Children's Computer Interaction in Schools: A Case Study for Promoting Healthy Computer Use

Marina Louise Ciccarelli

Curtin University

School of Occupational Therapy
and Social Work

Kent St, Bentley

WA, Australia 6102

m.ciccarelli@curtin.edu.au

**Courtenay-jane Campbell
Harris**

Curtin University

School of Occupational Therapy
and Social Work

Kent St, Bentley

WA, Australia 6102

c.harris@curtin.edu.au

Author Keywords

Children; human-computer interaction; school; notebooks; ergonomics; musculoskeletal disorders; health

ACM Classification Keywords

C.5.3 Personal computers, workstations, portable devices; H.1.2 Human factors; H.5.2 Ergonomics; H.5.3 Group and organization interfaces – Evaluation and Methodology; K.3.0 Computers and Education - General; K.4.1 Public policy - Computer related health issues

Abstract

This paper describes the macro-ergonomics approach currently being delivered in collaboration with a West Australian school community to ensure healthy computing for students in middle school (ages 11- 17 Years). **Background:** Introduction of notebook computers in many schools has become integral to learning. While this is rewarding from an educational perspective, increased screen-based exposure has been associated with potential risks to physical and visual health. Unhealthy computing behaviours include frequent and long durations of exposure; awkward

postures due to inappropriate furniture and workstation layout, and ignoring computer-related discomfort.

Methods: This research uses a community-based participatory research approach. Students in Year 7 in 2011 at a co-educational middle school, their parents, and teachers have been recruited. Baseline data was collected on students' knowledge of computer ergonomics, current notebook exposure, and attitudes towards healthy computing behaviours; and teachers' and self-perceived competence to promote healthy notebook use among students, and what education they wanted. The intervention phase is a health promotion program that is being developed by an inter-professional team in collaboration with students, teachers and parents to embed concepts of ergonomics education in relevant school activities and school culture. End of year changes in reported and observed student computing behaviours will be used to determine the effectiveness of the program.

Significance: Building a body of evidence regarding physical health benefits to students from this school-based ergonomics program can guide policy development on the healthy use of computers within children's educational environments. Additionally, an approach that attends to epidemiological risk factors, whole community attitudes, environmental factors and the organizational environment and culture of the community is essential.

Introduction

Ninety-two percent of Australian children of ages from 5-14 years use information and communication technologies (ICT) including computers, with increased exposure associated with older students [1]. A recent Australian government initiative to ensure that young Australians are well equipped for a more technologically advanced future has seen an estimated $1 billion allocated to the provision of computers to approximately 3000 Australian schools [2]. Government and non-government Australian schools are increasingly providing curricula and learning environments in which individual notebook computers (including tablets) are integral to students' daily in-class and at-home learning activities. These school initiated computer programs are commonly referred to as 1:1 Notebook Programs [3].

These 1:1 Notebook Programs have resulted in an increase in students' exposure to screen-based media, together with the potential risk to children's physical and visual health. This risk is occurring in critical stages of these young people's physical development.

Discomfort associated with high computer use among adults is well documented [4], with increasing concerns about the physical and visual health of children using ICT [5]. Previous research has shown ongoing discomfort in childhood as a potential risk factor for the development of chronic musculoskeletal disorders in adulthood, which can disrupt participation in self-care, work and leisure activities. Prior research has found significant associations between discomfort among children and hours spent using ICT [5,6,7], and a study of Western Australian children aged 10-17 years found that 60% of children reported discomfort when using their laptops [8].

Risk factors related to child related computer behaviours include; frequent and long durations of computer use [9], adopting awkward postures because of inappropriate seating and furniture [9] and workstation layout, inadequate forearm support during

keyboard and mouse use [9], and children ignoring discomfort experienced while computing [10].

To date, schools have been proactive with the promotion of psychological and mental wellbeing of students using ICT, especially with respect to cyber-bullying and avoiding 'on-line predators' [11]. Approaches have been holistic and community focused including school policy; providing workshops for students and teachers, and giving information to parents through newsletters. However, at an international and local level, there appears to be less attention given by schools to promoting students' physical and visual health when using ICT, and interventions are often at a micro-ergonomics level [12]. Evaluation of the usefulness of micro-ergonomics approaches have been difficult and suggested interventions and controls have often been restricted [13]. For this reason a community-based participatory research design was selected.

Community-based participatory research involves a collaborative approach to research that involves community members, organizational representatives, and researchers in all aspects of the research process. Each partner contributes unique skills and knowledge to enhance understanding of the health issue, the cultural dynamics of the community, and integrate the knowledge gained with action to improve the health and well-being of community members [14]. It is therefore well-suited to facilitate a cultural shift within schools regarding the relevance of macro-ergonomics in educational environments.

Facilitating change in the health behaviour of any community, including Year 7 middle school students in

a 1:1 notebook program, requires a macro-ergonomics approach that includes attention to epidemiological risk factors; as well as the attitudes of the entire community (teachers, students and their parents) towards the health-enhancing behaviours; and environmental factors, such as the physical learning environment (furniture, seating, lighting) and organisational environment (culture of the school). The likelihood that members of the school community (students, teachers and parents) will promote and/or adopt health-enhancing behaviours is based on a combination of knowledge, attitudes and skills [15] and opportunities for change afforded within the culture of the school.

This works-in-progress poster illustrates this macro-ergonomics approach used to promote healthy computing from a physical and visual health perspective. As this project is developmental the phases of the program are outlined, and where applicable results to date included.

Methods

Study Design: Longitudinal intervention study over six years duration, commencing in 2011.

Participants: 4 x Year 7 (ages 12-13 Years) classes (n=39), Year 7 teacher and parents of Year 7 students.

Objective: To implement a participatory ergonomics education program among Year 7 students, teachers and parents and measure change in ICT health-related knowledge and behaviours over time (Years 7 through 12).

Outcomes and outcome measures:

The following table describes the outcomes and measures used in the study. T1 indicates the measure being undertaken at the beginning of 2011 school year; T2 at the end of each school year throughout the study and T3 at the end of the study.

Outcome	Outcome measure
1.Knowledge of computer ergonomics among student participants	Computer Health Questionnaire (knowledge section) T1 and T2
2.Attitudes towards healthy computing practices among student participants	Computer Health Questionnaire (Attitude section)T1 and T2
3.Computer exposure (frequency and duration among student participants)	Computer Health Questionnaire (behaviour section)T1 and T2
4.Teachers self-perceived competence to promote healthy computing among students	Teacher survey – online T1 and T2
5.Parents' self-perceived competence to promote healthy computing among their children	Parent online survey – T2 and T3
6. Student participant's reported discomfort	Computer Health Questionnaire (behaviour section)T1 and T2
7.Sstudents' visual acuity	Test of visual acuity T1 and T2
8. Student participant's anthropometric measures (Height, weight, hand and arm span, seated height, seated eye height etc.)	T1 and T2
9.Student participant's satisfaction rating of workstations/seating used	Ongoing and T2

Table 1. Outcomes and outcome measures.

Intervention and Results

Phase One: Understanding organisational culture

- Meetings with Principal, teachers and students
- Attending parent information nights
- Information submitted to school website

Phase Two: Identifying knowledge and attitudes to healthy computing behaviour

- Students pre and post surveys
Computer related discomfort (last 7 days)
T1 (August 2011, n=39) – 61.5% of students
T2 (November 2012, n=35) – 31.4% of students
Nearly two thirds of students reporting discomfort for T1 & T2 were female

- Teachers pre and post surveys

Intervention Phases, Actions and Results

Phase Three: Application in the context of community partners

- Focus groups with students, teachers and parents
- Providing opportunity for feedback
- Development of resources for teachers and curriculum areas. Including child sized ergonomic equipment prescription and education.
- Introduction of student initiated health promotion strategies, eg. Posters in the canteen, screen savers, teacher made advertisements in common areas

Phase Four: Evaluation of program & Building capacity and sustainability

- Embedding ergonomics principles in other curriculum subjects and activities
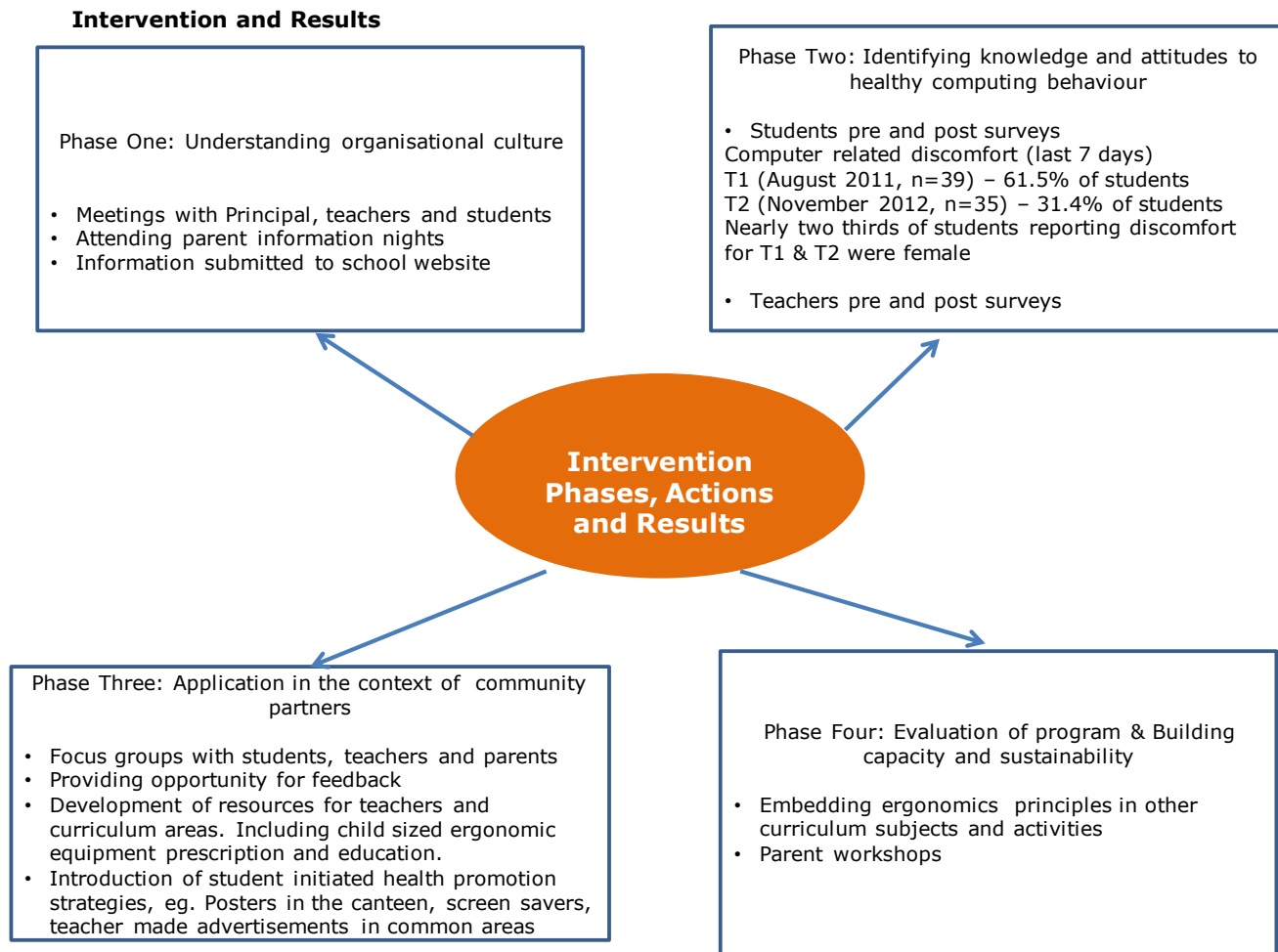- Parent workshops

Figure 1: The four phases of the macro-ergonomics approach representing interventions and available results

Conclusion

This works-in-progress poster has discussed an approach for working with a school community to develop and implement a planned health promotion program among Year 7 students who are involved in a 1:1 notebook computer program at school. The planned program utilizes community-based participatory research combined with a macro-ergonomics approach that considers the physical school environment, knowledge, attitudes and behaviours of school community members to promote healthy notebook use among students. Further findings will be published on completion of the longitudinal study.

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