

Reducing children's classroom sitting time using sit-to-stand desks: Findings from pilot studies in UK and Australian primary schools

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Abstract

Background: This research examined the influence of sit-to-stand desks on classroom sitting time in primary school children.

Methods: Pilot controlled trials with similar intervention strategies were conducted in primary schools in Melbourne, Australia and Bradford, UK. Sit-to-stand desks replaced all standard desks in the Australian intervention classroom. Six sit-to-stand desks replaced a bank of standard desks in the UK intervention classroom. Children were exposed to the sit-to-stand desks for 9-10 weeks. Control classrooms retained their normal seated desks. Classroom sitting time was measured at baseline and follow-up using the activPAL3 inclinometer.

Results: Thirty UK and 44 Australian children provided valid activPAL data at baseline and follow-up. The proportion of time spent sitting in class decreased significantly at follow-up in both intervention groups (UK: $-9.8 \pm 16.5\%$ [-52.4 ± 66.6 mins/day]; Australian: $-9.4 \pm 10\%$ [-43.7 ± 29.9 mins/day]). No significant changes in classroom sitting time were observed in the UK control group, while a significant reduction was observed in the Australian control group ($-5.9 \pm 11.7\%$ [-28.2 ± 28.3 mins/day]).

Conclusions: Irrespective of implementation, incorporating sit-to-stand desks into classrooms appears to be an effective way of reducing classroom sitting in this diverse sample of children. Longer term efficacy trials are needed to determine effects on children's health and learning.

Keywords: Sedentary behaviour; health; pilot controlled trial; activPAL; socio-economic status; ethnic diversity

Introduction

In children, adverse associations between sedentary behaviour (sitting) and cardio-metabolic health risk markers (obesity, blood pressure, cholesterol, insulin), fitness, cognitive development, and academic achievement have been reported.¹⁻⁴ In adults, sedentary behaviour has been associated with increased risk for numerous chronic conditions, including obesity, cardiovascular disease, some cancers, and type 2 diabetes.⁵⁻⁸ Sedentary behaviour is the most prevalent pastime exhibited by children and adults, accounting for approximately 65% of waking hours,⁹⁻¹¹ and has been shown to track from childhood into adolescence and adulthood.^{12,13} The successful reduction of sedentary behaviours in young people is pertinent for the primary and secondary prevention of diseases that result from excessive engagement in these behaviours.

The school classroom is conducive to high volumes of sitting, with Australian data showing that 63% of class time per school day is spent sedentary.¹⁴ Moreover, children sit for longer during school hours compared to non-school hours on school days.^{11,14} Due to the contextually driven nature of sedentary behaviour, interventions in children have begun to target reductions in classroom sitting,¹⁵⁻²¹ with initial studies demonstrating the feasibility of incorporating sit-to-stand desks in primary school classrooms.^{16,20,22} Evidence suggests the use of sit-to-stand desks in primary schools are effective in increasing energy expenditure^{17,21} and standing and movement during the school day.¹⁸ However, only one study has directly assessed the impact of such interventions on sitting time.¹⁶ Hinckson et al.¹⁶ reported a reduction in total daily sitting of approximately one hour/day in children exposed to sit-to-stand desks at school, however, the specific changes in classroom sitting time were not reported.

To date, evidence on the use of sit-to-stand desks in the school environment has largely been restricted to US and New Zealand samples. The generalizability of these studies to other countries is unclear due to differences in educational systems. This paper reports the findings of two controlled intervention pilot studies conducted in the UK and Australia, which adopted similar intervention strategies, to examine the influence of sit-to-stand desks on primary-school children's classroom sitting time and total school-day sitting.

Methods

Participants

UK study: Participants were recruited from an ethnically-diverse primary school located in the City of Bradford, England. Bradford has high levels of deprivation and childhood morbidity;²³ the school was located in a neighbourhood within the top third for overall

deprivation in England. The school contained two classrooms per year group and in consultation with the Head and Assistant Head Teachers, the Year 5 cohort (9-10 year olds) were selected for participation. Evidence suggests that children in Year 5 upwards are active participants in their own learning, making them an optimal target for classroom interventions that may facilitate learning.²⁴ Parents/guardians of Year 5 children received a letter explaining the school was replacing some existing desks within one Year 5 classroom with sit-to-stand desks. The study was approved by the Loughborough University Ethical Advisory committee. Parents/guardians provided written informed consent for their children to participate in the intervention evaluation.

Australian study: Participants were recruited from a primary school located in a middle-high socio-economic status (SES) area in Melbourne, Victoria. In consultation with the Principal and senior teachers, two Year 6 (11-12 year olds) classrooms (out of a possible three) were randomly selected for participation. Parents/guardians of all children from the respective classrooms received a letter explaining that their child's classroom had a 50% chance of receiving a sit-to-stand desk. Parents returned written informed consent for their children to participate in the intervention evaluation. The study was approved by Deakin Human Ethics Advisory Group-Health and the Department of Education and Early Childhood Development.

Interventions

In both the UK and Australian studies one classroom was allocated to the intervention condition while the other was assigned to the control (usual care) condition.

UK study: The intervention took place during the spring term (January-April 2014). In the intervention classroom, home to 27 students, three standard desks (sitting a total of six children) were replaced with six Ergotron WorkFit-PD sit-to-stand desks (Ergotron Inc, USA, Figure 1). The teacher rotated the children around the classroom in groups of six according to the specific lesson being taught to ensure that each child was exposed to the sit-to-stand desks once a day for at least one hour for nine weeks. The time of day during which each child was exposed to the desks varied over the course of the week and children were informed that they could sit (on stools provided) or stand when using the desks. The intervention teacher received training on desk adjustment. Information on the benefits of reducing sedentary behaviour and classroom sitting time reduction strategies, based on materials adapted from a previous cluster-randomized controlled study, were also provided.¹⁵ No environmental or other changes were made to the control classroom (home to 28 students), their teacher continued with normal lesson delivery.

Australian study: The intervention took place during the spring term (September-November 2013). In contrast to the UK study, all standard desks were replaced with Ergotron WorkFit-PD sit-to-stand desks providing all 26 children (and the teacher) with their own desk throughout the 10-week school term (Figure 1). Standard classroom chairs remained at the desks throughout. Children were initially encouraged to stand for at least one 30-minute class per day, and to increase this gradually over the 10-week intervention. As in the UK study, the intervention teacher received training on desk use and the same classroom sitting time reduction strategies.¹⁵ The control classroom involved 22 students and had no environmental or other changes, with the teacher continuing their usual lesson delivery.

Figure 1

Measurements

Identical measurements were taken in both studies at baseline (prior to desk installation) and at 9-10 weeks follow-up (last two weeks of school term). All measurements were undertaken in the schools by trained researchers. Children with parental consent self-reported their age and ethnicity (UK study, e.g. White, Asian) or parent's place of birth (Australian study). Height and weight were directly measured to the nearest 0.1cm and 0.1kg respectively, without shoes, using portable stadiometers (Australian study: Seca model 220; UK study: Leicester Height Measure) and electronic weighing scales (Australian study: Tanita model 1582; UK study: Seca model 887). For both, the average of two measurements was calculated. Children were issued with an activPAL3 accelerometer (PAL Technologies, UK), worn on the thigh for seven consecutive days, which responds to signals related to gravitational forces and provides information on thigh inclination.²⁵ The activPAL is a valid measure of time spent sitting, standing and walking in children.²⁶ In the UK study the activPAL was placed within a nitrile sleeve and attached to the leg using a waterproof hypoallergenic medical dressing (BSN Hypafix), enabling participants to wear the device continuously (24 hours a day). In the Australian study, the activPAL was placed in an elastic garter and worn on the front of the thigh during all waking hours. Children were asked to complete a daily log book where they reported the times they woke up and went to bed, and any time the activPAL was removed. On day 8, children returned the activPAL and diary to school where it was collected by a researcher.

Data management

All activPAL data were downloaded using manufacturer proprietary software (activPAL Professional v.7.2.29) in 15-second epochs and processed using a customized Microsoft Excel macro. The number of minutes that children spent sitting, standing and stepping

during waking hours (between 6am and 10pm) were obtained for each school day (weekend data were omitted due to low compliance). As applied in accelerometer studies, non-wear time was defined as 60 minutes of consecutive zero accelerometer counts.²⁷ To enable the examination of the influence of the sit-to-stand desks on classroom sitting time, time spent sitting, standing and stepping during class time (based on provided school bell times) were extracted from the daily weekday data. Due to the exploratory nature of the study, children were included in the analyses if they had worn the activPAL for at least 8 hours on at least 1 weekday at each time point.

Statistical analyses

Statistical analyses were conducted using SPSS v.22 (SPSS Inc., Chicago, IL). To account for differences in activPAL wear time between baseline and follow-up, and between the intervention and control groups within the UK and Australian studies, the proportions of wear time spent sitting, standing and stepping were calculated for each participant. These data were used in the analyses as opposed to the absolute minute data. The Shapiro-Wilk test confirmed that all data were normally distributed. To examine any differences between the children participating in the two studies, baseline data for the proportion of class time spent sitting, standing and stepping were compared using independent t-tests. The proportions of time spent in each behaviour during class time were compared between the baseline and follow-up periods for the intervention and control groups within each study using paired-samples t-tests. Differences in the proportion of time spent sitting, standing and stepping during class time at baseline and follow-up, along with changes in these behaviours, were compared between groups within each study using independent samples t-tests. These analyses were repeated for the proportions of time spent in each behaviour on a whole weekday.

Results

Participants

UK study: Fifty-four children had parental consent to participate in the study, of which 30 (56%; 16 boys, 14 girls; mean [\pm SD] age: 10.0 \pm 0.3 years, BMI: 18.3 \pm 3.2 kg/m²) provided valid activPAL data at baseline and follow-up. Twenty-three percent self-reported their ethnicity as White, 63% South Asian, and 13% mixed ethnicity. There were no significant differences between the compliant and non-compliant participants in terms of age, BMI, sex proportion, or the proportions of participants from each ethnic group ($p > 0.05$).

Australian study: Forty-eight children had parental consent, of which 44 (92%; 19 boys, 25 girls; mean [\pm SD] age: 11.6 \pm 0.5 years, BMI: 19.4 \pm 3.3 kg/m²) provided valid activPAL data at baseline and follow-up. Just over half (54%) of the sample's parents were born in Australia.

Changes in classroom sitting, standing and stepping time

At baseline, children from both countries spent five hours per day in the classroom (not including morning recess and lunch). There were no significant differences in classroom sitting time at baseline between the UK (200 \pm 48 mins/day, 70% of classroom wear time) and Australian (203 \pm 22 mins/day, 69% of classroom wear time) study samples.

Table 1 shows the mean minutes, and the proportion of time spent sitting, standing and stepping during class at baseline and follow-up for the intervention and control participants in the two studies. The proportion of time spent sitting in class decreased significantly at follow-up in both intervention groups. In the UK intervention group, whilst there were no significant changes in the proportion of time spent standing in class, there was a significant increase in the proportion of time spent stepping, along with step counts, at follow-up. In the Australian intervention group, a significant increase in the proportion of time spent standing during class was observed, no changes were seen in stepping time. In the UK control group, no significant differences in any behaviour during class time were observed over the intervention period. In the Australian control group, a significant reduction in the proportion of class time spent sitting, and a significant increase in the proportion of class time spent standing was observed.

Within the UK and Australian studies, the intervention and control groups did not differ significantly at baseline in terms of the proportion of class time spent sitting, standing or stepping ($p > 0.05$). In the UK sample, there were no significant differences between the intervention and control groups at follow-up. In the Australian sample, the intervention group spent a significantly lower proportion of time sitting ($p = 0.03$), and a higher proportion of time standing ($p < 0.01$) during class time at follow-up in comparison to the control group (Table 1). The changes in behaviours over the intervention period did not differ significantly between the intervention and control groups in either country ($p > 0.05$).

Table 1

Total weekday sitting, standing and stepping time

At baseline the UK study sample spent a significantly higher proportion of time sitting in comparison to the Australian study sample on a school day (70% [588 \pm 81 mins/day] versus

62% [494±81 mins/day] of waking time, $p < 0.001$). There were no significant differences in the proportion of time spent standing between the two samples, however the UK sample spent a significantly lower proportion of time stepping in comparison to the Australian sample (11% [91±32 mins/day] versus 17% [138±47 mins/day] of waking time, $p < 0.001$).

In the UK study, the proportion of time spent sitting, standing and stepping did not differ significantly between baseline and follow-up when examined over the course of a whole school day for the intervention and control groups ($p > 0.05$) (Table 2). In the Australian study, a significant increase in the proportion of time spent standing on a weekday was observed in the intervention group ($p < 0.01$). No significant changes were seen in any behaviour in the control group ($p > 0.05$, Table 2).

Table 2

Discussion

Main finding of this study

This paper reports the findings from two pilot studies conducted in ethnically and socio-economically diverse samples of primary school children from the UK and Australia, which adopted similar intervention strategies, to examine the influence of sit-to-stand desks on classroom sitting time. Despite differences in desk provision the intervention groups from both schools exhibited similar significant reductions in the proportion of class time spent sitting. Taken together, these pilot studies add to the limited evidence-base on the efficacy of sit-to-stand desks on objectively measured sitting time.¹⁶

What is already known on this topic

Sedentary behaviour is the most prevalent health-related behaviour exhibited by children and adults.⁹⁻¹¹ In children, adverse associations between sedentary behaviour and health have been reported.¹⁻⁴ While optimum reductions in sedentary time in children need to be established, recent data from adults shows that reallocating just 30 minutes of sedentary time per day to light movement is associated with a 2-4% improvement in cardio-metabolic biomarkers.²⁸ The school classroom is conducive to high volumes of sitting.¹⁴ Earlier studies have demonstrated the feasibility of incorporating sit-to-stand desks in the classroom environment,^{16,20,22} however specific changes in classroom sitting time have not been reported.

What this study adds

An important practical and novel finding of this research was that similar changes in classroom sitting time were seen in the UK and Australian studies (9.8% [-52 mins/day] and 9.4% [-44 mins/day]), despite the differences in desk provision. The similar reductions in classroom sitting between interventions suggests it may not be necessary to replace all standard desks in a given classroom with sit-to-stand desks and a bank of desks may be sufficient to produce meaningful changes in sedentary behaviour in the classroom. A randomized controlled trial directly comparing these two intervention strategies is required to confirm this finding. Furthermore, the use of the sitting time reduction strategies provided to intervention teachers were not formally evaluated in the present pilot studies, further research will be required to evaluate the effectiveness of sit-to-stand desks on their own and in combination with sitting time reduction strategies.

The interventions appeared to have different effects on classroom non-sedentary time. For example, the UK intervention group demonstrated a significant increase in the proportion of class time spent stepping, which was coupled by a significant increase in step counts. In contrast, the Australian intervention group displayed a significant increase in the proportion of class time spent standing, with no changes in stepping. These findings could partially be attributed to the fact that the UK sample had to move around the classroom to use the sit-to-stand desks. Installing a bank of sit-to-stand desks and rotating children around to them appears to promote movement in class, in addition to reductions in sedentary time, as reported previously.^{18,21}

Overall on a school day, both samples spent a high proportion of time sitting. This was particularly evident in the UK sample who accumulated just under 10 hours sitting per day, equivalent to 70% of their waking hours. The Australian children accumulated 8.25 hours per day, accounting for 62% of waking hours. Reductions in total daily sitting time were observed in both intervention groups, these changes were not statistically significant however the study was not powered to detect significant changes. The present findings, in agreement with others,^{16-18,21} suggest that whilst the classroom environment is an ideal setting to target reductions in sedentary behaviour and increases in activity, in highly sedentary populations such as the UK sample multi-setting interventions which target both the school and home environment¹⁵ may be necessary for reducing overall daily sitting time.

Limitations of this study

Limitations of the study include the relatively small sample sizes, the relatively short intervention periods (9-10 weeks), potential changes in school schedules during baseline

and follow-up (although this would be equivalent for the intervention and control groups within each school), and the lack of long-term follow-up. The lower compliance to the activPAL protocol seen in the UK study is also a limitation. Reasons for the differences in compliance could be attributable to differences in SES, sample age and attachment methods between studies. Lastly, in both studies the control groups consisted of children from the same school as the intervention groups. Contamination of the intervention appears to be evident, as seen elsewhere,¹⁶ as small reductions in sitting were observed in both control groups.

Despite these limitations, strengths of the present study include the ethnically and socio-economically diverse samples. The UK school was located in a region known for its high levels of deprivation and childhood morbidity.²³ Children attending the school represent a range of ethnic groups, with the majority being South Asian. It is widely acknowledged that South Asians living in the UK have an increased risk of numerous chronic diseases,²⁹ with South Asian children exhibiting a number of elevated risk factors for disease in comparison to White children.³⁰⁻³² In contrast, the Australian study sample was drawn from a middle-high socio-economic area in Melbourne. These pilot studies suggests that the implementation of sit-to-stand desks is a feasible way of reducing classroom sitting in children from a range of socio-economic groups, including ethnic minority and high risk groups. Longer-term efficacy trials are needed to confirm these findings, and to determine the impact of such interventions on children's health, cognition and academic achievement.

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Conflict of Interest Statement

The desks used in both interventions were supplied via an in-kind donation from Ergotron Inc, USA. The company played no role in the study designs, analyses, or in the preparation of this manuscript.

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Table 1: Sitting, standing and stepping time (mean mins/day \pm SD), along with the proportion of time spent in these behaviours for the UK and Australian sample, measured using the activPAL during class time for the intervention and control groups at baseline and follow-up.

	Intervention class				Control class			
	Baseline	Follow-up	Change	Difference (p value)*	Baseline	Follow-up	Change	Difference (p value)*
UK Sample	n = 16				n = 14			
Sitting: minutes	210.4 \pm 34	158 \pm 49.2	-52.4 \pm 66.6		187.4 \pm 59.1	180.5 \pm 67.5	-6.9 \pm 91	
% of wear time	71.8 \pm 10.6	62 \pm 15.8	-9.8 \pm 16.5	0.03	68.6 \pm 20	65.4 \pm 20.1	-3.2 \pm 30.2	NS
Standing: minutes	58.5 \pm 25.1	61.3 \pm 34.3	2.8 \pm 39.6		57.8 \pm 32	57.9 \pm 34.1	0.1 \pm 52.8	
% of wear time	20.1 \pm 8.7	23.5 \pm 12.5	3.4 \pm 14.9	NS	24 \pm 20.8	21.9 \pm 12.8	-2.1 \pm 26.2	NS
Stepping: minutes	23.9 \pm 8.1	38 \pm 23.5	14.1 \pm 18.8		20.2 \pm 9.7	33.8 \pm 22.7	13.6 \pm 25.9	
% of wear time	8.2 \pm 2.8	14.5 \pm 7.9	6.3 \pm 6.8	0.002	7.4 \pm 3.6	12.8 \pm 8.2	5.4 \pm 9.1	NS
Steps	1654 \pm 528.9	3024 \pm 2195	1370 \pm 1937	0.013	1425 \pm 663	2588 \pm 1867	1163 \pm 2028	NS
Wear time (mins)	292.7 \pm 12.2	257.2 \pm 47.5	-35.5 \pm 50.9	0.014	265.4 \pm 36.2	272.1 \pm 37.3	6.7 \pm 45.2	NS
Australian Sample	n = 24				n = 20			
Sitting: minutes	201.5 \pm 25.4	157.8 \pm 19.7	-43.7 \pm 29.9		205.3 \pm 18.3	177.1 \pm 22	-28.2 \pm 28.3	
% of wear time	67.9 \pm 8.4	58.5 \pm 8.4	-9.4 \pm 10	<0.001	70.8 \pm 5.8	64.8 \pm 10.8	-5.9 \pm 11.7	0.04
Standing: minutes	53.7 \pm 13.3	72 \pm 21.6	18.2 \pm 21.2		43.7 \pm 7.7	58.2 \pm 18.1	14.6 \pm 18.9	
% of wear time	18.1 \pm 4.5	26.4 \pm 7.5	8.3 \pm 7.6	<0.001	15.1 \pm 2.7	20.7 \pm 5.9	5.6 \pm 6.4	0.001
Stepping: minutes	41.4 \pm 15.5	41.1 \pm 9.9	-0.3 \pm 15.4		41.1 \pm 11.5	40.9 \pm 16.7	-0.2 \pm 18.1	
% of wear time	14 \pm 5.2	15.1 \pm 3	1.1 \pm 4.9	NS	14.2 \pm 3.9	14.5 \pm 5.6	0.3 \pm 6.2	NS
Steps	3356 \pm 1264	3213 \pm 738	-143 \pm 1245	NS	3318 \pm 932	3209 \pm 1296	-109 \pm 1449	NS
Wear time (mins)	296.6 \pm 5.6	270.8 \pm 20.4	-25.8 \pm 22.2	<0.001	290 \pm 7.4	276.1 \pm 28.1	-13.8 \pm 26.4	0.03

*Due to variations in wear time between the baseline and follow-up measurement periods, comparisons were made between the proportion of wear time spent sitting, standing and stepping, and not for the absolute minute data. The time spent in these behaviours is provided however for information.

NS – not significant

Table 2: Sitting, standing and stepping time (mean mins/day \pm SD), along with the proportion of time spent in these behaviours for the UK and Australian sample, measured using the activPAL on a whole weekday for the intervention and control groups at baseline and follow-up.

	Intervention class				Control class			
	Baseline	Follow-up	Change	Difference (p value)*	Baseline	Follow-up	Change	Difference (p value)*
UK Sample	n = 16				n = 14			
Sitting: minutes	606.5 \pm 66.4	525.7 \pm 103.7	-80.8 \pm 103.4		566.1 \pm 92.6	574 \pm 180.6	7.9 \pm 199	
% of wear time	69.1 \pm 8.3	66.8 \pm 6.6	-2.3 \pm 10.7	NS	71.4 \pm 7.6	69.1 \pm 14.1	-2.3 \pm 16.8	NS
Standing: minutes	176.0 \pm 62.5	160.1 \pm 40	-15.9 \pm 76.2		149.2 \pm 48.1	151 \pm 68.4	1.8 \pm 93.4	
% of wear time	19.5 \pm 6	20.8 \pm 6	1.3 \pm 9.1	NS	18.9 \pm 5.9	18.8 \pm 9	-0.1 \pm 12.1	NS
Stepping: minutes	102.1 \pm 30.2	100.4 \pm 45.7	-1.7 \pm 48.1		77.4 \pm 30.5	95.1 \pm 53.9	17.7 \pm 59.8	
% of wear time	11.4 \pm 2.9	12.5 \pm 4.4	1.1 \pm 4.7	NS	9.7 \pm 3.6	12.1 \pm 6.9	2.4 \pm 7.4	NS
Steps	7695 \pm 2378	7776 \pm 3769	81 \pm 4223	NS	5974 \pm 2307	7295 \pm 4309	1321 \pm 4712	NS
Wear time (mins)	884.4 \pm 97.4	785.9 \pm 131.1	-98.5 \pm 129.9	0.01	792.4 \pm 95.3	819.8 \pm 131.2	27.4 \pm 157.1	NS
Australian Sample	n = 24				n = 20			
Sitting: minutes	498.2 \pm 80.2	429.8 \pm 60.4	-68.3 \pm 97.2		489.7 \pm 84.6	435.5 \pm 81.2	-54.2 \pm 115.8	
% of wear time	62.1 \pm 11	59 \pm 5.7	-3.1 \pm 11.2	NS	62.4 \pm 8.5	62.4 \pm 8.6	0 \pm 10.6	NS
Standing: minutes	172 \pm 51.3	185 \pm 39.6	13 \pm 53.1		152 \pm 38	145.5 \pm 34.7	-6.5 \pm 35.8	
% of wear time	21.3 \pm 6.1	25.5 \pm 5.5	4.2 \pm 7.4	0.01	19.4 \pm 4.6	20.7 \pm 3.9	1.4 \pm 4.4	NS
Stepping: minutes	134.4 \pm 53.4	113.5 \pm 29.9	-20.9 \pm 40.2		142.2 \pm 39.2	118 \pm 44.2	-24.2 \pm 50.3	
% of wear time	16.6 \pm 6.6	15.5 \pm 3.4	-1.1 \pm 5.1	NS	18.3 \pm 5.1	16.9 \pm 6	-1.3 \pm 7.7	NS
Steps	11011 \pm 4441	9103 \pm 2348	-1908 \pm 3268	0.01	11678 \pm 3230	9513 \pm 3520	-2165 \pm 4238	0.03
Wear time (mins)	804.4 \pm 49.6	728.2 \pm 68.2	-76.2 \pm 59	<0.001	783.7 \pm 65	698.8 \pm 88.1	-84.9 \pm 97.4	<0.001

* Due to variations in wear time between the baseline and follow-up measurement periods, comparisons were made between the proportion of wear time spent sitting, standing and stepping, and not for the absolute minute data. The time spent in these behaviours is provided however for information.

NS – not significant

Figure 1. The sit-to-stand desks located in the intervention classrooms of the UK (top panel) and Australian (lower panel) schools.

