

Research article

Ergonomics and computer use: Increasing the awareness of rural secondary school students

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Abstract

Background: While the application of ergonomics to computer use can reduce health risks and increase productivity, it has generally not been emphasised in schools. For this reason, a two-hour educational session to promote awareness of the principles of ergonomics relating to computer use was proposed. **Aims:** The objectives of the research were: (1) to design an educational session to promote awareness of the principles of ergonomics relating to computer use; (2) provide guidelines for healthy computing in an effort to improve comfort and efficiency; (3) evaluate the session; and (4) explore how secondary students might be assisted in understanding the principles of ergonomics and in practising the principles in daily computer use. **Method:** The educational session included discussions on disorders associated with computer use, warning signs, applying the principles of ergonomics, software, a practical session (demonstration and return demonstration), a summary, and evaluation. The Harvard One-Minute questionnaire was administered to participants at the conclusion of the session. **Results:** The findings indicated the educational session succeeded in increasing students' knowledge. The best aspects of the session were considered to be the stretching exercises and information relating to posture. **Conclusions:** This study examined the experiences of students from high schools in a regional area who participated in a session designed to promote awareness of the principles of ergonomics that relate to computer use. The students revealed the personal and educational benefits of the session, the learning that transpired, and the value of participating in the session.

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Background

The exponential spread of new technologies for communication is apparent to all, no less so in secondary schools, where today's information and communication technologies (ICT) can enhance the quality of teaching and allow students greater access to information and flexibility in their interaction with others [1, 2, 3]. Society is becoming increasingly computerised and students are pressured to become more computer literate and take up the benefits the technology offers. However, it is generally acknowledged that prolonged periods of computer use can result in visual, musculoskeletal and psychological problems [4, 5, 6]. The application of the principles of ergonomics to computer work can reduce these health risks and increase comfort and efficiency [7, 8, 9]. In a world of computerisation, the awareness and priority given to this important technological consideration will prove advantageous for the schools and the students. School students should learn the principles of ergonomics that relate to computer use early so as to prevent future health problems [10, 11].

The literature indicates the need to provide information on ergonomics to adolescents [12, 13 14]. A Swedish study by Palm et al. [10], found the median use of computers by upper secondary students was 31 hours per week by male and 19 hours per week by female students. Approximately 90% of this computer use was outside of school, for entertainment purposes. Fifty-one percent of the female and 24% of the male students experienced headaches, and 31% of the females and

15% of the male students reported neck or shoulder problems. Where students had intensive use of laptop computers, the prevalence of neck/shoulder symptoms increased to 49%. Sixty-three percent of the students reported that they had not received information in relation to ergonomics and computer use at school. These authors concluded "the fact that adolescents are young does not protect them from possible computer-related health complaints" and "if students are given knowledge of adequate practical techniques and actions that can be done at home or in school, there is probably a potential for prevention." The findings of a study conducted by Anna and Newhouse [15] found the increase in computer facilities in Australian schools was not accompanied by a consideration of ergonomics, as had the findings of Bennett [16] in relation to a study of schools in the United States. Anna and Newhouse emphasised the importance of providing information about correct posture and the risks associated with incorrect posture to students, and also the importance of teaching staff being well informed "in order to encourage students to take care of themselves and make optimum use of the computer facilities at their disposal." Dockrell et al. [17] in their study with secondary schools in the Republic of Ireland, also found little consideration was given to ergonomics and computer use. This study revealed that only 34% of the teachers reported giving information on ergonomic issues to their students. Eighty percent of the teachers believed they needed more knowledge in this area and would welcome more information. The need for such education was also supported by a recent study conducted

within secondary schools in New Zealand, that surveyed the extent to which the schools provided a learning environment in ICT classrooms that was in accordance with principles of ergonomics. This study found a “general lack of awareness of ergonomic guidelines and the resulting potential problems for students” [18].

The application of the principles of ergonomics to the computer use of secondary students has generally not been emphasised in schools. It is for this reason that a two-hour educational session to promote awareness of the principles of ergonomics relating to computer use was proposed. The aims of the research were to: (1) design an educational session that would provide awareness and knowledge of the principles of ergonomics that relate to computer use amongst secondary students enrolled in local schools that do not include a component related to ergonomics in their curricula; (2) provide simple tips for healthy computing to improve the computer user’s comfort and efficiency; (3) evaluate the educational session provided; and (4) explore how secondary students might be assisted in understanding the principles of ergonomics relating to computer use.

Method

Three educational outreach sessions were conducted. Year 10 students undertaking university preparation experience at the University of South Australia’s Centre for Regional Engagement and other Year 10 students enrolled at a local secondary school were recruited for this study. Purposive sampling was used to select participants for the study. This sampling involves deliberate selection of individuals who share common experiences or characteristics (rural secondary school students using computers on a daily basis). Potential participants were recruited through the school principals and/or designated teachers of the secondary schools. The schools included in the research were those that did not provide any component related to ergonomics and computer use in the courses they offered. Discussions were held with the principals and/or teachers in order to organise an appropriate program. This included the content of the educational session and mode of delivery.

The schools were given copies of the participant information letter, which contained the purpose of the study and potential outcomes of the research together with a parental/guardian consent form, for distribution. The letter informed the parents/guardians and students of the expected benefits of the research, the procedure of survey, and the actual involvement requested of them. The letter also included a statement regarding the voluntary nature of participation and assurance of confidentiality of information provided. Ethics approval for the study had been gained from the Human Research Ethics Committee of the University of South Australia (P002/10) and directions to the ethics committee were given should there be any questions and queries regarding the research. Consent forms providing written approval to conduct the study were also completed by the Department of Education and Children’s Services and the school Principal. A sample of fifty five students was deemed adequate for this study.

The structure of the two-hour educational session conducted for all classes, was:

Introduction and objectives (5 minutes); disorders associated with computer use, symptoms and warning signs (10 minutes); problems relating to computer use from students’ perspectives (10 minutes); tips for healthy computer use, applying the principles of ergonomics to the work area and environment, posture, rest breaks (30 minutes); stretching exercises (15 minutes); software that monitors activity and reminds users to stretch and take breaks (10 minutes); a practical session (25 minutes); summary and evaluation (15 minutes). There were opportunities for demonstration and return demonstration, reflection on current computer practice, and open discussion. The same two lecturers (the authors) conducted the sessions which were held in a computer room with groups of approximately 18 students. The schools designated the classes, time and date in relation to the students who would attend the session.

A survey approach, using an evaluation tool known as the Harvard One-Minute questionnaire, was used to assess the educational session. This form of evaluation has high completion rates, can be adapted to most contexts, is simple to prepare and administer, is relatively quick to execute, and is generally well received, making it ideal for young participants who might find long questionnaires tedious [19]. At the conclusion of the session, all participants were asked to complete the questionnaire which contained the following four questions:

- (1) In your view, what was the most important information you gained from the session?
- (2) List the best aspects of the educational session.
- (3) What information could be included or expanded upon for future sessions?
- (4) Any other comments.

The Harvard One-Minute questionnaire has been credited with being an effective learning technique, in that it asks questions which stimulate reflection and critique of content immediately after the event [20]. It was deemed to be particularly appropriate for use with Year 10 students as they were able to provide responses quickly and easily. In order to preserve students’ anonymity and confidentiality, names were not required at any stage of the research. Completion and submission of the evaluation questionnaire was taken as consenting to participate in the evaluation of the session. Students had the option not to participate in the evaluation. Descriptive and frequency analyses were performed; data analysis consisted of sorting the data into files and tables, and counting frequency of responses. The data collected are securely stored in accordance with University policy.

Results

The Harvard One-Minute questionnaire administered after the educational session collected data relating to information gained from attending the session, what were considered the best aspects of the educational session, the learning that transpired during the session, and suggestions for improvement. The responses are summarised in the

following Tables. Students could provide more than one piece of information for any of the four questions, or choose to leave a question unanswered. The data in each of the Tables has been presented in order of the most frequently received responses.

The replies from the students to the question asking their views on the most important information gained from the session revealed that they found information in relation to posture and the use of laptops particularly valuable. It was evident throughout the session that the majority of the students used laptop computers with no thought of ergonomics, and were surprised to learn of the health risks laptops could pose.

Table 1. Student responses to the question “What was the most important information you gained from the session?” (n=55)

Item	n*
How to sit at a computer, posture, position of head, arms, elbows	19
Benefits of stretching, how to stretch	11
How to position computer, viewing distance, to adjust screen	7
Can get back and neck pain, injuries from computer use, symptoms	6
Important to rest, take hourly break, and micro-breaks	5
Laptops should not be used for extended periods	5
Eye exercises, relieve eye strain	2
Adjusting the chair, type of chair	2
How to hold the mouse	1
Total	58

*Number of times item identified

Some of the learning that transpired is evident in the following comments received from the students:

- *Poor posture will affect you in the future.*
- *Learning about posture and how sitting correctly can help work efficiently.*
- *Laptops aren't good for you after long periods of time.*
- *That laptops shouldn't replace normal computers, and that you should take micro-breaks.*
- *Information on Ergonomics- how to use computer/laptops safely.*

Table 2. Student responses to the request to “List the best aspects of the educational session” (n=55)

Item	n*
Stretching to avoid strain	27
Correct posture, elbows and forearms level	15
How to use a computer properly, placement, adjustment	6
Laptops can cause problems	4
More aware of ergonomics related to computer use	4
Keyboard strategies	2
Symptoms to look for, the effects	2
Viewing distance from screen	2
How to hold Mouse	1
Total	63

* Number of times item identified

When asked to list the best aspects of the educational session, the students most often selected the information provided regarding the importance of stretching and posture (Table 2).

The following comments received after the session indicate the student’s understanding of the topic:

- *The stretches, learning how you should set up your computer to have good posture.*
- *Not to strain your body.*
- *Elbows and forearms level with work height.*
- *How your desk should be set up.*

Students were generally unsure of information that could be included or expanded upon for future sessions. Many considered the information provided was sufficient to meet their needs. The summary of their responses in Table 3, indicates that more material related to stretching and keyboard use could be included, and this will be taken into consideration in future planning.

Table 3. Student responses to the question “What information could be included or expanded upon for future sessions?” (n=55)

Item	n*
Don't know	12
None, enough information	12
Doing stretches, other kinds of stretches	6
More hands-on activities	5
Use of computers, how to use the keyboard	4
Symptoms, disorders, effects of bad posture	3
Posture, how to sit	3
Different types of screens	1
Micro-breaks	1
Non-responses	9
Total	56

* Number of times item identified

Some of the comments received were:

- *More kinds of stretches you could do.*
- *More on how you should sit at the computer.*
- *I think there was enough information, it was very helpful.*

While many students included no additional comments, it was noted that some requested more practical activity be included in the session to “make it more fun”. Overall, the educational session was regarded as interesting and enjoyable (Table 4). The students believed that they had received valuable information from the session, increasing their knowledge of ergonomics and its application to their computer use.

These comments are representative of those received from the students:

- *That was a good session and now I have learnt a lot.*
- *It was interesting.*
- *Stretching was good.*
- *More practical stuff.*

Table 4. Student responses to the question “Any other comments?” (n=55)

Item	n*
None, No	22
Good, interesting, well done, learnt a lot, thank you	13
More hands on, more practical	6
Make it more fun	3
Non-responses	12
Total	56

* Number of times item identified

The teachers present also commented on how the session benefited them, as well as the students, in terms of knowledge, attitudes and skills relating to healthy computer use.

Discussion

The extensive use of computers, especially laptop computers, has revolutionised the way students learn and communicate. This study examined the experiences of Year 10 secondary school students from rural South Australia who participated in an educational session designed to increase the level of awareness and knowledge of the principles of ergonomics that relate to computer use. The objectives of this research were met satisfactorily. Based on the student and teacher feedback, ongoing short educational sessions, such as the one conducted, can be valuable in providing information to school students about computer-related health problems and the proper use of computer technology. The findings reflect the learning that transpired during the sessions, especially in relation to correct posture and the value of stretching. The sessions were informative as can be discerned from the comments illustrating the many lessons learnt by the students.

Feedback was positive, due to the well planned and delivered topics for discussion. The session commenced by asking students if they had encountered health problems relating to computer use and drawing from their own experiences, strategies that might alleviate their issues were discussed. The students were given the opportunity to understand disorders associated with prolonged computer use and the principles of ergonomics applied to computer use. They discovered ways by which they could use the computer safely and effectively. Acquisition of skills was a focal point for the students, and the practical session where they learnt simple exercises, demonstrate and return demonstrate a skill or task, were appreciated. Students were able to recall and assess their practices in order to confirm if they were observing proper techniques or needed improvement.

However, the students were not the only ones to benefit, as there were also opportunities for personal and professional development of the teachers involved. The teachers' verbal feedback conveyed appreciation for the knowledge they had also gained from attending the session. The increased awareness of teaching staff to considerations of ergonomics and computer use will assist the schools in promoting the message about healthy human-computer interaction. Of significance is the potential to prevent associated disorders which could restrict the students' possibilities in future work life [10].

The impact of the educational session was determined by a post-session evaluation. The impact of interventions and health promotion programs must be evaluated in order to decide if they are indeed useful to the target audience. It is important to understand, verify or increase the impact of interventions and explore ways to improve them. Although the post-session questionnaire revealed that, after completing the educational session, the majority of the students were more knowledgeable about ergonomics and computer use, the real benefit can only be assessed in the long-term, that is, whether they actually make the positive changes in behaviours and achieve the outcomes. Follow-up and other interventions may be undertaken to reinforce learning, but the use of a dedicated person for this purpose, possibly the schools' Occupational Health and Safety Welfare officer is recommended. Special attention should be directed towards computer activities outside school and for this reason the authors suggest the involvement of parents, increasing their awareness and interest in computer hazards. Moreover, this educational session may be further improved by adding more exercises and practical activities to make it more fun and hands on as the students suggested.

In exploring how school students might be assisted in understanding the principles of ergonomics, learning could be expanded to include other kinds of stretches and more time spent discussing posture and the repercussions of poor computer use. Future outreach activities could consider the recommendations of participating students with regard to incorporating more interesting, hands-on and interactive activities in the session.

To increase the application of principles of ergonomics in daily computer use, interventions such as educational sessions have been conducted [13, 14, 21]. The prevention of health complaints associated with computer use must be a priority especially for students in rural and remote areas that may be disadvantaged due to isolation. Efforts must be directed at increasing students' capabilities and knowledge about health-related computer disorders, identifying warning signs and symptoms, and understanding the importance of applying the principles of ergonomics to their work and study place. This could be assisted by the installation of software on the schools' computers that monitors activity and encourages students to stretch and take regular breaks.

Conclusion

In conclusion, the educational session on ergonomics and computer use implemented by university academic staff aimed to provide secondary school students' with an understanding of the importance and relevance of applying ergonomic principles in computer use. The evaluation of the sessions has revealed that this initiative was fit for purpose. The educational session was local, cost-effective and strategic, allowing school-university partnerships and engagements to happen. It is important for the university to build connections and maintain partnerships at multiple levels with secondary schools in order to meet the educational needs of school students, and to be part of the community.

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