exposure of this sample was more than 10 hours. At school, learners used the computer predominantly for educational purposes e.g. delivery of curriculum subjects instead of for communication and entertainment.

Results have demonstrated that adolescent high school learners in the Cape Metropolitan region suffer from musculoskeletal dysfunction. The prevalence of dysfunction among this study sample was higher than for similar samples internationally. Girls had higher prevalence of musculoskeletal dysfunction than boys and the prevalence was higher among the non-computer than the computer group. Learners, who received instruction on exercises and/or stretches to do during computer usage at school, reported less musculoskeletal dysfunction than the learners who did not receive such instruction.

Factors that were associated with musculoskeletal dysfunction were female gender, playing sport more than once a week and school computer use of more than three years. More than 7 hours weekly computer exposure was predictive of general musculoskeletal dysfunction, low back pain and neck pain. Among girls, computer exposure of more than 7 hours per week was predictive of neck pain and left wrist pain, and among boys of left and right shoulder pain. Musculoskeletal dysfunction had a negative impact on learners' participation in physical activity and sport, as 31% of the sample indicated that they have stopped playing sport. Musculoskeletal dysfunction during adolescence may interfere with or hamper learners' choice of future careers, especially in the science field, as 35% of the learners reported that they have not felt like using the computer because of their musculoskeletal complaints in the past month. In the past month 29% of the sample stopped working on the computer due to their musculoskeletal complaints. Only 14% of this learner sample has sought medical attention for their musculoskeletal complaints.

7.1.2 ERGONOMIC STANDARDS OF COMPUTER LABORATORIES

The ergonomic design of the various components of the computer laboratory has an impact on the musculoskeletal dysfunction of users (Juul-Kristensen et al. 2004 and Straker et al. 2002). In the current study, the adherence to ergonomic guidelines of the computer laboratories in the Cape Metropolitan region, was however not associated with musculoskeletal dysfunction among this learner sample.

The assessment of the ergonomic standards of 29 computer laboratories at 16 randomly selected high schools of the Cape Metropolitan region was conducted by means of the Computer Workstation Design Assessment (CWDA). All the computer laboratories assessed obtained scores of equal to or less than 50% adherence to ergonomic guidelines. Two subsections of the CWDA obtained better scores, namely the working and visual environments. The working environment assessed the space for movement and storing of equipment and the visual environment assessed the control of glare from lighting sources, within the computer laboratories. Two sections, namely the spatial and workspace environments obtained the poorest scores according to the CWDA. The section on the specific workspace environment involving assessment of the chair, desk, computer screen and keyboard, obtained the poorest results. The assessment scores for the desks across the four EMDC's were the poorest, ranging from 8.9% to 19.4% adherence to ergonomic guidelines.

7.1.3 CONCLUSION

The results of this study highlight the need for intervention strategies focusing on education of involved parties (education department, educators, learners and parents) on safe computer interaction and the design of ergonomically safe computer laboratories.

7.2 LIMITATIONS

7.2.1 LACKS OF THE STUDY

7.2.1.1 Study Design

The cross-sectional design of the current study does not allow for clear identification of risk factors. The study design was however appropriate, as this is a fairly new field being explored in South Africa and identification of all possible associative and risk factors is required.

7.2.1.2 Sample selection

The estimated sample size of 1600 learners was not obtained, due to logistical problems within schools and the education department. The size of the final study sample did, however, allow for meaningful results with statistical analysis.

7.2.1.3 Time constraints

Time constraints were a huge obstacle especially in the first quarter of the school year of 2006. An already full school program had to deal with extra public holidays due the National Election. Many schools were reluctant to participate in the study due to the loss of school time. The researcher had to make special arrangements to ensure minimal influence on the schooling process. The unpredictability of the postal service led to informed consent forms arriving late at two of the participating schools in phase 1.

7.2.1.4 Reading Difficulties among Learners

Learners at certain schools had poor reading skills and required more time to complete the questionnaire in phase 1 of the study, than the allocated 20 minutes, even though the questionnaire was in their preferred language. Learners' poor reading skills may have been a contributing factor to the number of unanswered questions in the Computer Usage Questionnaire.

7.2.2 LACKS OF THE CUQ

Time constraints proved to be an obstacle during the validity and reliability testing of the CUQ. During the peer review process a second round of review would have been conducted to determine if all the concerns of the reviewers had been adequately addressed in the

revised CUQ. This was however not possible due to the limited time allocated to the researcher for completing the study in the schools (Section 3.8.1).

The potential for bias existed with pre-determined options at closed-ended questions of the CUQ. Many questions did however have the option of "other" where learners were allowed to give their own opinion.

The psychosocial section in the CUQ was an adapted version of the Strengths and Difficulties questionnaire of Goodman et al. (1998). Although the original questionnaire had good reliability and validity, the adapted version that was used in the CUQ was not tested separately for its stability and validity among the learner sample. The results of the pilot study and test-retest did demonstrate good correlation of the learners' responses between the two data collection periods.

A number of other associative factors that could be involved in learners' musculoskeletal dysfunction were not assessed in this questionnaire, as it did not fall within the scope of this study. In future the assessment of the following factors need to be investigated to determine whether they play a role in the development of learners' musculoskeletal dysfunction: back packs, family history of musculoskeletal dysfunction, smoking and part-time employment (Zapata et al. 2006, Pukree et al. 2004, Grimmer & Williams 2000 and Harreby et al. 1999).

7.2.3 LACKS OF THE CWDA

The CWDA was adapted from an existing workstation assessment tool, The Computerized Classroom Environment Inventory (CCEI) (Zandvliet & Straker 2001). The validity of the adapted tool (CWDA) was assessed by one expert in the field of Ergonomics. To improve the validity of the instrument for future use, a panel of experts in the field of computer workstation design and -evaluation can be consulted to assess the CWDA's content validity. In order to improve the reliability of the CWDA, inter-rater reliability can be tested on a specific setting. In the current study only intra-rater reliability was assessed.

The potential for intra-rater bias existed as the researcher was the only person assessing the computer laboratories in the selected schools. Due to unforeseen circumstances, a research assistant was unavailable to conduct the assessment of the work stations with the researcher.

7.3 RECOMMENDATIONS

Learners from the current study suffering from musculoskeletal dysfunction should consult a medical professional, e.g. a General practitioner or Physiotherapist, to prevent progression of their musculoskeletal condition into chronic disabling disorders. The medical fraternity should be made aware of the high prevalence of musculoskeletal dysfunction among adolescents.

Consultation with the following parties is recommended to identify specific needs among the learner population using computers: the WCED, educators, learners, parents/guardians, computer installation firms, e.g. the Khanya Project and furniture companies.

The implementation of intervention programs in schools should involve education of learners and educators on good posture during computer use, instilling the value of rest breaks from computer work and teaching appropriate exercises and stretches during rest breaks from computer work. Teaching school learners from an early age good postural and ergonomic habits will benefit them in their adulthood and for their future careers as well.

Regular evaluation of the intervention programs is required in order to determine whether the goals of these programs are met. Feedback sessions are recommended with educators, learners and parents to identify areas of concern with the content, implementation and/or management of the programs.

International researchers and the latest literature should be consulted to determine the best ergonomic features of computer laboratories and workstations that will benefit learners' musculoskeletal health, but also be affordable to schools and the education department.

Prospective longitudinal studies within the South African context are recommended to determine whether South African children and adolescents show similar tendencies as among international learner samples, e.g. increasing severity of dysfunction and more widespread musculoskeletal dysfunction. These factors are important predictors for future musculoskeletal disorders and disability among adults.

Future research in this field is necessary as many of the possible factors involved in learners' musculoskeletal dysfunction had not been investigated in the South African context. These factors include psychosocial aspects, back packs, smoking, part-time jobs and parental history of musculoskeletal pain. Early identification of risk factors for learners' musculoskeletal dysfunction is essential in order to prevent the onset or progression of adolescent musculoskeletal pain into chronic disorders in adulthood.

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Addendum 1: Search Strategies

Databasis	Year	Limits	Key words	Initial hits	Retained Hits (on title)	Search Nr	Nr of Duplicates
Pubmed	From inception	All child: 0-18 yrs, English, Humans	Neck pain or Back pain and schools	66	18	89	2
			Neck pain OR back pain OR shoulder pain AND schools	65	4	85	
			Arm pain OR wrist pain OR m-s pain AND schools	20	11	75	
			Computers (MESH) AND posture (MESH)	41	2	40	1
			Neck pain AND schools	11	2		
			Neck pain OR shoulder pain AND comput*	140	1	47	1
			Comput* AND pain AND posture*	33	1	51	1
			School AND comput* AND pain	32	4	10	2
			Comput* AND musculoskeletal pain	50	3		3
			Comput* AND neck pain	108	0		
			Comput* AND back pain	350			
			Comput* AND Back pain AND school	8	2		2
			Computers AND young adults AND health	43	0	89	
			Computers AND school	202	17	91	
			Computers AND musculoskeletal health	8	2	90	
			Computers AND school AND child	138			
			Computers AND school AND pain	4	3	93	3

Database	Year	Limits	Key words	Initial hits	Retained Hits (on title)	Search Nr	Nr of Duplicates
Africa Wide	From Inception	None	Neck pain OR back pain AND schools	132		3	
			Neck pain OR back pain AND child	119		4	
			Comput* AND pain AND child	30	0	5	
			Comput* AND posture AND child*	10	0	6	
			Comput* AND child* AND back pain	3	0	7	
			Pain AND posture	34	0	1	
			Computer AND ergonomics	47	0	2	
CINAHL	From inception	English Age: 6-18; child and adolescent	Posture AND child AND school	51	2	17	
			Posture AND child AND school AND pain	16	0	18	
			((MH “Back pain”) AND (MH “Neck pain”))	144		1	
OVID	From Inception	None	Child AND posture AND pain	267	1	8	
			Child$ AND computer AND pain	743			
			Child AND computer AND school AND posture AND pain	30	0	10	
			Child AND computer AND school AND pain	314			
			Child AND musculoskeletal health AND comput$	5	1	13	
			Neck pain OR back pain AND child AND computer	99	2	14	

Database	Year	Limits	Key words	Initial hits	Retained Hits (on title)	Search Nr	Nr of Duplicates
ERIC	From inception	English	Computer AND school AND posture	4	1	1	
			School AND computers AND pain	4	0	4	
			(TX “Computer uses in Education” AND DE pain	1	0	7	
			Computers AND young adults AND health	5	0	14	
PsycInfo	From inception	None	Child AND back pain	24	1	4	
			Child AND back pain AND school	0		3	
			Child AND school AND pain	491		12	
			Child AND back pain OR neck pain AND school	46	0	14	
			Child AND ergonomics and pain	3	1	9	1
			Child AND pain AND posture	1	0	2	
			Computer AND children AND health	74	3	16	2
Proquest	From inception	None	(LSU Child AND LSU posture)	57		2	
			Child AND pain AND posture	24	1	1	1
			(LSU Child AND LSU pain epidemiology)	16		9	
			Child AND back pain OR neck pain AND school	40	7	17	7
			Computers AND young adults AND health	26	1	18	
			(LSU Child AND LSU Back pain etiology)	25	0	19	
			Child AND musculoskeletal pain AND school	2	0	20	

Database	Year	Limits	Key words	Initial hits	Retained Hits (on title)	Search Nr	Nr of Duplicates
PEDro	From Inception	None	Child AND pain	0		6	
			Computers AND child	0		3	
			Pain AND musculoskeletal AND child	0		1	
			Child OR adolescent AND pain or Musculoskeletal pain	0			
Science Direct	From Inecption	None	Child AND back pain OR neck pain AND school	55	1	1	1
			Child AND musculoskeletal health AND computers	3	2	2	
			Child AND posture AND pain AND computers	0		3	
			Child AND computers AND posture	8	2	4	1
			Child AND pain AND computers	13	0	5	
			Computer AND school AND musculoskeletal health	0		6	
SCOPUS	From Inception	None	Child AND back pain OR neck pain AND schools	190	11	1	9
			Computers AND young adults AND health	95	1	2	1
			Child AND computer AND musculoskeletal health	9	0	3	
			Child AND pain AND posture	100	5	4	4
			Computer AND child AND school AND pain	16	4	5	4
			Computer AND child AND school AND posture	13	5	6	4

Database	Year	Limits	Key words	Initial hits	Retained Hits (on title)	Search Nr	Nr of Duplicates
Web of Science	From Inception	None	Child* AND back pain OR neck pain AND school	135	10	1	
			Pain AND child* AND posture AND school	30	0	2	
			Computer AND child* AND school	469		3	
			Back pain OR neck pain AND child* AND school	64	6	4	5
			Child AND computer AND posture	0		5	
			Child AND computer AND musculoskeletal health	2	0	6	
			Child AND comput* AND pain AND school	23	7	7	
			Child AND computer AND school	87	2	8	1
			Pain AND child AND posture AND school	8	0	9	
			Pain AND child* AND posture AND school	23	2	10	2
			Computer AND child AND pain	18	1	11	1

Addendum 2: List of Excluded Studies

ARTICLES PER DATABASE: 2ND ROUND EXCLUSIONS

1. **Study Type: Reviews**

- Gillespie, R. 2002. The physical impact of computers and electronic game use on children and adolescents: A review of current literature. *Work*, 18(3):249-59
- Trevelyan, F.C & Legg, S.J. 2006. Back pain in school children: where to from here. *Applied Ergonomics*, 37(1):45-54
- Barrero, M. & Hedge, A. 2002. Computer environments for children: A review of design issues. *Work,* 18(3):227-237
- Balague, F., Troussier, B. & Salminen, J.J. 1999. Non-specific LBP in children and adolescents: Risk factors. *European Spine Journal*, 8(6):429-38

2. **Study Type: Prevalence and posture assessment**

- Murphy,S., Buckle, P. & Stubbs, D. 2004. Classroom posture and self-reported back and neck pain in schoolchildren. *Applied Ergonomics*, 35(2):113-120
- Murphy, S. 2005. Children and back pain: back pain amongst school children and physical risk factors in schools. *Talkback Magazine*, January:24

3. **Population: Adults**

    - Juul-Kristensen, B., Sogaard, K., Stroyer, J. & Jensen, C. 2004. Computer users' risk factors for developing shoulder, elbow and back symptoms. *Scandinavian Journal of Work Envrionmental Health,* 30(5):390-398
    - Szeto, G.P. & Lee, R. 2002. An ergonomic evaluation comparing desktop, notebook and subnotebook computers. *Archives of Physical Medicine Rehabilitation*, 83:527-532

4. **Population: Child < 6 years**

- Straker, L., Pollock, C.M., Zubrick, S.R. & Kurinczuk, J.J. 2006. The association between information and communication technology exposure and physical activity, musculoskeletal and visual symptoms and socio-economic status in 5 year olds*. Child Care Health and Development,* 32(3):343-351.

5. **Study Topic: Ergonomic Evaluation of workstation and / or psychosocial aspects of comp lab.**

- Sotoyama, M., Bergqvist, U., Jonai, H. & Saito, S. 2002. An ergonomic survey on the use of computers in schools. *Industrial Health*, 40(2):135-141
- Bennett, C. 2002. Computers in the elementary school classroom. *Work* 18(3):281-285
- Maxwell L. 1999.Children, computers and school furniture. *Educational Facility Planner,* 35(2):5-7.
- Zandvliet, D.B. & Straker, L.M. 2001. Physical and psychosocial aspects of the learning environment in information technology rich classrooms. *Ergonomics*, 44(9):838-57

6. **Study Topic: Developmental Issues related to computer**

- Subrahmanyam, K., Kraut, R.E., Greenfield, P.M. & Gross, E.F. 2000. The impact of computer use on children's activities and development. *Future Child*, 10(2):123-144

7. **Study Topic: Only prevalence's**

- De Inocencio. 1998. Musculoskeletal pain in primary pediatric care: analysis of 1000 consecutive general pediatric clinic visits. *Pediatrics,* 102(6):E63
- Prista, A., Balague, F., Nordin, M. & Skovron, M.L. 2004. Low back pain in Mozambican adolescents. *European Spine Journal*, 13:341-345
- Gunzburg, R., Balague, F., Nordin, M., Szpalski, M., Duyck, D., Bull, D. & Melot, C. 1999. Low back pain in a population of school children. *European Spine Journal*, 8:439-443
- Watson, K., Papageorgiou, A., Jones, G., Taylor, S., Symmons, D., Silman, A. & Macfarlane, G. 2002. Low back pain in school children: occurrence and characteristics. *Pain*, 97:87-92
- Smedbraten, B., Natvig, B., Rutle, O. & Bruusgaard, D. 1998. Self-reported bodily pain in school children. *Scandinavian Journal of Rheumatology*, 27(4):273-276
- Mikkelsson, M., Salminen, J. & Kautiainen, H. 1997. Non-specific musculoskeletal pain in pre-adolescents. Prevalence and 1-year persistence. *Pain*, 73:29-35
- Stahl, M., Mikkelsonn, M., Kautiainen, H., Hakkinen, A., Ylinen, J. & Salminen, J. 2004. Neck pain in adolescence. A 4-year follow-up of pain-free pre-adolescents. *Pain,* 110: 427-431

- Szpalski, M., Gunzburg, R., Balague, F., Nordin, M. & Melot, C. 2002. A 2-year prospective longitudinal study on low back pain in primary school children. *European Spine Journal*, 11(5):459-464.
- Jones, M.A., Stratton, G., Reilly, T. & Unnithan, V.B. 2004. A school-based survey of recurrent non-specific low-back pain prevalence and consequences in children. *Health Educ Res,* 19(3):284-9
- Beija, I., Abid, N., Ben Salem, K., Letaief, M., Younes, M., Touzi, M. & Bergaoui, N. 2005. Low back pain in a cohort of 622 Tunisian school children and adolescents: an epidemiological study. *European Spine Journal*, 14(4):331-6

8. Study Topic: Back packs

- Iyer, S.R. 2001. An ergonomic study of chronic musculoskeletal pain in school children. *Indian Journal of Pediatrics*, 68(10):937-41

9. Study Topic: Other risk factors

- Feldman, D.E., Barnett, T., Shier, I., Rossignol, M. & Abenhaim, L. 2003. Is physical activity differentially associated with different types of sedentary pursuits? *Arch Pediatr Adolesc Med*, 157(8):797-802
- Ehrmann Feldman, D.E, Shier, I., Rossignol, M. & Abenhaim, l. 2002. Risk factors for the development of neck and upper limb pain in adolescents. *Spine*, 27(5):532-8.
- Shehab, D.K. & Al-Jarallah, K.F. 2005. Non-specific LBP in Kuwaiti children and adolescents: associated factors. *J Adolesc Health*, 36(1):32-35
- Limon, S., Valinsky, L.J., & Ben-Shalom, Y. 2003. Children at risk: risk factors for low back pain in school children and their parents: a population based study. *Pain* 103(3):259-68
- Jones, G., Watson, K., Silman, A., Symmons, D. & Macfarlane, G. 2003. Predictors of LBP in British school children: a population based prospective cohort study. *Pediatrics* 111(4,1):822-8
- Grimmer, K. & Williams, M. 2000. Gender-age environmental associates of adolescent LBP. *Appl Ergon*, 31(4):343-60

- Siivola, S.M., Levoska, S., Latvala, K., Hoskio, E., Vanharanta, H. & Keinanen-Kiukaanniemi, S. 2004. Predictive factors for neck and shoulder pain: a longitudinal study in young adults. *Spine* 29(15):1662-9
- Kovacs, F., Gestoso, M., Gil del Real, M., Lopez, J., Mufraggi, N. & Mendez, J.I. 2003. Risk factors for non-specific LBP in school children and their parents: a population based study. *Pain* 103(3): 259-68
- Chiang, H.Y., Jacobs, K. & Orsmond, G. 2006. Gender-age environmental associates of middle school students' low back pain. *Work* 2006, 26(1): p19-28
- Wedderkopp, N. & Leboeuf-Yde, C. 2003. Back pain in children: No association with objectively measured level of physical activity. *Spine*, 28(17):2019-2024
- Kristjansdottir, G. & Rhee, H. 2002. Risk factors of back pain frequency in school children: a search for explanations to a public health problem. *Acta Paediatica*, 91:849-854
- Cardon, G., De Bourdeaudhuij, I., De Clercq, D., Philippaerts, R., Verstraete, S. & Geldhof, E. 2004. Physical fitness, physical activity and self-reported back and neck pain in elementary school children. *Pediatric Exercise Science*, 16(2):147-157
- Bejia, I., Abid, N., Ben Salem, K., Letaief, M., Younes, M., Touzi, M. and Bergaoui, N. 2005. Low back pain in a cohort of 622 Tunisian school children and adolescents: an epidemiological study. *European Spine Journal,* 14:331-336
- Cakmak, A., Yucel, B., Ozyalcn, S., Bayraktar, B., Ibrahim, U., Tuncay, D. & Genc, A. 2004. The frequency and associated factors of low back pain among a younger population in Turkey. *Spine*, 29(14):1567-1572
- Viry, P., Creveuil, C., Marcelli, C.1999. Non- specific back pain in children: A search for associated factors in 14-year old school children. *Revue du Rhumatisme*, 66(7-9):381-388.
- Krismer, M. 2003. Prevalence and risk factors of LBP in children and adolescents between 8 and 18 years: an epidemiological study among 1500 school children. Talkback Magazine, Apr 4

10. Study topic: Computer access (comments, prevalence, issues)

- Becker, H. 2000. Who's wired and who's not: children's access to and use of computer technology. *Future Child*. Fall-Winter 10(2):44-75

- Anonymous. 1999. Computers: a real pain in the neck. Current Health, 23(4):2
- Harris, C., Straker L., Pollock, C. & Trinidad, S. 2005. Musculoskeletal outcomes in children using information technology-the need for a specific etiological model. *International Journal of Industrial Ergonomics*, 35(2):131-138
- Straker, L.M and Pollock, C. 2005. Optimizing the interaction of children with information and communication technologies. *Ergonomics*, 48(5):506-521
- Kerrawalla, L. & Crook, C. 2002. Children's computer use at home and school: context and continuity. *British Edu Research J*, 28(6):751-71

11. Study Topic: quality of life issues/ Disability Issues

- Roth-Isigkeit, A., Thyen,U., Stoven, H., Schwarzenberger, J. & Schmucker, H. 2005. Pain among children and adolescents: Restrictions in daily living and triggering factors. *Pediatrics,* 115(2):483-484 (e152: Abstract)

12. Language

- Kratenova, J., Zejglicova, K., Maly, M. & Filipova, V. 2005. Risk factors and prevalence of bad posture in school-age children. *Prakticky Lekar*, 85(11):629-634 (Polish Language).

Addendum 3: Methodological Appraisal Scores

AUTHORS	Jones & Orr '98	Royster & Yearout '99	Harreby et al. '99	Harris & Straker '00	Jacobs & Baker '02	Burke & Peper '02
Study purpose clearly stated (Y=1; N=0)	1	0	1	1	1	1
Literature review: relevant (Y=1; N=0)	1	1	1	1	1	1
Design appropriate (Y=1; N=0)	1	0	1	1	1	1
Design biases present (Y=0; N=1)	0	0	0	0	0	0
Sample described in detail (Y=1; N=0)	1	0	1	1	0	0
Sample size justified (Y=1; N=0)	0	0	0	0	0	0
Informed consent obtained (Y=1; N=0)	0	0	0	1	1	0
Statistical significance reported (Y=1; N=0)	1	0	1	1	1	1
Appropriate analysis of results (Y=1; N=0)	1	0	1	0	1	1
Clinical importance of results noted (Y=1; N=0)	1	1	1	1	0	0
Appropriate conclusions (Y=1; N=0)	1	1	1	1	0	1
Reliable outcomes (Y=1; N=0)	0	0	0	0	0	0
Valid outcomes (Y=1; N=0)	0	0	0	0	0	0
Clinical implications reported (Y=1; N=0)	1	1	1	1	1	1
Limitations reported (Y=1; N=0)	1	1	0	1	0	1
TOTAL SCORE: /15	**10**	**5**	**9**	**10**	**7**	**8**

AUTHORS	Alexander & Currie '04	Sjolie '04	Ramos et al. '05	Diepenmaat et al. '06	Hakala et al. '06	Zapata et al. '06	TOTAL
Study purpose clearly stated (Y=1; N=0)	0	1	1	1	1	1	**10**
Literature review: relevant (Y=1; N=0)	1	1	1	1	1	1	**12**
Design appropriate(Y=1; N=0)	1	1	1	1	1	1	**11**
Design biases present (Y=0; N=1)	0	0	0	0	0	0	**0**
Sample described in detail (Y=1; N=0)	1	1	1	1	0	1	**8**
Sample size justified (Y=1; N=0)	0	0	0	0	0	0	**0**
Informed consent obtained (Y=1; N=0)	1	1	1	0	0	1	**6**
Statistical significance reported (Y=1; N=0)	1	1	1	1	0	1	**10**
Appropriate analysis of results (Y=1; N=0)	0	1	1	1	1	1	**9**
Clinical importance of results noted (Y=1; N=0)	0	0	1	1	0	0	**6**
Appropriate conclusions (Y=1; N=0)	1	1	1	1	0	1	**10**
Reliable outcomes (Y=1; N=0)	0	0	0	0	0	0	**0**
Valid outcomes (Y=1; N=0)	0	1	0	0	0	0	**1**
Clinical implications reported (Y=1; N=0)	1	0	1	1	1	0	**10**
Limitations reported (Y=1; N=0)	1	1	0	1	1	1	**9**
TOTAL SCORE: /15	**8**	**10**	**10**	**10**	**6**	**9**	

Addendum 4: WCED Approval of study and extension of period

Navrae
Enquiries
IMibuzo
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Verwysing
Reference
ISalathiso
20051108-0038

Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

Miss Leonè Smith
P.O. Box 19063
TYGERBERG
7505

Dear Miss L. Smith

RESEARCH PROPOSAL: INVESTIGATING THE CORRELATION BETWEEN MUSCULOSKELETA DYSFUNCTION AND COMPUTER USAGE AMONG HIGH SCHOOL LEARNERS.

Your application to conduct the above-mentioned research in schools in the Western Cape has been approve subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of th investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **20th March 2006 to 28th April 2006.**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi fo examinations (October to December 2006).
7. Should you wish to extend the period of your survey, please contact Dr R. Cornelissen at the conta numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the Principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as submitted to the Western Cape Educatio Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Educatio Research.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

The Director: Education Research
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000

We wish you success in your research

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**
DATE: 10th November 2005

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Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

Miss Leonè Smith
P.O. Box 19063
TYGERBERG
7505

Dear Miss L. Smith

RESEARCH PROPOSAL: INVESTIGATING THE CORRELATION BETWEEN MUSCULOSKELETAL DYSFUNCTION AND COMPUTER USAGE AMONG HIGH SCHOOL LEARNERS.

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **20th March 2006 to 19th May 2006.**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December 2006).
7. Should you wish to extend the period of your survey, please contact Dr R. Cornelissen at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the Principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as submitted to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Education Research.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

The Director: Education Research
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000

We wish you success in your research.

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**
DATE: 02nd February 2006

Addendum 5: Schools in Phase 1

PHASE 1

NORTH EMDC

1. Settlers High
2. Elswood Secondary

EAST EMDC

1. Macassar Secondary
2. Brackenfell High

CENTRAL EMDC

1. Pinelands High
2. Good Hope Seminary

SOUTH EMDC

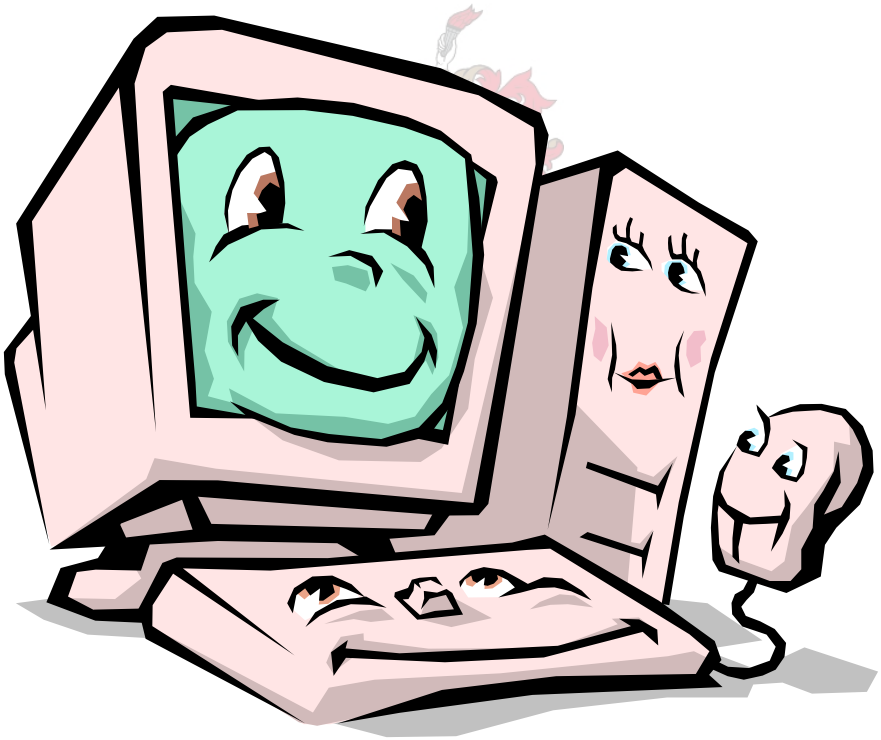
1. Crestway Secondary
2. Simon's Town High

Pectora roborant cultus recti

Addendum 6: CUQ

COMPUTER USAGE QUESTIONNAIRE for

SCHOOL LEARNERS



COMPUTER USE AT SCHOOL…..

*If you **don't** use a computer at **school**, go to **page 3**. Mark your answer with a **cross (X)**.*

1. How long have you been using a computer during **lessons at school**?
   ☐ Less than 1 year ☐ 2 years ☐ 3 years ☐ 4 years or more

2. Do you **use the computer** for any of the following **subjects**? Mark as many as you want.
   ☐ Mathematics ☐ Computer Studies ☐ Languages ☐ Compu-Typing
   ☐ Others, please list:_____

3. What do you **use** the **computer** for at **school**? Mark as many as you want.
   ☐ Typing ☐ View lessons ☐ Experiments ☐ Internet and e-mail
   ☐ Use educational programmes ☐ Other, please list:_____

4. How many **times per week** do you use the **computer at school**?
   ☐ Once or less per week ☐ Twice per week ☐ Three times per week ☐ Four times per week
   ☐ Five times or more per week

5. During **one session** at school, **how long** do you spend using the computer?
   ☐ Less than 30 minutes ☐ About 45 minutes ☐ 1 Hour ☐ 1 ½ Hours ☐ 2 Hours or more

6. How many **hours per week** do you spend working on the **school computer**?
   ☐ About 2 Hours per week ☐ About 4 Hours per week ☐ About 6 Hours per week ☐ 8 Hours or more per week

7. Did you receive any **instruction** on **how to sit** in front of the **computer**?
   ☐ Yes ☐ No

Please turn the page…..

7.1. If **"Yes"**, who **instructed** you?_____

8. Do you take a short **break** of a few minutes at least **once an hour**, when using the **computer?** (A short computer break, means to stop using your hands at the keyboard/ mouse, e.g. to stand up, stretch out, use the bathroom, etc.)
   ☐ Yes ☐ No

9. Have you received any information on **stretches/ exercises** you can do during the above-mentioned short breaks?
   ☐ Yes ☐ No

   9.1. If **"Yes"**, who provided the information?_____
   9.2. Please describe the type of **stretches** or **exercises** that you do?
   _____

COMPUTER USE ELSEWHERE….

*If you don't use a computer **outside school**, go to **page 5**. Mark your answer with a **cross (X)**.*

1. **Where** do you use a computer **outside school**? Mark as many as you want.
   ☐ At your home ☐ Internet Café ☐ Relative/ friend's home ☐ Library
   ☐ Elsewhere (state where)_____

2. Roughly, **how long** have you been using the computer **outside school**?
   ☐ Less than a year ☐ 2-3 Years ☐ 4 Years ☐ 5 years or more

3. On average, how many **times per week** do you use the computer?
   ☐ Less than once a week ☐ 2 times per week ☐ 3 times per week ☐ 4 times per week
   ☐ Five times or more per week

Please turn the page……

4. On average, how many **hours per day** do you spend working on the computer **outside of school?**
   ☐ Less than 30 minutes ☐ 1 Hour ☐ 2-3 Hours ☐ 4 Hours or more

5. What **type of computer** do you use most of the time?
   ☐ Desktop computer ☐ Laptop computer ☐ Both

6. Where is the computer **positioned** when you are using it? Mark as many as you want.
   ☐ On a desk/ table ☐ On your lap ☐ On the floor ☐ On a chair
   ☐ Other, please list_____

7. Do you participate in any **other activity** whilst simultaneously working on the computer? Mark as many as you want.
   ☐ Talk to a friend ☐ Listen to music ☐ Talk on the phone ☐ Writing on a page
   ☐ Other, please list_____

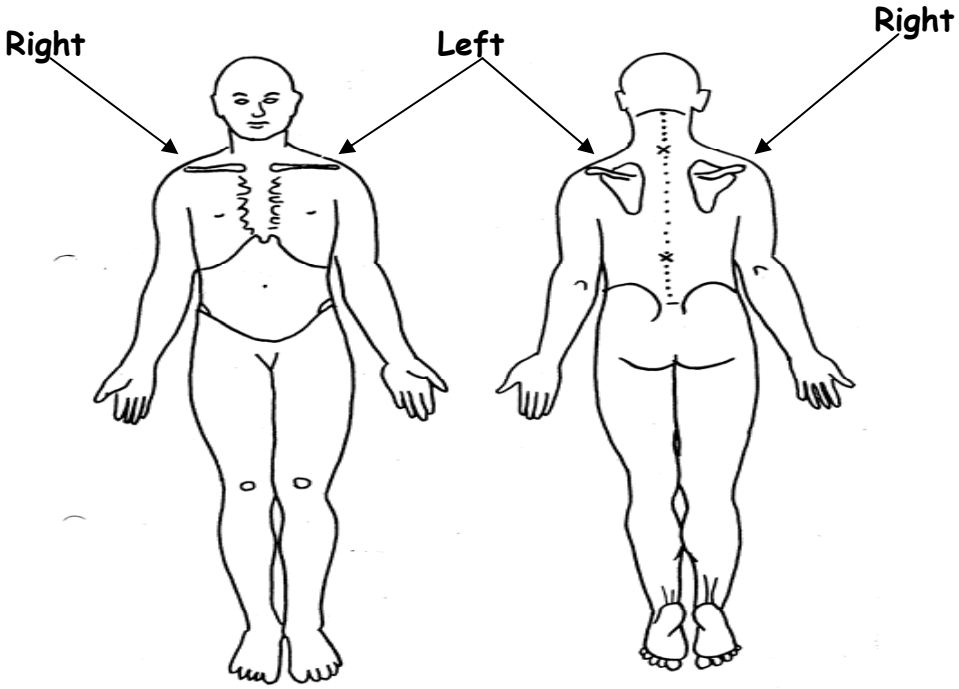
Please turn the page……

TELL US ABOUT YOUR ACHES and PAINS…

*Mark your answer with a **cross (X).***

1. Have you experienced any **headaches, discomfort, stiffness, pain,** or **tingling** in your **muscles** or **joints** in the **last month?**
   ☐ Yes ☐ No **If "No", go to page 8.**

2. If **"Yes"**, in which **areas of the body** did you experience these feelings in the last month? Mark the **areas** where you **felt** your **symptoms** with a "**X**"



Please turn the page…..

3. Tell us **how bad** these feelings of **discomfort, stiffness, pain** or **tingling** has been in the **last month**

If you had **SLIGHT discomfort, stiffness, pain,** or **tingling**, mark (**X**):  .

If you had ***A LOT*** of **discomfort, stiffness, pain,** or **tingling,** mark (**X**): 

This is an example of how you should do it…

Neck	X	

Body Area	Slight Discomfort, Pain, etc	A lot of discomfort, pain, etc
Head		
Neck		
Upper Back		
Mid-Back		
Lower Back		
Right Shoulder		
Left Shoulder		
Right Elbow		
Left Elbow		
Right Wrist and Hand		
Left Wrist and Hand		

Please turn the page…..

4. **When** did you feel the **headaches**, **discomfort, stiffness, pain** or **tingling** of your **muscles and joints?** Mark as many as you want.

☐ Sitting in front of your school desk ☐ During or after sports. ☐ Working on the computer at school.
☐ Writing in a book at school desk ☐ Working on the computer elsewhere.
☐ Other (please list):_____

5. Have you ever felt like not using the computer because of **headaches, discomfort, stiffness, pain,** or **tingling** of your **muscles** and **joints?**

☐ Yes ☐ No

6. Have you **stopped** any of the following **activities** because of the **headaches, discomfort, stiffness, pain**, or **tingling** of your **muscles** and **joints** in the **last 3 months?** Mark as many as you want.

☐ Playing sports ☐ Working on the computer ☐ Writing in a book ☐ Playing a musical instrument
☐ List any other_____

7. In the **last month**, have you seen a **Doctor** or any other **medical professional** for any of your muscle and joint **complaints** mentioned above?

☐ Yes ☐ No

Please turn the page……

HOW DO YOU FEEL?

*Tell us how you have **felt** about **yourself**, other **people** and **situations** in the **last month**. Mark each answer with a **cross (X)**.*

1. Do you **care** about **other people** and try to be **nice** to them?
   ☐ Always ☐ Sometimes ☐ Never

2. Do you get a lot of **headaches** and **stomach aches**?
   ☐ Always ☐ Sometimes ☐ Never

3. Do you get very **angry** and loose your **temper**?
   ☐ Always ☐ Sometimes ☐ Never

4. Do you feel **sad** and **tearful**?
   ☐ Always ☐ Sometimes ☐ Never

5. Do you **fight** a lot?
   ☐ Always ☐ Sometimes ☐ Never

6. Do you feel **nervous** when meeting **new people** and going to **new places**?
   ☐ Always ☐ Sometimes ☐ Never

7. Do you get **scared** easily?
   ☐ Always ☐ Sometimes ☐ Never

8. Do you make **new friends** easily?
   ☐ Always ☐ Sometimes ☐ Never

Please turn the page……

YOUR SPORTS and MUSIC….

*Mark your answer with a **cross (X)**.*

1. Do you participate in **sports?**
   ☐ Yes ☐ No…… **If "No", go to question 5.**

2. If **"Yes"**, **which sports** do you participate in? Mark as many as you want.
   ☐ Rugby ☐ Soccer ☐ Tennis ☐ Cricket ☐ Netball
   ☐ Athletics ☐ Hockey ☐ Other, please list_____

3. How many **times per week** do you participate in your combined sporting activities?
   ☐ Less than once a week ☐ Once a week ☐ Twice a week ☐ Three times or more per week

4. On average, how many **hours per week** do you participate in all your sports?
   ☐ Less than an hour ☐ About 2 Hours ☐ About 4 Hours ☐ 6 Hours or more

5. Do you play a **musical** instrument?
   ☐ Yes ☐ No **If "No", go to page 10.**

6. If **"Yes"**, what **type** of musical instrument/ s do you play?
   _____

7. On average, how many **hours per week** do you play your musical instrument?
   ☐ Less than 1 hour ☐ About 2 Hours ☐ About 4 Hours ☐ Six Hours or more

Please turn the page……

TELL US ABOUT YOURSELF….

1. What is your **school's** name?_____

2. What is **your name?**_____

3. What is your **date of birth** (day, month, year)?_____

4. In which **grade** are you?_____

5. Are you: ☐ A **boy** ☐ A girl

6. Are you: ☐ **Mainly right handed** ☐ **Mainly left handed**

7. Do you wear: ☐ **Spectacles** ☐ **Contact Lenses** ☐ **None**

8. Do you suffer from any **medical condition/s**, e.g. Epilepsy, Diabetes, Asthma?
   ☐ Yes ☐ No **If "No", go to question 10**

9. If **"Yes"**, do you use any **medication** for this condition?
   ☐ Yes ☐ No

10. Have you ever been involved in an **accident or sporting injury** where you injured your **back** or **neck?**
    ☐ Yes ☐ No

11. Have you had any **surgery** involving your **muscles** or **joints** done?
    ☐ Yes ☐ No

Please turn the page……

11.1. If **"Yes"**, please list the **type of surgery** and when it was done.

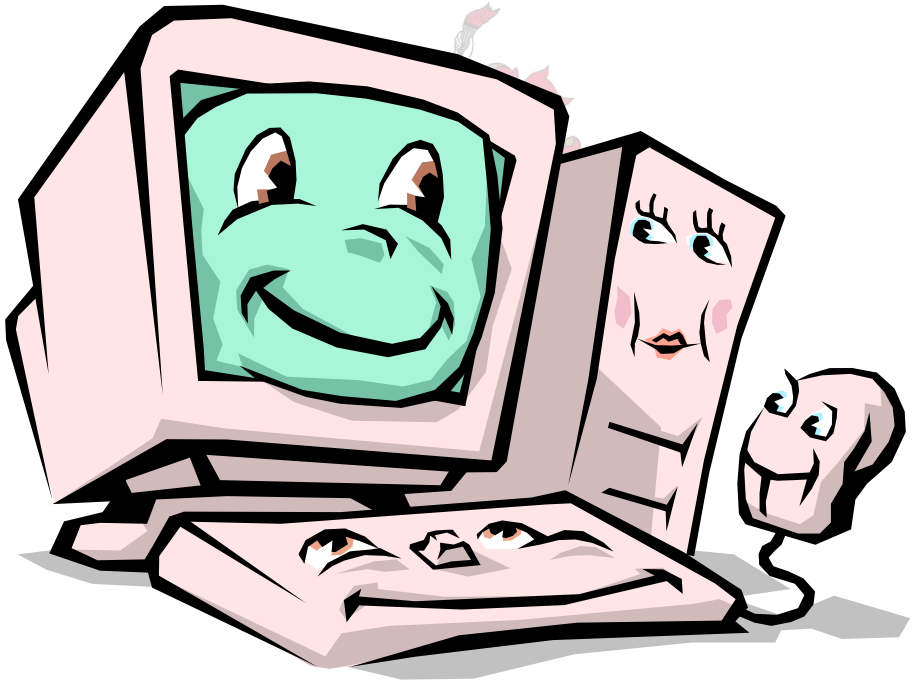
Year: _____ Surgery: _____
Year: _____ Surgery: _____
Year: _____ Surgery: _____

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!!!

The End.

REKENAARGEBRUIKVRAELYS vir

SKOOLLEERDERS



REKENAARGEBRUIK BY DIE SKOOL…

*Indien jy **nie** 'n rekenaar by die **skool** gebruik nie, blaai na **bladsy 3**. Dui jou antwoord met 'n **kruisie (X)** aan.*

1. Hoe lank gebruik jy al 'n rekenaar gedurende **klastyd**?
   ☐ Minder as 'n jaar ☐ 2 jaar ☐ 3 jaar ☐ 4 jaar of langer

2. **Gebruik jy die rekenaar** vir enige van die volgende **vakke**? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Wiskunde ☐ Rekenaarstudie ☐ Afrikaans/ Engels ☐ Rekenaartik
   ☐ Ander, noem asseblief:_____

3. Waarvoor **gebruik** jy die **skoolrekenaar**? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Tikwerk ☐ Bestudeer lesse ☐ Eksperimente ☐ Internet en e-pos
   ☐ Gebruik opvoedkundige programme ☐ Ander, noem asseblief:_____

4. Hoeveel **keer per week** gebruik jy die **skoolrekenaar**?
   ☐ Een keer per week, of minder ☐ Twee keer per week ☐ Drie keer per week
   ☐ Vier keer per week ☐ Vyf keer per week, of meer

5. **Hoe lank** duur **een rekenaargebruiksessie** by die skool?
   ☐ Minder as 30 minute ☐ Omtrent 45 minute ☐ 1 uur ☐ 1½ uur
   ☐ 2 uur of langer

6. Hoeveel **uur per week** gebruik jy die **skoolrekenaar**?
   ☐ Ongeveer 2 uur per week ☐ Ongeveer 4 uur per week ☐ Ongeveer 6 uur per week
   ☐ 8 uur per week, of meer

7. Het enigiemand jou **gewys hoe** om voor die **rekenaar te sit**?
   ☐ Ja ☐ Nee

Blaai asb om…..

7.1 Indien wel, wie? _____

8. Neem jy ten minste **elke uur** 'n **kort ruskans** van 'n paar minute wanneer jy die **rekenaar** gebruik? ('n Kort **rekenaarruskans** beteken om op te hou om die sleutelbord/muis te gebruik, en byvoorbeeld op te staan, te strek, badkamer toe te gaan, ensovoorts.)

☐ Ja ☐ Nee

9. Het jy enige inligting oor **strek- of ander oefeninge** ontvang, wat jy gedurende bogenoemde kort ruskanse kan doen?

☐ Ja ☐ Nee

9.1 Indien wel, **wie** het die **inligting** verskaf? _____

9.2 Beskryf asseblief die tipe **strek- of ander oefeninge** wat jy doen?

_____

REKENAARGEBRUIK ELDERS…

*Indien jy **net by die skool** 'n rekenaar gebruik, blaai na **bladsy 5**. Dui jou antwoord met 'n **kruisie (X)** aan.*

1. **Waar anders as by die skool** gebruik jy ook 'n rekenaar? Merk soveel opsies as wat op jou van toepassing is.

☐ By die huis ☐ Internetkafee ☐ By 'n familielid/vriend se huis ☐ Biblioteek

☐ Elders (noem waar) _____

2. Ongeveer **hoe lank** gebruik jy al 'n rekenaar **buiten die een by die skool?**

☐ Minder as 'n jaar ☐ 2-3 jaar ☐ 4 jaar ☐ 5 jaar of meer

3. Ongeveer hoeveel **keer per week** gebruik jy dié rekenaar?

☐ Minder as een keer per week ☐ 2 keer per week ☐ 3 keer per week

☐ 4 keer per week ☐ Vyf keer per week, of meer

Blaai asb om....

4. Gemiddeld hoeveel **uur per dag** werk jy op dié rekenaar?

☐ Minder as 30 minute ☐ 1 uur ☐ 2 uur ☐ 3 uur ☐ 4 uur of meer

5. Watter **tipe rekenaar** gebruik jy meestal?

☐ Tafelrekenaar ☐ Skootrekenaar ☐ Beide

6. Waar **staan** die rekenaar wanneer jy dit gebruik? Merk soveel opsies as wat op jou van toepassing is.

☐ Op 'n lessenaar/tafel ☐ Op jou skoot ☐ Op die vloer ☐ Op 'n stoel

☐ Ander, noem asseblief: _____

7. Verrig jy enige **ander** gelyktydige **aktiwiteit** terwyl jy op die rekenaar werk? Merk soveel opsies as wat op jou van toepassing is.

☐ Gesels met 'n vriend ☐ Luister na musiek ☐ Praat oor die telefoon ☐ Skryf

☐ Ander, noem asseblief: _____

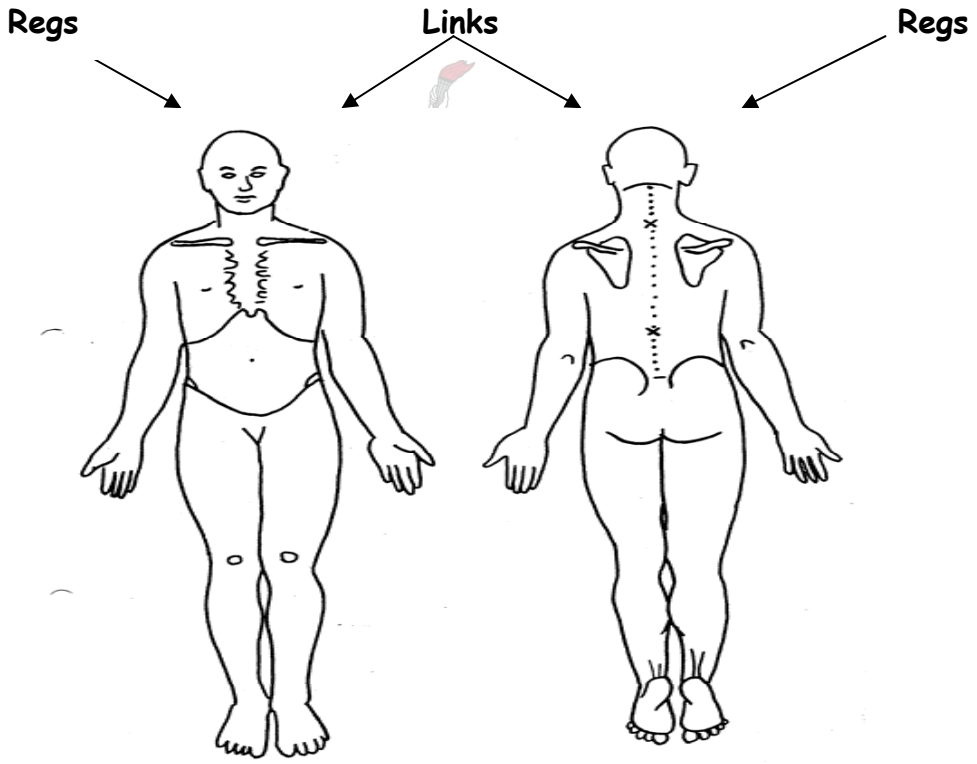
Blaai asb om....

VERTEL ONS VAN JOU PYNE EN SKETE…

*Dui jou antwoord met 'n **kruisie (X)** aan.*

1. Het jy in die **afgelope maand** enige **hoofpyn, ongemak, styfheid, pyn** of 'n **tintelende** gevoel in jou spiere of gewrigte ervaar?
   ☐ Ja ☐ Nee ***Indien nie, blaai na bladsy 8.***

2. Indien wel, in watter **liggaamsdele** het jy hierdie pyn/gevoel ervaar? Merk (**X**) slegs die **dele** waar jy jou **simptome gevoel** het.



Blaai om asb.....

3. Vertel vir ons hoe **"erg"** hierdie **ongemak, styfheid, pyn of tinteling** in jou spiere en /of gewrigte was in die **afgelope maand**.

Inien jy slegs **GERINGE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**) 

Indien jy **BAIE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**) 

Hier is 'n voorbeeld van hoe jy dit moet doen…

Nek	 X	

Liggaamsdeel	**Geringe ongemak, pyn, ens**	**Baie ongemak, pyn,ens**
Hoofpyn		
Nek		
Bo-Rug		
Middel Rug		
Lae Rug		
Regter Skouer		
Linker Skouer		
Regter Elmboog		
Linker Elmboog		
Regter Pols en Hand		
Linker Pols en Hand		

Blaai asb om…..

4. **Wanneer** het jy die **hoofpyn, ongemak, styfheid, pyn** of **tinteling** in jou **spiere** en **gewrigte** gevoel? Merk soveel opsies as wat op jou van toepassing is.

☐ Wanneer jy voor jou skoollessenaar sit ☐ Tydens of na sportdeelname ☐ Wanneer jy op die skoolrekenaar werk
☐ Wanneer jy by jou skoollessenaar in 'n boek skryf ☐ Wanneer jy elders op 'n rekenaar werk
☐ Ander (noem asseblief):_____

5. Het jy in die **afgelope maand** gevoel om nie op die **rekenaar** te werk nie a.g.v. die bogenoemde **ongemak, styfheid, pyn,** of **tinteling** in jou **spiere** en **gewrigte?**

☐ Ja ☐ Nee **Indien "Nee", gaan na vraag 7.**

6. Het jy in die afgelope **3 maande** enige van die volgende **aktiwiteite gestop** a.g.v die **ongemak, styfheid, pyn** of **tinteling** in jou **spiere** en **gewrigte?** Merk soveel opsies as wat op jou van toepassing is.

☐ Speel van 'n sport ☐ Werk op 'n rekenaar ☐ Skryf in 'n boek ☐ Speel van 'n musiek instrument
☐ Lys enige ander aktiwiteite_____

7. Het jy in die **afgelope maand** 'n **dokter** of enige ander **mediese praktisyn** oor die **spier- en gewrigprobleme** wat jy hierbo noem, gaan spreek?

☐ Ja ☐ Nee

Blaai asb om.....

HOE VOEL JY?

*Vertel vir ons hoe jy in die **afgelope maand** oor **jouself, ander mense** en **situasies** gevoel het. Dui jou antwoord telkens met 'n **kruisie (X)** aan.*

1. **Gee** jy **om** vir **ander mense**, en probeer jy **gaaf** teenoor hulle wees?
   ☐ Altyd ☐ Soms ☐ Nooit

2. Kry jy baie **hoof-** en **maagpyn**?
   ☐ Altyd ☐ Soms ☐ Nooit

3. Word jy baie **kwaad** en verloor jou **humeur**?
   ☐ Altyd ☐ Soms ☐ Nooit

4. Voel jy **hartseer** en **huilerig**?
   ☐ Altyd ☐ Soms ☐ Nooit

5. **Baklei** jy baie?
   ☐ Altyd ☐ Soms ☐ Nooit

6. Voel jy **senuweeagtig** wanneer jy **nuwe mense** ontmoet en **nuwe plekke** besoek?
   ☐ Altyd ☐ Soms ☐ Nooit

7. Word jy maklik **bang**?
   ☐ Altyd ☐ Soms ☐ Nooit

8. Maak jy maklik **nuwe vriende**?
   ☐ Altyd ☐ Soms ☐ Nooit

Blaai asb om.....

JOU SPORT en MUSIEK…

*Dui jou antwoord met 'n **kruisie (X)** aan.*

1. Neem jy aan **sport** deel?
   ☐ Ja ☐ Nee **Indien nie, gaan direk na vraag 5.**

2. Indien wel, aan **watter sport** neem jy deel? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Rugby ☐ Sokker ☐ Tennis ☐ Tafeltennis ☐ Netbal
   ☐ Atletiek ☐ Hokkie ☐ Ander, noem asseblief: _____

3. Altesaam hoeveel **keer per week** neem jy aan sportaktiwiteite deel?
   ☐ Minder as een keer per week ☐ Een keer per week ☐ Twee keer per week
   ☐ Drie keer per week, of meer

4. Altesaam hoeveel **uur per week** neem jy gemiddeld aan sport deel?
   ☐ Minder as 'n uur ☐ Ongeveer 2 uur ☐ Ongeveer 4 uur ☐ 6 uur of meer

5. Bespeel jy 'n **musiekinstrument**?
   ☐ Ja ☐ Nee **Indien nie, blaai na bladsy 10.**

6. Indien wel, watter **tipe** musiekinstrument(e)?
   _____

7. Gemiddeld hoeveel **uur per week** bespeel jy jou musiekinstrument?
   ☐ Minder as 'n uur ☐ Ongeveer 2 uur ☐ Ongeveer 4 uur ☐ 6 uur of meer

Blaai asb om.....

VERTEL ONS VAN JOUSELF…

1. Wat is jou **skool** se naam? _____

2. Wat is **jou naam**? _____

3. Wat is jou **geboorte datum** (dag, maand, jaar)? _____

4. In watter **graad** is jy? _____

5. Is jy: ☐ 'n Seun ☐ 'n Meisie

6. Is jy: ☐ Hoofsaaklik **regshandig** ☐ Hoofsaaklik **linkshandig**

7. Dra jy: ☐ 'n bril ☐ kontaklense ☐ **niks van die genoemde nie**

8. Ly jy aan enige **mediese toestand(e)**, byvoorbeeld epilepsie, diabetes, asma?
   ☐ Ja ☐ Nee

9. Indien "**Ja**" by vraag 8, gebruik jy enige **medikasie** vir hierdie toestand(e)?
   ☐ Ja ☐ Nee

10. Was jy al ooit in 'n **ongeluk of sportbesering** betrokke waar jou rug of nek seergekry het?
    ☐ Ja ☐ Nee

11. Het jy al enige **operasies** aan jou spiere of gewrigte gehad?
    ☐ Ja ☐ Nee

Blaai asb om….

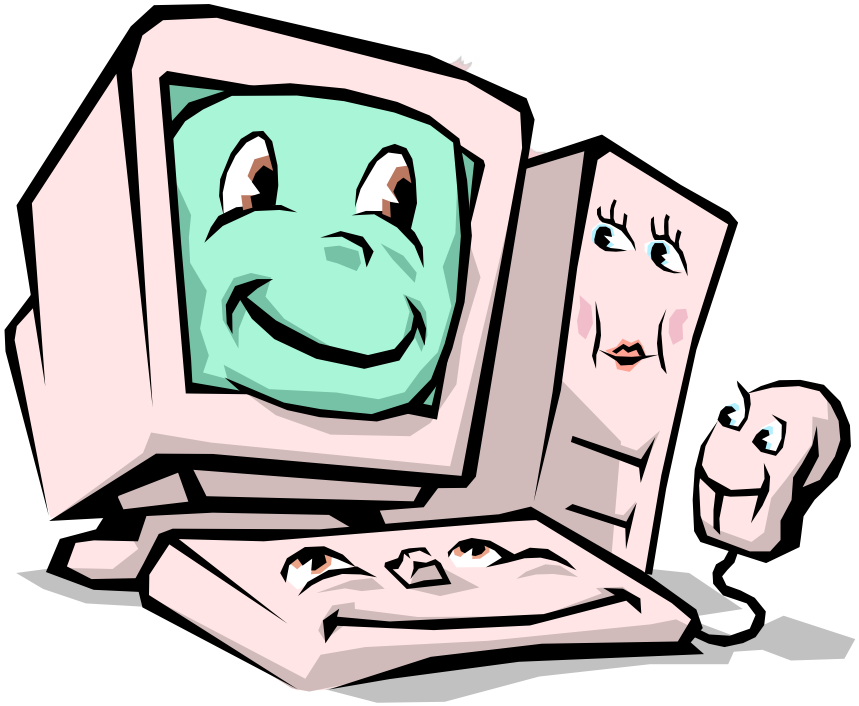
12. Indien **"Ja"** by vraag 11, noem asseblief die **tipe operasie** en ook **wanneer** dit gedoen is.

Jaar: _____ Operasie: _____
Jaar: _____ Operasie: _____
Jaar: _____ Operasie: _____



DANKIE DAT JY DIE VRAELYS VOLTOOI HET!!!

IMIBUZWANA NGOKUSETYENZISWA KWEKHOPMUYUTHA NGABAFUNDI



UKUSETYENZISWA KWEKHOMPUYUTHA ESIKOLWENI…

*Ukuba **awuyisebenzisi** ikhompuyutha **esikolweni,** tyhila **kwiphepha lesi 3**. Beka u-**X kwimpendulo** yakho.*

1. Unexesha elingakanani usebenzisa ikhompuyutha xa **kufundiswa esikolweni?**
   ☐ Ngaphantsi konyaka ☐ Iminyaka emibini ☐ Iminyaka emithathu ☐ Iminyaka emine okanye ngaphezulu

2. Ingaba **uyayisebenzisa ikhompuyutha** kwenye yezi **zifundo** zilandelayo? Khetha kangangoko ufuna.
   ☐ IziBalo ☐ IziFundo zeKhompuyutha ☐ Iilwimi ☐ Ikhompuyutha-nokuchwetheza
   ☐ Ezinye, yenza uluhlu lwazo:_____

3. **Uyisebenzisela** ntoni **ikhompuyutha esikolweni?** Khetha kangangoko ufuna.
   ☐ Ukuchwetheza ☐ Izifundo zokubonisa ☐ Imifuniselo/ieksperimenti ☐ I-intanethi ne e-meyili
   ☐ Iinkqubo ezincedisa ekufundiseni ☐ Ezinye, yenza uluhlu lwazo:_____

4. Uyisebenzisa **kangaphi ngeveki ikhompuyutha esikolweni** sakho?
   ☐ Kanye ngeveki okanye ngaphantsi kweveki ☐ Kabini ngeveki ☐ Kathathu ngeveki
   ☐ Kane ngeveki ☐ Kahlanu ngeveki okanye ngaphezulu

5. **Uchitha ixesha elingakanani** ekusebenziseni ikhompuyutha **kwiseshini nganye** esikolweni sakho?
   ☐ Ngaphantsi kwemizuzu engamashumi amathathu ☐ Kangangemizuzu engamashumi amane anesihlanu
   ☐ KangangeYure enye ☐ KangangeYure enye enesiqingatha ☐ KangangeeYure ezimbini nangaphezulu

6. Uchitha **iiyure ezingaphi ngeveki** usebenza **kwikhompuyutha yesikolo?**
   ☐ KakangeeYure ezimbini ngeveki ☐ KangangeeYure ezine ngeveki ☐ KangangeeYure ezintandathu ngeveki
   ☐ KangangeeYure ezisibhozo nangaphezulu ngeveki

7. Ingaba ukhe wawufumana **umyalelo** wokuba **uhlala njani** phambi **kwekhompuyutha?**
   ☐ Ewe ☐ Hayi

   7.1. Ukuba ngu**"Ewe"**, ngubani **owayekufundisa?**_____

8. Ingaba uyaziphumza **kancinci kwikhompuyutha** imizuzwana embalwa ubuncinane **kanye ngeyure**, xa usebenzisa **ikhompuyutha?**
(Ukuziphumza kancinci kwikhompuyutha , kuthetha ukuba ususe izandla zakho kwikhibhodi/kwimawusi, umzekelo: ukuma, ukuzolula, njalo njalo)
☐ Ewe ☐ Hayi

9. Ingaba lukhona ulwazi olufumeneyo **ngendlela yokuzolula/yemithambo** onokuyenza xa uziphumza okomzuzwana ekusebenziseni ikhompuyutha?
☐ Ewe ☐ Hayi

9.1. Ukuba ngu**"Ewe",** ngubani owayekufundisa?_____
9.2. Chaza **imithambo** okanye iindlela z**okuzolula** ozenzayo?_____

UKUSEBENZISA IKHOMPUYUTHA KWENYE INDAWO…

*Ukuba awuyisebenzisi ikhompuyutha xa **ungekho sikolweni,** tyhila kwiphepha. Beka u-**X** kwimpendulo yakho.*

1. **Uyisebenzisa phi** ikhompuyutha xa **ungekho sikolweni?** Khetha kangangoko ufuna.
☐ Ekhaya ☐ E-Intanethi khefi ☐ Kwisizalwana/kulomhlobo wam ☐ Kwithala leencwadi
☐ Naphi na (xela)_____

2. Qikelela ukuba, **unexesha elingakanani** usebenzisa ikhompuyutha xa **ngaphandle kwasesikolweni?**
☐ Ngaphantsi konyaka ☐ Iminyaka emibini ukuya kwemithathu ☐ Iminyaka emine
☐ Iminyaka emihlanu nangaphezulu

3. Ubuncinane, uyisebenzisa **kangaphi** ikhompuyutha ngeveki?
☐ Kanye ngeveki okanye ngaphantsi koko ☐ Kabini ngeveki ☐ Kathathu ngeveki
☐ Kane ngeveki ☐ Kahlanu ngeveki nangaphezulu

4. Ubuncinane, uchitha **iiyure ezingaphi ngemini** usebenzisa ikhompuyutha **ngaphandle kwasesikolweni?**
☐ Ngaphantsi kwemizuzu engama-30 ☐ Iyure enye ☐ Iiyure ezimbini ukuya kwezintathu ☐ Iiyure ezine nangaphezulu

5. Loluphi **udidi lwekhompuyutha** olusebenzisa kakhulu?
   ☐ Yi"Desktop" ☐ Yi"Laptop" ☐ Zombini

6. **Ihleli phi** le khompuyutha uyisebenzisayo? Khetha kangangoko ufuna.
   ☐ Edesikeni/etafileni ☐ Emathangeni ☐ Phantsi ☐ Esitulweni
   ☐ Naphi na, xela_____

7. Ingaba ukho **omnye umsebenzi** owenza ngaxesha-nye nalo wokusebenzisa ikhompuyutha? Khetha kangangoko ufuna.
   ☐ Uncokola netshomi/umhlobo ☐ Umamele umculo ☐ Uthetha efowunini
   ☐ Ubhala ephepheni ☐ Nezinye, xela_____

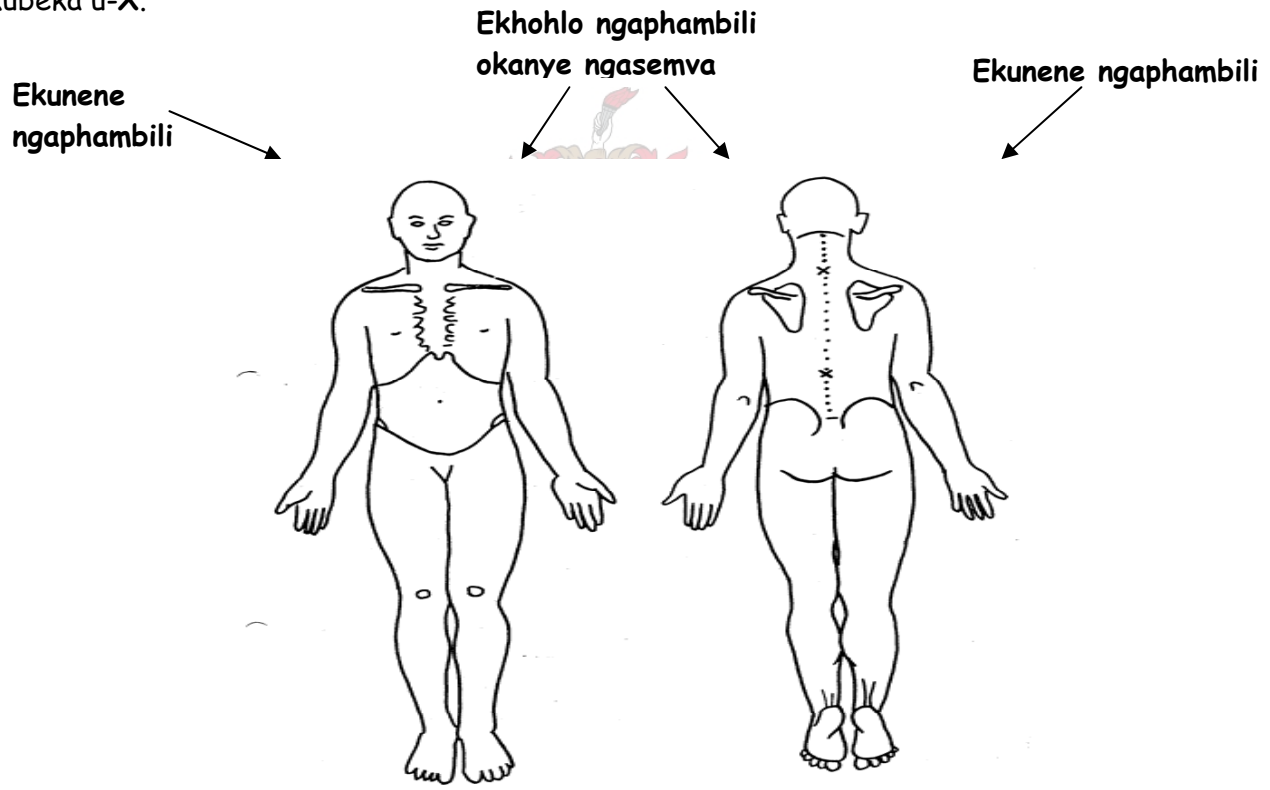
SIXELELE NGAMALUNGU AKHO ABA BUHLUNGU…

*Beka u-**X** kwibhokisi oyikhethe njengenempendulo echanekileyo.*

1. Ingaba ukhe wanenye yezi zinto: **intloko ebuhlungu, ukuphatheka kakubi, ukuqina kwezihlunu,** okanye **ukudikizelelwa** zizihlunu okanye amalungu omzimba kule **nyanga iphelileyo?**

   ☐ Ewe ☐ Hayi Ukuba ngu ***"Hayi", tyhila kwiphepha 8.***

2. Ukuba ngu**"Ewe"**, ngawaphi la malungu omzimba **athe aqaqamba** kule nyanga iphelileyo? Khetha **ezo ndawo uzive zinezi mpawu** zokuqaqamba ngokubeka u-**X**.



3. Sixelele ukuba **unokuxhalaba okanye ukungonwabi okuncinane, ukuqinelwa zizihlunu, ukuqaqanjelwa,** okanye **ukunyukuzelelwa** kukuphethe
kakubi kangakanani kule nyanga iphelileyo.

Ukuba **ukuxhalaba okanye ukuxhalaba**, **ukuqinelwa zizihlunu, ukuqaqanjelwa**, okanye **ukunyukuzelelwa bekukuncinci**, beka u- **X**: 

Ukuba **unokuxhalaba okukhulu, ukuqinelwa zizihlunu, ukuqaqanjelwa,** okanye **ukunyukuzelelwa,** beka u-**X:** 

Lo ngumzekelo wendlela ekufuneka uphendule ngayo…

Intamo	 X	

Ilungu lomzimba	**Ukuqaqamba kancinci, ukuqina, ukuqaqqmba okanye ukunyukuzelelwa**	**Ukuqaqamba kakhulu, ukuqina, ukuqaqanjelwa, okanye ukunyukuzelelwa**
Intloko		
Intamo		
Umntla womqolo		
Umbindi womqolo		
Umzantsi womqolo		
Igxalaba lasekunene		
Igxalaba lasekhohlo		
Ingqiniba yasekunene		
Ingqiniba yasekhohlo		
Isihlala nengalo yasekunene		
Isihlahla nengalo yasekhohlo		

4. **Uve** nini ukuqaqamba **kwentloko**, **ukuphatheka kakubi, ukuqinelwa zizihlunu, ukuqaqamba** okanye **ukunyukuzelelwa zizihlunu namalungu omzimba?** Khetha kangangoko ufuna.
   ☐ Uhleli edesikeni esikolweni ☐ Xa ndidlala okanye emva kokudlala ☐ Xa bendisebenza ngekhompuyutha esikolweni
   ☐ Xa bendibhala edesikeni ☐ Xa bendisebenza ngekhompuyutha kwenye indawo
   ☐ Kwenye indawo xela:_____

5. Wakha waziva ungafuni ukusebenzisa ikhompyutha ngenxa **yokuqaqanjelwa yintloko**, **ukungaphatheki kakubi, ukuqinelwa zizihlunu, ukuqaqamba** okanye **ukunyukuzelelwa zizihlunu namalungu** omzimba
   ☐ Ewe ☐ Hayi **Ukuba uthi "hayi" tyhila kumbuzo 8**.

6. Ingaba **uyiyekile le misebenzi** ilandelayo ngenxa **yokuqaqanjelwa yintloko, ukuqinelwa zizihlunu, ukuqaqamba okanye ukunyukuzelelwa zizihlunu namalungu omzimba kwezi nyanga zintathu zidlulileyo?** Khetha kangangoko ufuna ngokubeka u- x kwibhokisana nganye ofuna ukuyikhetha apha ngasezantsi.
   ☐ ukudlala imidlalo ☐ ukusebenza ngekhompyutha ☐ ukubhala encwadini ☐ ukusebenzisa izixhobo zomculo.
   ☐ Xela nezinye_____

7. Ingaba ukhe wabonana **nogqirha** okanye **nomnye umntu wezonyango kule nyanga iphelileyo** malunga **nokukhalazela** ukuqaqanjelwa zizihlunu okanye ezi zinto uzichaze ngasentla?
   ☐ Ewe ☐ Hayi

UZIVA NJANI

*Sixelele ukuba **uzive njani , uve njani** ngabanye **abantu neemeko kule nyanga iphelileyo?** Beka u-**X** kwimpendulo yakho.*

1. Ingaba **uyakhathala ngabanye abantu** uze uzame **ukubanceda**?
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Andikhathali

2. Ingaba uba **nentloko ebuhlungu nesisu esibuhlungu?**
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

3. Ingaba uba **nomsindo** uze ucaphuke **msinya?**
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

4. Ingaba ukhe uzive **ukhedamile** okanye **ulile?**
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

5. Ingaba **ulwa qho**?
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

6. Ingaba uziva **uphakuphaku** xa ubona abantu **abatsha nongabaqhelanga** naxa utyelele **iindawo ezintsha**?
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

7. Ingaba **woyika msinya**?
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

8. Ingaba uzifumanela **izihlobo ezitsha** ngokulula?
   ☐ Rhoqo ☐ Ngelinye ixesha ☐ Azange

EZEMIDLALO NOMCULO…

*Beka u-**X** kwimpendulo yakho.*

1. Ingaba uthatha inxaxheba **kwezemodlalo?**
   ☐ Ewe ☐ Hayi Ukuba impendulo ngu**"Hayi", yiya kumbuzo 5.**

2. Ukuba ngu**"Ewe"**, **zeziphi ezemidlalo** othatha inxaxheba kuzo? Khetha kangangoko ufuna.
   ☐ Umbhoxo/irabhi ☐ Ibhola ekhatywayo/isoka ☐ Intenetya/itenesi ☐ Intenetya edlalwa ezitafileni
   ☐ Ibhola yomnyazi ☐ Imidlalo yeembaleki ☐ Ihokhi
   ☐ Eminye, yixele_____

3. Ingaba **uthatha inxaxheba kangaphi ngeveki** kule midlalo iyonke?
   ☐ Andiyidlali ☐ Kanye ngeveki ☐ Kabini ngeveki ☐ Kathathu nangaphezulu ngeveki

4. Ubuncinane, uchitha **iiyure ezingaphi ngeveki** kuyo yonke imidlalo oyidlalayo?
   ☐ Ngaphantsi kweYure ☐ KangangeeYure ezimbini ☐ KangangeeYure ezine
   ☐ IiYure ezintandathu nangaphezulu

5. Ingaba udlala umculo **usebenzisa izixhobo zawo?**
   ☐ Ewe ☐ Hayi Ukuba impendulo ngu**"Hayi", tyhila kwiphepha 10.**

6. Ukuba ngu**"Ewe"**, **Sesiphi esi sixhobo** somculo usidlalayo? Sixele/zixele.
   _____

7. Ubuncinane, uchitha **iiyure ezingaphi ngeveki** xa udlala umculo usebenzisa ezi zixhobo uzixele ngasentla?
   ☐ Ngaphantsi kweYure ☐ KangangeeYure ezimbini ☐ KangangeeYure ezine
   ☐ IiYure ezintandathu nangaphezulu

SIXELELE NGAWE…

1. Ngubani igama **lesikolo** sakho?_____
2. Ngubani **igama lakho**?_____
3. **Wazalwa nini** (umhla, inyanga nonyaka)?_____
4. Ufunda kweliphi **ibanga**?_____
5. Ingaba:
   ☐ Intombazana ☐ **Uyinkwenkwe**
6. Ingaba:
   ☐ Ubhala **ngesandla sasekhohlo** ☐ Ubhala **ngesandla sasekunene**
7. Unxiba
   ☐ izipeksi ☐ ilensi ☐ andizinxibi
8. Ingaba **ukugula** yenye yezi meko, umzekelo, ukuxhuzula, iswekile, isifuba?
   ☐ Ewe ☐ Hayi **Ukuba ngu"Hayi" yiya kumbuzo -10**
9. Ukuba ngu**"Ewe"**, ingaba usebenzisa **unyango**?
   ☐ Ewe ☐ Hayi
10. Ingaba wakhe wafumana **ingozi okanye ukwenzakala kwezemidlalo** apho wenzakala **emqolo okanye entanyeni**?
    ☐ Ewe ☐ Hayi

11. Ingaba wawukhe wafumana **unyango** kwizihlunu okanye kumalungu akho omzimba?

☐ Ewe ☐ Hayi

11.1. Ukuba ngu**"Ewe"**, xela uhlobo lonyango nokuba lwalwenziwe nini.

Unyaka: _____ Uqhaqho/utyando: _____
Unyaka: _____ Uqhaqho/utyando : _____
Unyaka: _____ Uqhaqho/utyando : _____



ENKOSI NGOKUPHENDULA LE MIBUZWANA!!!

Addendum 7: School Principal Letter (Phase 1)

5 December 2005

Dear Sir or Madam

Re: Participation in Master's Degree Research Study March- April 2006

My name is Leoné Smith. I am a qualified Physiotherapist, currently busy with my Master's Degree at Stellenbosch University. My research study aims to determine whether there exist a correlation between the musculoskeletal complaints and computer usage of high school learners in the Cape Metropole.

I have obtained permission from the Western Cape Education Department to conduct this study in schools of the Cape Metropole (see attached letter). Your school has been selected through a random sampling procedure of eligible schools to take part in this study. Your school qualifies as it is equipped with computer laboratories and is situated in one of the Education Management and Development Centres (EMDC's) of the WCED. I am thus addressing this writing to you to explain the procedure of the study and ask for you participation and co-operation in the study's execution process.

This research study is two-fold. At your school both parts of the study will be executed. Firstly it entails 2 groups of 100 learners from grades 9-11 to complete a questionnaire. The one group will comprise of learners who partake in computer- based subjects at school and the other group will consist of learners who do not partake in any computer- based subjects at school. The two groups of learners will be able to complete the questionnaire at the same time in different venues, as the researcher and an assistant will be available. The explanation and completion of the questionnaire will take approximately 20 minutes. The questionnaire aims to obtain information on the school learners' computer usage, musculoskeletal dysfunction and activity level.

The second part of the study will entail the researcher and an assistant evaluating the empty computer laboratories according to ergonomic guidelines. This evaluation will last a maximum of 30 minutes per computer lab and will be conducted during recess or after school hours. No learners will be required to take part in this process.

I wish to collect the data for this study from the 20th March- 28th April 2006. The day and time used is negotiable, according to your school- and test roster. I will contact you early in the new school year to organise a meeting at your school at which time we would be able to discuss all the logistical issues pertaining to the study.

The information gained from this study, will be used to advise the WCED on ergonomic issues related to children and computer use. Educational programmes can also be developed to train teachers and learners on safe computing techniques.

If you have any questions about this study or its impact on your schooling process, please contact me by any of the following means:

-Tel. Nr: 021-938 9538
-E-mail: leonie@sun.ac.za
-Postal address: Physiotherapy Department,
University of Stellenbosch
P O Box 19063
Tygerberg
7505

I will be happy to answer any of your queries.

Yours truly,
Leoné Smith
B. Sc. Physiotherapy.

School Principal Letter (Phase 2)

5 December 2005

Dear Sir or Madam

Re: Participation in Master's Degree Research Study March- April 2006

My name is Leoné Smith. I am a qualified Physiotherapist, currently busy with my Master's Degree at Stellenbosch University. My research study aims to determine whether there exist a correlation between the musculoskeletal complaints and computer usage of high school learners in the Cape Metropole.

I have obtained permission from the Western Cape Education Department to conduct this study in schools of the Cape Metropole (see attached letter). Your school has been selected through a random sampling procedure of eligible schools to take part in this study. Your school qualifies as it is equipped with computer laboratories and is situated in one of the Education Management and Development Centres (EMDC's) of the WCED. I am thus addressing this writing to you to explain the procedure of the study and ask for you participation and co-operation in the study's execution process.

This research study is two-fold. At your school only the second part of the study will be executed. This entails the researcher and an assistant evaluating the empty computer laboratories according to ergonomic guidelines. This evaluation will last a maximum of 30 minutes per computer lab and will be conducted during recess or after school hours. No learners will be required to take part in this process.

I wish to collect the data for this study from the 20th March- 19 May 2006. The day and time used is negotiable, according to your school- and test roster. I will contact you early in the new school year to organise a meeting at your school at which time we would be able to discuss all the logistical issues pertaining to the study.

The information gained from this study, will be used to advise the WCED on ergonomic issues related to children and computer use. Educational programmes can also be developed to train teachers and learners on safe computing techniques.

If you have any questions about this study or its impact on your schooling process, please contact me by any of the following means:

-Tel. Nr: 021-938 9538
-E-mail: leonie@sun.ac.za
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P O Box 19063
Tygerberg
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I will be happy to answer any of your queries.

Yours truly,
Leoné Smith
B. Sc. Physiotherapy.

Addendum 8: Letters of Informed Consent (English, Afrikaans & Xhosa)

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR USE BY PARENTS/LEGAL GUARDIANS

TITLE OF THE RESEARCH PROJECT:

Investigating the correlation between the musculoskeletal dysfunction and computer usage of high school learners.

REFERENCE NUMBER: Project number: N05/09/164

PRINCIPAL INVESTIGATOR: Leoné Smith (B.Sc Physiotherapy)

ADDRESS: Physiotherapy Department
Stellenbosch University
P O Box 19063
Tygerberg
7503

CONTACT NUMBER: 021-938 9300

Your child *(or ward)* is being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please feel free to ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research project is about and how your child could be involved. Also, your child's participation is **entirely voluntary** and you are free to decline the participation of your child. If you say no, this will not affect you or your child negatively in any way whatsoever. You are also free to withdraw him/her from the study at any point, even if you do initially agree to let him/her take part.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

Your child has been selected to participate in this research study. This research project forms part of a Masters degree study being done by the researcher at the Physiotherapy Department of the University of Stellenbosch.
The main aim of the research is to determine if high school pupils have pain in their joints, muscles or bones and if their use of computers are related to this pain.

Your child will be asked to complete a questionnaire to obtain information on their computer use, any symptoms of pain/ discomfort they may experience and their general activity level.

The completion of the questionnaire will be done in the safety of your child's classroom during recess and your child's schooling will not be affected by this study. The day and time will be discussed with the school principal and you will be notified in advance.
The researcher will give a full explanation as well as instructions to the learners on how to complete the questionnaire. The completion of the questionnaire should last a maximum of 30 minutes.

Why has your child been invited to participate?

Your child's school is participating in this study and this has been approved by the Western Cape Education Department.

What will your responsibilities be?

You, as parent have no responsibility to this study

Will your child benefit from taking part in this research?

Your child will not benefit directly from this study. Information gained from this study will be used to advise the Education Department on issues which can affect your child during computer use. This, in turn can be used to develop educational and training programs for teachers and pupils on how to protect their joints and muscles when using a computer.

Are there any risks involved in your child taking part in this research?

There are no risks involved for your child participating in this study.

If you do not agree to allow your child to take part, what alternatives does your child have?

It is your choice to withhold your child from participating in this study. He/ she will neither gain nor lose anything.

Who will have access to your child's medical records?

The researcher will not have access to your child's medical records

What will happen In the unlikely event of your child getting injured in any way, as a direct result of taking part in this research study?

This study will be conducted in the safety of your child's school during class time. There are no risks involved to his/ her safety during completion of the questionnaire.

Will you or your child be paid to take part in this study and are there any costs involved?

You or your child will not be paid to take part in the study. There will be no costs involved for you, if your child do take part.

Is there any thing else that you should know or do?

- You can contact Leoné Smith at tel. Nr.: 938 9300, if you have any further queries or encounter any problems.
- You can contact the Committee for Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your child's study staff.
- You will receive a copy of this information and consent form for your own records.

Assent of minor

I (*Name of Child/Minor*)..... have been invited to take part in the above research project.

- The study staff and my parents have explained the details of the study to me and I understand what they have said to me.
- I also know that I am free to withdraw from the study at any time if I am unhappy.
- By writing my name below, I voluntary agree to take part in this research project. I confirm that I have not been forced either by my parents or doctor to take part.

....

Name of child **Independent witness**

(To be written by the child if possible)

Declaration by parent/legal guardian

By signing below, *(name of parent/legal guardian)* ..

agree to allow my child (name of child) ..... who is

years old, to take part in a research study entitled: **Investigating the correlation between the musculoskeletal dysfunction and computer usage of high school learners.**

I declare that:

- I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.
- If my child is older then 7 years, he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.

- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to let my child take part.
- I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.
- My child may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my child's best interests, or if my child do not follow the study plan as agreed to.

Signed at (*place*) ..... on (*date*) 200

.....
Signature of parent/legal guardian

.....
Signature of witness

Declaration by investigator

(name) .... declare that:

- I explained the information in this document to .....
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understand all aspects of the research, as discussed above
- I did not use a translator.

Signed at (*place*) .... on (*date*) 200

.....
Signature of investigator

.....
Signature of witness

DEELNEMERINLIGTINGSBLAD EN -TOESTEMMINGSVORM VIR GEBRUIK DEUR OUERS/WETTIGE VOOGDE

TITEL VAN DIE NAVORSINGSPROJEK:

"n Ondersoek na die verband tussen die muskulo-skeletale disfunksie en rekenaar gebruik van hoërskool leerders.

VERWYSINGSNOMMER: Projek Nommer: N05/09/164

HOOFNAVORSER: Me Leoné Smith (B.Sc Fisioterapie)

ADRES: Fisioterapie Departement
Stellenbosch Universiteit
Posbus 19063
Tygerberg
7503

KONTAKNOMMER: 021-938 9300

U kind *(of pleegkind*) word genooi om deel te neem aan 'n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die projek daarin verduidelik word. Indien daar enige deel van die projek is wat u nie ten volle verstaan nie, is u welkom om die navorsingspersoneel daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsing behels en hoe u kind daarby betrokke kan wees. U kind se deelname is ook **volkome vrywillig** en dit staan u vry om deelname van u kind te weier. U kind sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om hom/haar te laat deelneem nie. U mag u kind ook te eniger tyd aan die studie onttrek, selfs al het u ingestem om hom/haar te laat deelneem.

Hierdie studie is deur die **Komitee vir Mensnavorsing van die Universiteit Stellenbosch** goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

U kind/ pleegkind is gekies om deel te neem aan die navorsingstudie. Dit vorm deel van die Meestersgraad studie van die naovorser aan die Fisioterapie departement van Stellenbosch Universiteit.
Die hoofdoel van die navorsing is om vas te stel of hoërskool leerders pyn het in hul spiere, gewrigte en bene en of hul gebruik van rekenaars daarmee verband hou.

U kind/ pleegkind is gekies omdat sy/ haar skool deelneem aan die studie

U kind/ pleegkind sal gevra word om 'n vraelys te voltooi. Die vraelys is spesfiek opgestel om inligting te verkry omtrent leerders se rekenaar gebruik, of hul enige pyn of ongemak ervaar, asook hul algemene aktiwiteitsvlak. Die vraelys sal in die veiligheid van u kind/ pleegkind se skool klaskamer geskied tydens pouse, sonder om u kind se leerproses nadelig te beïnvloed. Die dag en tyd waarop die vraelys voltooi sal word, sal met u kind se skoolhoof bespreek word en u sal vooraf in kennis gestel word hiervan.

Die navorser sal vooraf 'n volle verduideliking aan die leerders gee omtrent die voltooing van die vraelys en sal beskikbaar wees indien enige vrae onduidelik is. Die voltooing van die vraelys behoort 'n maksimum van 30 minute te duur.

Waarom is u kind genooi om deel te neem?

U kind/ pleegkind is gekies omdat sy/ haar skool deelneem aan die studie en dit is deur die Weskaap Onderwys Departement goedgekeur.

Wat sal u verantwoordelikhede wees?

U, as ouer, het geen verpligtinge tot hierdie studie nie.

Sal u kind voordeel trek deur deel te neem aan hierdie navorsing?

U kind/ pleegkind sal nie direk uit die studie voordeel trek nie. Die inligting wat bekom word vanuit die studie sal gebruik word om advies te gee aan die Onderwys Departement omtrent faktore wat kinders se gebruik van rekenaars kan beïnvloed. Dit sal dan hopelik lei tot die ontwikkeling van onderrig- en opleidingsprogramme vir onderwysers en leerders oor hoe om hul gewrigte en spiere te beskerm tydens rekenaar gebruik.

Is daar enige risiko's verbonde aan u kind se deelname aan hierdie navorsing?

Daar bestaan geen gevare vir u kind/ pleegkind met haar/ sy deelname aan die studie nie.

Watter alternatiewe is daar vir u kind indien u nie instem om hom/haar te laat deelneem nie?

Dit is heeltemal u keuse om u kind/ pleegkind te weerhou om deel te neem aan die studie. Hy/ sy sal niks wen / verloor daardeur nie.

Wie sal toegang hê tot u kind se mediese rekords?

Die navorser sal nie toegang hê tot u kind/ pleegkind se mediese leêrs nie.

Wat sal gebeur in die onwaarskynlike geval van 'n besering wat mag voorkom as gevolg van my kind se deelname aan hierdie navorsingsprojek?

Die studie sal uitgevoer word in die veiligheid van u kind/ pleegkind se skool omgewing. Daar bestaan geen gevaar vir hom/ haar veiligheid tydens die voltooiing van die vraelys nie.

Sal u of u kind betaal word vir deelname aan die projek en is daar enige koste verbonde aan deelname?

Daar is geen koste verbonde aan u, met u kind/ pleegkind se deelname aan die studie nie. Nóg uself , nóg u kind/ pleegkind sal betaal word om aan die studie deel te neem.

Is daar enigiets anders wat u moet weet of doen?

- U kan Me Leoné Smith kontak by tel. 021- 938 9300, indien u enige verdere vrae het of enige probleme ondervind.
- U kan die Komitee vir Mensnavorsing kontak by 021-938 9207 indien u enige bekommernis of klagte het wat nie bevredigend deur die navorsingspersoneel hanteer is nie.
- U sal 'n afskrif van hierdie inligtings- en toestemmingsvorm ontvang vir u eie rekords.

Instemming van minderjarige

Ek (naam van kind/minderjarige) .....
is genooi om deel te neem aan bogenoemde navorsingsprojek.

- Die navorsingspersoneel en my ouers het die besonderhede van bogenoemde navorsingsprojek aan my verduidelik en ek verstaan wat hulle aan my gesê het.
- Ek weet ook dat ek te eniger tyd aan die navorsingsprojek kan onttrek indien ek ongelukkig is.
- Deur my naam hieronder in te vul, onderneem ek om **vrywillig** aan die navorsingsprojek deel te neem. Ek bevestig ook dat ek nie deur my ouers of navorser gedwing is om deel te neem nie.

.....

Naam van kind **Onafhanklike getuie**
(Deur kind geskryf te word indien moontlik)

Verklaring deur ouer/wettig voog

Met die ondertekening van hierdie dokument onderneem ek, (*naam van ouer/wettige voog*) .., om my kind *(naam van kind)* ., wat jaar oud is, te laat deelneem aan 'n navorsingsprojek getiteld: **'n Ondersoek na die verband tussen die muskulo-skeletale disfunksie en rekenaar gebruik van hoërskool leerders.**

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik mee is.

  My kind moet instem om aan die navorsingsprojek deel te neem as hy/sy ouer as 7 jaar is, en dat sy/ haar INSTEMMING op hierdie vorm aangeteken sal word.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.
- Ek verstaan dat deelname aan hierdie projek **vrywillig** is en dat daar geen druk op my geplaas is om my kind te laat deelneem nie.
- My kind te eniger tyd aan die projek mag onttrek en dat hy/sy nie op enige wyse daardeur benadeel sal word nie.
- My kind gevra mag word om aan die projek te onttrek voordat dit afgehandel is indien die navorser van oordeel is dat dit in sy/haar beste belang is, of indien my kind nie die ooreengekome studieplan volg nie.

Geteken te (*plek*) .. op (*datum*) …… 2006

....

Handtekening van ouer/wettige voog **Handtekening van getuie**

Verklaring deur navorser

Ek (naam) ..... verklaar dat:

- Ek die inligting in hierdie dokument verduidelik het aan

- Ek hom/ haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek tevrede is dat hy/ sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.
- Ek het nie van 'n tolk gebruik gemaak nie.

Geteken te (*plek*) ..... op (*datum*) ..... 2006.

....

Handtekening van navorser **Handtekening van getuie**

INCWADANA ENIKA ULWAZI KUMTHATHI-NXAXHEBA KUNYE NEFOMU YEMVUMELWANO EKUMELE ISETYENZISWE NGUMZALI/NGUMGCINI-MNTWANA OSEMTHETHWENI

ISIHLOKO SEPROJEKTHI YOPHANDO:
Uphando ngonxulumano phakathi kokungasebenzi kakuhle kwe"musculoskeletal" nokusetyenziswa kwekhompuyutha ngabafundi besikolo esiphakamileyo.

INOMBOLO YONXULUMANO: ***Project Nr: N05/09/164***

UMPHANDI OYINTLOKO: ***Leoné Smith (B.Sc Physiotherapy)***

IDILESI: ***Physiotherapy Department***
Stellenbosch University
P O Box 19063
Tygerberg
7503

INOMBOLO YOQHAGAMSHELWANO: ***021-938 9300***

Umntwana wakho (okanye iwadi) uyamenywa ukuba athathe inxaxheba kule projekthi yophando. Nceda uzinike ithuba lokufunda olu lwazi lulapha, oluza kucacisa ngayo yonke into ngale projekthi. Uvumelekile ukuba ubuze kubantu abasebenza ngale projekthi xa kukho into ongayiqondiyo okanye ofuna ukucaciselwa ngayo. Kubalulekile ukuba waneliseke ukuba ucaciselwe ngokupheleleyo ukuba uphando olu lungantoni na nokuba umntwana wakho uza kuchaphazeleka njani kulo. Umntwana wakho uthabatha inxaxheba ***ngokuzithandela****, yaye unelungelo lokungavumi ukuba athathe inxaxheba xa uthanda. Ukuba akufuni, oku akuyi kukuchaphazela okanye kuchaphazele umntwana wakho ngendlela engalunganga. Uvumelekile ukuba ungamyekisa nanini na kule projekthi xa ufuna nokuba ubuvumile ekuqaleni ukuba athathe inxaxheba.*

Olu phando luvunyiwe ***yiKomiti*** *ye****Human Research kwiYunivesithi yaseStellenbosch*** *yaye luza kuqhutywa ngokwemiqathango nezikhokelo ezimiselweyo yi"International Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research".*

Lumalunga nantoni olu phando?

Umntwana wakho ukhethiwe ukuba athathe inxaxheba kolu phando. Olu phando luyinxalenye yezifundo ze"Masters" apho umfundi wazo kufuneka enze uphando oluququzelelwa liSebe le"Physiotherapy" kule Yunivesithi yase Stellenbosch.

Injongo yolu phando kukufumanisa ukuba ingaba abafundi bamabanga aphezelu baqaqanjelwa ngamalungu omzimba, izihlunu okanye amathambo nokuba ingaba ukusebenzisa kwabo ikhompuyutha kunxulumene na nezi ngqaqambo.

Umntwana wakho uza kucelwa ukuba aphendule imibuzwana efuna lwazi ngendlela asebenzisa ngayo ikhompuyutha, iingqambo/ubunzima abufumanayo neqondo asebenza ngalo.
Ukuphendulwa kwale mibuzwana kuya kwenziwa ngokukhuselekileyo kwigumbi afundela kulo umntwana ngethuba lekhefu ngoko ke akuyi kusetyenziswa ithuba lokufunda kwakhe xa kusenziwa olu phando. Usuku nexesha lophando luya kuxoxwa nenqununu yesikolo, yaye uyakwaziswa phambi kokuba luqhube olu phando ngaloo mhla umiselweyo.
Umphandi uya kunika inkcazelo nengcaciso epheleleyo ngemiyalelo ekufuneka ilandelwe ngabafundi xa bephendula le mibuzwana.
Unikwa imizuzu engama-30 ukuba uphendule le mibuzwana.

Kutheni umntwana wakho emenywa ukuba athathe inxaxheba?

Isikolo afunda kuso umntwana wakho sithatha inxaxheba kolu phando luvunyiweyo liSebe leMfundo laseNtshona Koloni.

Luyakuba yintoni uxanduva lwakho?

Wena mzali awunaxanduva unalo kolu phando

Ingaba uza kuzuza umntwana wakho ngokuthatha inxaxheba kolu phando?

Akukho nzuzo ithe ngqo iza kufunyanwa ngumntwana wakho kolu phando. Ulwazi olufunyenwe kolu phando luza kusetyenziswa ukucebisa iSebe leMfundo ngezinto ezinokuchaphazela umntwana wakho xa asebenzisa ikhompuyutha. Olu lwazi lunokusetyenziswa xa kusenziwa iinkqubo zokuqeqesha nokufundisa ootitshala nabafundi ukuba bangawakhusela njani amalungu nezihlunu zomzimba xa besebenzisa ikhompuyutha.

Ingaba zikho iingozi ezichaphazela umntwana wakho xa ethatha inxaxheba kolu phando?

Akukho bungozi bunokufunyanwa ngumthathi-nxaxheba kolu phando

Ukuba awumvumeli umntwana wakho athathe inxaxheba, loluphi olunye unyango analo umntwana wakho?

Unelungelo lokunqanda umntwana wakho angathathi nxaxheba kolu phando. Akukho nzuzo ngokuthatha okanye ukungathathi nxaxheba kolu phando.

Ngubani oza kufumana ingxelo yomntwana wakho yamayeza?

Umphandi akanalungelo lakufumana ingxelo ngrekhodi yonyango lomntwana wakho

Kuza kwenzeka ntoni kwimeko yesiganeko esingalindekanga sokwenzakala komntwana wakho nangayiphi na indlela; ngenxa yokuthatha kwakhe inxaxheba kolu phando?

Olu phando luza kwenziwa ngokukhuselekileyo esikolweni somntwana, eklasini yakhe. Akukho bungozi malunga nokhuseleko lwakhe xa ephendula le mibuzwana.

Ingaba wena okanye umntwana wakho uza kuhlawulwa ngokuthatha inxaxheba kolu phando kwaye ingaba kukho iindleko ezibandakanyekayo?

Umntwana wakho okanye wena akukho ntlawulo niza kuyifumana ngokuthatha inxaxheba kolu phando. Akukho ndleko uza kungena kuzo xa umntwana wakho ethatha inxaxheba kolu phando.

Ingaba ikho enye into ekumele uyazi okanye uyenze?

- Unganxibelelana noLeoné Smith kule nombolo yomnxeba 021 938 9300 ukuba unengxaki okanye ufuna ingcaciso.
- Unganxibelelana neKomiti yakwa "Human Research" kule nombolo 021 938 9207 ukuba unesikhalazo okanye into ocinga ukuba awuyicaciselwanga ngokupheleleyo ngabantu abaqhuba uphando.
- Uza kufumana ikopi yale fomu enolu lwazi nesivumelwano ukuze uyigcine njengerekhodi lakho ngolu phando.

Imvume yomntwana

Mna (Igama lomntwana)..... Ndimenyiwe ukuba ndithathe inxaxheba kolu phando lungasentla

- Abancedisi kuphando nabazali bam bandichazele ngokwaneleyo ngolu phando yaye ndiyayiqonda yonke into abayithethileyo.

  Ndiyayazi ukuba ndingayeka nanini na ndifuna ukungaqhubekeki nolu phando.
- Ngokubhala igama lam apha ngasezantsi, ndiyavuma ukuthatha inxaxheba kolu phando. Ndiyangqina ukuba andinyanzeliswanga mntu ukuba ndithathe inxaxheba kolu phando.

.....

Igama lomntwana **Ingqina elizimeleyo**
(Kumele libhalwe ngumntwana)

Isifungo somzali/somngcini-mntwana osemthethweni

Ngokutyikitya apha ngasezantsi Mna *(Igama lomzali/umgcini-mntwana ngokusemthethweni)* ndiyamvumela umntwana wam ongu(igama lomntwana) obudala buyiminyaka e ukuba athathe inxaxheba kolu phando lusihloko salo sithi: **Ukuphando ngonxulumano phakathi kokungasebenzi kakuhle kwezihlunu namalungu omziba nokusetyenziswa kwekhompuyutha ngabafundi kwizikolo eziphakamileyo**

Ndiyafunga ukuba

- Ndilufundile okanye ndilufundelwe lonke ulwazi oluqulethwe kule fomu yesivumelwano yaye ibhalwe ngolwimi endilwaziyo nendingenangxaki yalo.
- Ukuba umntwana wam uneminyaka engaphezulu kwesi-7, kufuneka avume ngokwakhe ukuthatha inxaxheba kolu phando, imvumi yakhe kufuneka irekhodishwe kule fomu.

  Ndilifumene ithuba lokubuza imibuzo, ndayifumana nengcaciso eyanelisayo.
- Ndiyazi ukuba **ndizithandele** ukuba umntwana wam athathe inxaxheba kolu phando, akukho mntu undinyanzelisileyo.

  Ndingamyekisa umntwana wam nanini na kolu phando yaye akayi kutshutshiswa ngenxa yesigqibo endisenzileyo.

  Umntwana wam usenokucelwa ukuba ayeke phambi kokuba lugqitywe uphando ukuba umphandi okanye ugqirha ubona kukho imfuneko yoko, okanye umntwana wam akalandeli imfuno zophando aluvumileyo.

Kutyikitywe e-(indawo) ngo-(usuku) 2006

....

Umtyikityo womzali/womgcini-mntwana osemthethweni **Umtyikityo wengqina**

Isifungo somphandi

Mna *(igama)* ndiyafunga ukuba

Ndiyinikile ingcaciso ngolwazi oluqulathwe kule dotyhumenti ku.....

- Ndimkhuthazile ukuba abuze imibuzo aze athathe ixesha ukuphendula le mibuzwana.

- Ndanelisekile ukuba uyazazi zonke iinkcukacha zolu phando njengoko zichaziwe apha ngasentla

  Andisebenzisanga mntu uza kutolika.

Kutyikitywe e-(indawo) ngo-(usuku) 2006

Umtyikityo womphandi **Umtyikityo wengqina**

Isifungo setoliki

Mna *(igama)* ..... ndazisa ukuba:

- Ndicende umphandi (igama) ..... Ekucaciseni ulwazi olu lapha kweli xwebhu ku-(igama lomthathi-nxaxheba) ndisebenzisa ulwimi lwesiAfrikaans/lwesiXhosa

  Simkhuthazile ukuba abuze imibuzo kwaye athathe ixesha elifanelekileyo ukuba ayiphendule.
- Ndimxelele eyona nto iyiyo malunga nokunxulumene nam
- Ndiyaneliseka kukuba umzali/umgcini-mntwana ukuqonda ngokupheleleyo okuqulathwe loluxwebhu lwemvumelwano eyazisiweyo kwaye nemibuzo yakhe yonke iphendulwe ngokwanelisayo.

Kutyikitywe e-(indawo) ngo-(usuku) 2006

Umtyikityo wetoliki **Umtyikityo wengqina**

Addendum 9: Schools in Phase 2 of study

PHASE 2

NORTH EMDC

3. Settlers High
4. Elswood Secondary
5. J.G. Meiring High
6. Valhalla Secondary

EAST EMDC

3. Macassar Secondary
4. Brackenfell High
5. False Bay Secondary
6. De Kuilen High

CENTRAL EMDC

3. Pinelands High
4. Good Hope Seminary
5. Boston House College
6. Cedar House

SOUTH EMDC

3. Crestway Secondary
4. Simon's Town High
5. Strandfontein Secondary
6. Lentegeur High

Addendum 10: Computerized Classroom Environment Inventory (CCEI)

Appendix A. Computerized Classroom Environment Inventory (CCEI) and Computerized Classroom Environment Worksheet (CCEW)

A1. Notes for inventory and worksheets

This inventory is designed for use in conjunction with the attached environment worksheet (CCEW). Depending on classroom variations, one or more worksheets may be required for observations taken in a given classroom (i.e. due to different equipment or lighting arrangements). The maximum score for each item in the complete inventory is one—denoting 100% compliance with a given standard.

Where several worksheets have been used, weighted averages will be used to complete the inventory. In this calculation, the total score for an inventory item would match the percentage of the given variations that conform to that standard. For example, if a room has ten computers, three of which conform to the standard, the item score is 0.3—indicating 30% compliance with the standard.

A2. Computerized Classroom Environment Inventory (CCEI)

Tick if true:

Workspace environment

- Adequate workspace exists for the placement of notebooks and other resources
- Screen depth (front of screen to table edge) located within the range of 500 – 750 mm
- Chair has adjustable height and back support and is set on movable (rolling) casters
- Keyboard height (floor to home row) is adjustable within a minimum range of 700 – 850 mm
- Screen height (screen centre above floor) is adjustable within a range of 900 – 1150 mm

Total score:

Computer environment

- Inclination of the viewing monitor is adjustable (within 88° – 105° from the horizontal)
- Keyboard height (home row to desk level) is adjustable within a range of 100 – 260 mm
- Operating system utilizes a graphical interface with icons rather than teletype inputs
- System uses a colour display monitor with adjustable brightness and contrast controls
- Computer software uses a reverse display (dark text on a light or neutral background)

Total score:

Visual environment

- Glare controlled through the use of screens, indirect lighting or equipment positioning
- Good light quality with natural or indirect lighting sources (full spectrum preferred)
- Excessive contrast of work surfaces are controlled through the use of neutral finishes
- Illumination levels (measured on the horizontal plane) fall in the range of 500 – 750 lux
- Luminance of surrounding surfaces is maintained within 10 – 100% of illumination

Total score:

Spatial environment

- Adequate space exists for easy movement among workstations, resources and exits
- The number of students in the classroom does not normally exceed 30 students
- Resource areas are of sufficient size to display or store necessary learning materials
- Overall finishing of room walls, flooring etc. is in light coloured or neutral tones
- The aisle width between desks or benches falls within the desire range of 152 – 183 cm

Total score:

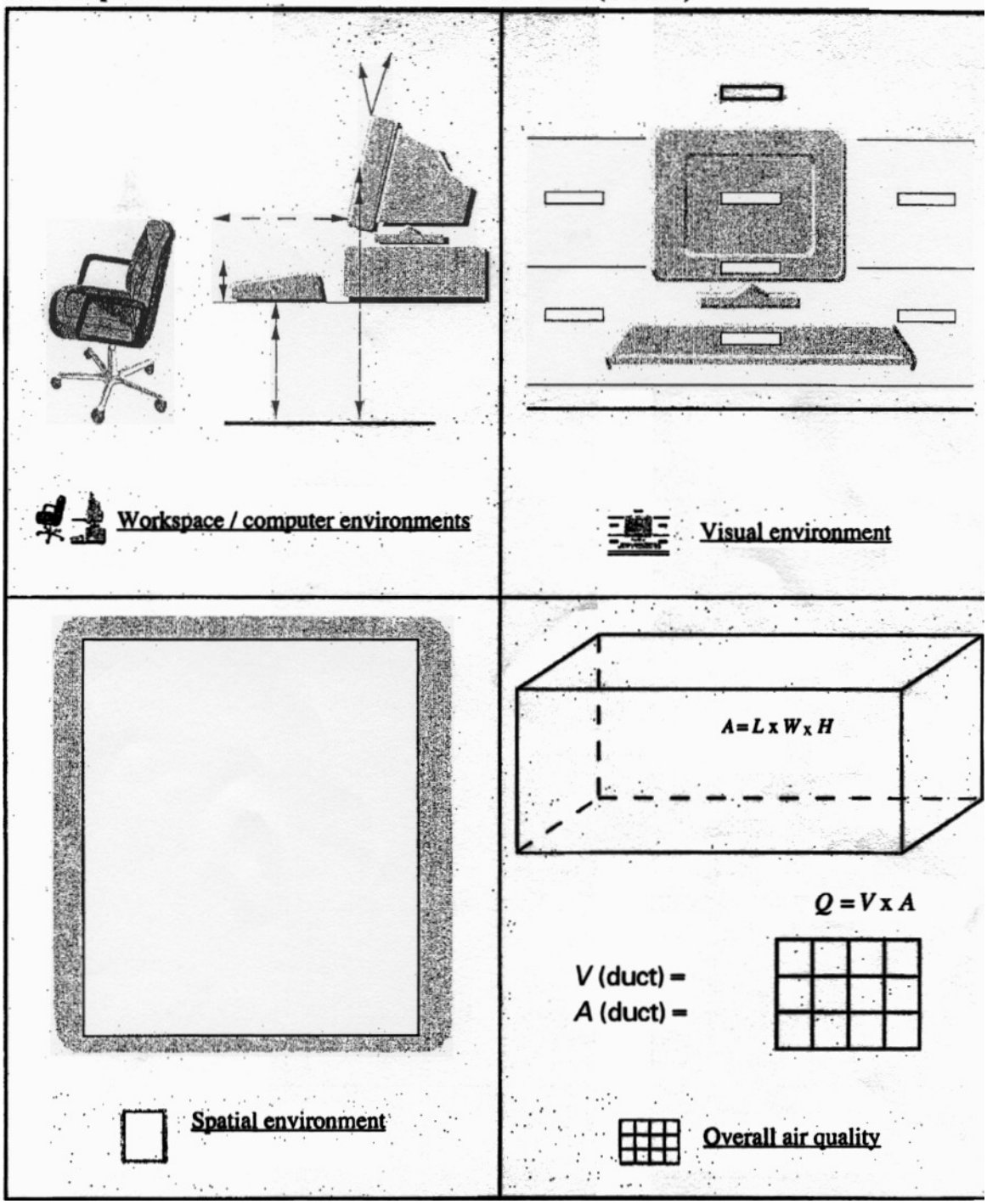
Air quality

- The classroom is climate controlled with localized temperature and humidity controls
- Room objects are maintained at temperatures within 2 – 3° of air temperature
- Draughts at the levels of head and knees have been controlled (do not exceed 2 m/s)

- Air volume in the room meets the minimum volume standard (5 m^3 per person)
- Air flow rates (measured at duct) conform to a minimum of 30 m^3/person/h

Total score:

A3. Computerized Classroom Environment Worksheet (CCEW)



Addendum 11: Consent to use *CCEI*

Subject: FW: Physio SA

Dear Leone,

Thanks for your message -- I did receive the earlier message but you must not have received it -- I'd be happy to have you use the instrument and adapt it as needed -- I'm afraid that I don't have any reliability data for that one though.

warm regards

David

PS - I'd love the hear how your study turns out!

David B. Zandvliet, Ph.D.

Assistant Professor - Science, Technology and Environmental Education Faculty of Education, Simon Fraser University
Email: dbz@sfu.ca Phone: 604-291-5680
8888 University Drive, Burnaby BC Canada V5A 1S6

> > -----Original Message-----
> > From: Smith, LG, Mej <leonie@sun.ac.za>
> > Sent: 04 October 2006 04:20 PM
> > To: 'dbz@sfu.ca'
> > Subject: Physio SA
> > Importance: High
> >
> >
> > Dear David,
> >
> > I hope you are doing well? We communicated late last year in
> connection with the validation study of a measurement tool I wanted to
> use in my Master's study on children, their musculoskeletal complaints
> and computer use. You reviewed the questionnaire and gave feedback on
> the content and face validity of the Computer Usage Questionnaire.
> Thank you for that, again!
> >
> >

As part of that research, I also had to assess the computer
> workstations at schools. I obtained a copy of your study with Leon
> Straker from 2001: "Physical and psychosocial aspects of the learning
> environment in information technology rich classrooms".
> >

> > I found the Computerised Classroom Environment Inventory very
> useful. Would it be possible for me to use the CCEI in my study? I
> need to make slight adjustments to it and add extra data to address
> all the aspects at the workstation.
> >
> > I will of course give full recognition to you and Leon Straker as
> developers of the tool. Did you do any reliability testing of the
> tool?
> >
> > I will attach a copy of the tool I use and you can see the changes I
> have made and how it differs from the CCEI. I have used other sources
> from Australia, Sweden and Canada to supplement information. This tool
> is not for publishing, it's only to be used in my current study.
> >
> > I hope to hear from you soon. Do you have any reservations or
> > questions?

> >
> > Keep well,
> > Best wishes,
> > Leoné Smith
> >
>
> > Leoné Smith
> > Physiotherapy Department

COMPUTER WORKSTATION DESIGN ASSESSMENT

School Name:

Date:

Number of Labs:

Lab Nr:

Assessed by:

Study Nr:

WORKING ENVIRONMENT	Yes	No
1. Classroom is climate controlled by means of an air conditioner.		
2. Draughts at the level of head and knees.		
3. Noise level interferes with concentration.		

SPATIAL ENVIRONMENT	Yes	No
1. Number of learners in computer laboratory during one lesson/ class, not exceeding 30.		
2. Aisle width between desks or workstations is in the range of 152cm- 183 cm.		
3. Adequate space exists for easy movement among workstations, book cases, shelves and doorways/ exits.		
4. Book cases and shelves are of sufficient size to display and/ or store necessary learning materials.		

WORKSPACE ENVIRONMENT

Chair	Yes	No
1. Chair has movable rolling coasters		
2. Surface of seat to floor in range of 380-510mm		
3. Seat pan depth in the range of 330-430mm		
4. Back support's height is adjustable		
5. Back support's angle is adjustable		
6. Arm supports present		
7. Arm support's height is adjustable		

Desk	Yes	No
1. Desk height is adjustable		
2. Desk width from left to right edge is 1500mm minimum		
3. Desk depth from front to back edge is 900mm minimum		
4. Width of legs space under desk when in seated position 800mm minimum		
5. Depth of space for legs when seated 550mm minimum		
6. Height of space between legs and desk when seated 580mm minimum		
7. Footrest provided		
8. Footrest area: 300x 375mm		
9. Footrest angle is adjustable		

Computer Screen	Yes	No
1. Screen depth (front of screen to table edge): 500-750mm		
2. Screen height measured from floor to centre of screen: 900-1150mm		
3. Screen dimension: _____ mm/mm		
4. Inclination of viewing monitor is adjustable : 88°-105° from the horizontal		
5. Usable manuscript holder attached to screen		

Keyboard	Yes	No
1. Keyboard positioned on separate tray		
2. Height from floor to home row of keyboard is in the range of 700-850mm		
3. Height of home row of keyboard to desk level in the range of 100-260mm		
4. Keyboard angle is adjustable		
5. Gel wrist support in use		

Input Device	Yes	No
1. Mouse used as in-put device		
2. Mouse has an adjustable position		
3. Mouse can be used ambidextrously		
4. Mouse pad available and used		

VISUAL ENVIRONMENT	Yes	No
1. Screen image is stable		
2. Monitor has adjustable brightness and contrast controls		
3. Control of glare through the use of screens, indirect lighting sources or equipment positioning		
4.Good quality light with natural or indirect lighting sources		

Addendum 13: CWDA Validity Assessor

CWDA REVIEWER

The Reviewer

Dr Wendy Macdonald

Qualifications: BSc (Psychol) (London), Dip Psych Psychol (Melb), PhD (Melb)

Roles:

- Director of the Centre for Ergonomics and Human Factors and Ergonomics Courses Coordinator at the Centre
- Associate Professor, School of Human Biosciences
- Fellow SIA, Member APS (Aust), Member HFES, Member HFESA

Main Areas of Expertise:

- Workload analysis and evaluation
- Occupational stress and psychosocial hazards
- Ergonomics and ageing
- Evaluation of information displays
- Analysis and evaluation of driver performance

Publications/ Conferences Presentations:

- 118 Publications/ conference presentations
- See: http://www.latrobe.edu.au/ergonomics/people.html.

CENTRE for ERGONOMICS and HUMAN FACTORS

SCHOOL OF HUMAN BIOSCIENCES

FACULTY OF HEALTH SCIENCES

LATROBE UNIVERSITY

MELBOURNE, AUSTRALIA

About the Centre

The Centre for Ergonomics and Human Factors was established in 1987 in response to growing community requests for assistance and information related to ergonomics. The Centre staff and associates are involved in a variety of fields (e.g. academic, engineering, management) and work within a multi-disciplinary team of professionals. These professionals are recruited for their expertise in specific project-related areas.

Both undergraduate and post-graduate courses are provided by the centre.

Main Activity Areas

- Risk factors for musculoskeletal disorders (MSD's)
- Workload and Work-related stress: optimizing performance and employee well-being
- Work analysis and measurement methods
- Evaluation of design: equipment, products and systems
- Driver behavior, performance testing and road safety
- System design for our ageing population

Addendum 14: Committee for Human Research Approval of Study

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot • your knowledge partner

14 October 2005

Ms LG Smith
Dept of Physiotherapy

Dear Ms Smith

RESEARCH PROJECT : **"INVESTIGATING THE CORRELATION BETWEEN MUSCULO-SKELETAL DYSFUNCTION AND COMPUTER USAGE AMONG HIGH SCHOOL LEARNERS"**
PROJECT NUMBER **N05/09/164**

It is a pleasure to inform you that the Committee for Human Research has approved the above-mentioned project on 5 October 2005, including the ethical aspects involved, **for a period of one year from this date**.

According to the requirements of the US Department of Health and Human Services for research in children and adolescents, the risk/benefit category 45 CFR 46.404 (research not involving greater than minimal risk) was designated to this project.

This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project number in all further correspondence.

Please note that a progress report (obtainable on the website of our Division) should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary).

Patients participating in a research project in Tygerberg Academic Hospital will not be treated free of charge as the Provincial Government of the Western Cape does not support research financially.

Due to heavy workload the nursing corps of the Tygerberg Academic Hospital cannot offer comprehensive nursing care in research projects. It may therefore be expected of a research worker to arrange for private nursing care.

Yours faithfully

CJ VAN TONDER
RESEARCH DEVELOPMENT AND SUPPORT (TYGERBERG)
Tel: +27 21 938 9207 / E-mail: cjvt@sun.ac.za

CJVT/ev

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Fakulteit Gesondheidswetenskappe • Faculty of Health Sciences

Verbind tot Optimale Gesondheid • Committed to Optimal Health
Afdeling Navorsingsontwikkeling en -steun • Research Development and Support Division
Posbus/PO Box 19063 • Tygerberg 7505 • Suid-Afrika/South Africa
Tel: +27 21 938 9677 • Faks/Fax: +27 21 931 3352
E-pos/E-mail: rdsdinfo@sun.ac.za

Addendum 15: Peer review panel

PEER REVIEW PANEL

1. Dr Ina Diener
    - Physiotherapist, South Africa

2. Sam Murphy
    - Researcher, United Kingdom

3. Dr Winifred Bowman
    - Ergonomist/ Physiotherapist, South Africa

4. Dr Wendy MacDonald
    - Ergonomist, Australia

5. Dr Karen Jacobs
    - Occupational Therapist, United States of America

6. Ms Charlyn Goliath
    - Occupational Therapist, South Africa

7. Mr Christo Davids
    - E-schools Coordinator, South Africa

8. Linda Hunter
    - Physiotherapist, South Africa

9. Dr David Zandvliet
    - Researcher, Canada

Addendum 16: Checklist for CUQ

Checklist for Computer Usage Questionnaire:		
1. Is the format of the questionnaire easy to follow? If not, please motivate your answer.	**Yes**	**No**
2. Is the presentation of the questionnaire interesting? Please motivate your answer.	**Yes**	**No**
3. Does the structure of the questionnaire follow a logical lay-out? Please motivate your answer.	**Yes**	**No**
4. Are the instructions for completion of the questionnaire clear enough? If not, please explain why?	**Yes**	**No**
5. Is the presentation of the questionnaire appropriate for the target age group (14-18 year olds)? Please motivate your answer.	**Yes**	**No**
6. Are the questions in this questionnaire direct and clear enough? If not, which questions are ambiguous?	**Yes**	**No**
7. Does this questionnaire assess computer-related musculoskeletal pain? Please motivate your answer.	**Yes**	**No**

8. Have all associated factors involved with computer use and musculo-skeletal pain been addressed in this questionnaire? Which other factors would you recommend need to be assessed?	**Yes**	**No**
9. Which information required to assess computer related musculoskeletal pain, is lacking from this questionnaire? Please motivate your answer.	**Yes**	**No**
10. Do any of the questions infringe on the correspondents' privacy? If "Yes", please state which question/s and why?	**Yes**	**No**
11. Do you have any other comments or suggestions to make about the Computer Usage Questionnaire?	**Yes**	**No**
Thank you for your valuable time and in-put.		

Addendum 17: Peer Review Letter

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot • your knowledge partner

31 August 2005

Dear Colleague,

Re: Validation of Questionnaire

I refer to our previous correspondence regarding the validation of the Computer Usage Questionnaire.

Thank you for your willingness to assist in the validation of this questionnaire. This questionnaire was drawn up in consultation with one of my supervisors, Prof Q. Louw and Leon Straker (international researcher in this field). It forms part of my research study (M.Sc Physiotherapy), to be conducted in high schools of Cape Town in the first semester of the 2006 school year. The main aim of the research study is to determine the correlation between high school learners' musculoskeletal complaints and computer use.

You are part of a panel to assess the validity and relevance of this questionnaire to the South African school learner. A checklist is provided to assist you in assessing specific aspects of the questionnaire.

I will appreciate it if you can keep the following points in mind, when evaluating the questionnaire:

1. Are the questions specific and clear enough to obtain the necessary information on the learner's computer use and associated musculoskeletal pain and discomfort?

2. Can you suggest any other questions that need to be added to the questionnaire to provide more information on the learners' symptoms or that might improve the validity of the questionnaire?

Fakulteit Gesondheidswetenskappe • Faculty of Health Sciences

Verbind tot Optimale Gesondheid • Committed to Optimal Health
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Tel +27 21 938 9300 • Faks/Fax: +27 21 931 7810

You can forward your reply to the postal address provided, or return it electronically via return e-mail by 12 September 2005. Your timely feedback will be greatly appreciated.

Postal Address: Physiotherapy Department,
Tygerberg Campus
University of Stellenbosch
P O Box 19063
Tygerberg
7505

E-mail address: leonie@sun.ac.za

Yours sincerely,
Leoné Smith
B.Sc Physiotherapy