Daily and Weekly Standing Patterns When Using a Sit-Stand Desk in a College Class

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Abstract: Objective: Sit-stand desks have been designed to address high daily sitting in work and school environments. The purpose was to determine the daily pattern of use and overall likeability of sit-stand desk over the course of a semester. Participants: A total of 18 subjects (12 standing) completed the 11-week study (week 5-15 of the semester) from January-April, 2016. Methods: Each student in the standing group was given a sit-stand desk to use as they desired. Results: Individual daily standing time ranged from 0-100% of daily attendance time and the daily group average ranged from 2.1-38.4%. Two-thirds of the standing bouts were ≤ 2 min. Perception questionnaire answers were positive for using the desk and their effect on students’ ability to work in class. Conclusions: The results indicate the sit-stand desks were utilized at low levels and for short durations for most participants, but perceptions of desk use remained positive.

Key words: Sit-stand desks, adjustable-height desks, classroom, perceptions.

1. Introduction

A shift in recent years is placing more focus on the behaviors and environments that cause people to sit for long periods of time daily and the potential deleterious health consequences of accumulating large amounts of sitting time. However, previously there was more of a focus on increasing people’s levels of MPA (moderate physical activity) and VPA (vigorous physical activity) as one of the major mechanisms to reduce morbidity and mortality. Less attention is given to daily body position or movement outside of this “exercise” time. The rest of the day provides ample opportunity to potentially accumulate sedentary time, despite possibly meeting or even exceeding the current PA (physical activity) guidelines, due to office or classroom environments that only provide sitting options and may not encourage any movement due to limited space. Sedentary time is now thought to be associated with negative health consequences independent of the level of PA [1] or BMI (body mass index) [2].

The trend of moderate PA occupations being replaced with occupations requiring only sedentary or light intensities over the last 50 years [3] may provide a rationale to the recent efforts to design numerous devices to address the increasingly sedentary nature of work and school environments. The standard desks and chairs used in work and school settings, unchanged for many years, have been altered to change the body position for workers and students while still allowing them to complete normal work or school tasks (i.e., typing, writing, talking on the phone, using a computer, etc.). Few expensive examples of these alterations include removing all chairs and desks to have standing meetings [4] or using physio balls or stools instead of chairs [5, 6]. Costlier examples of devices created to reduce sedentary time include rigid [7] or adjustable [8] standing-height desks and rigid [9] or adjustable [10] treadmill desks that incorporate walking on a treadmill at low speeds (e.g., 0.5-2.0 mph) instead of desks requiring a static, seated position, as well as pedal desks that allow a self-selected pedaling motion [11].

Much of the research addressing sedentary behaviors has focused on the work environment, with a few
studies addressing the school environments of elementary-aged-students, leaving a gap in the research which addresses students in the college setting. In many respects, the college population has the same difficulty in engaging in the proper amount and intensity of physical activity as does the general population [12]. It has been reported that a large percentage of the college population does not engage in the proper amount of MVPA (moderate-to-vigorous physical activity) and they accumulate nearly 30 hours of sedentary time from studying, and computer and television use [13]. In addition, the college classroom environment is like the office and elementary school environments of previously mentioned interventions in that colleges have utilized standard chairs and sitting-biased desks for students for many years. However, the college setting is different in that students are not often limited to sitting for a full workday, like in an office environment, but rather they are intermittently sitting in class, at work, to study, to relax, etc., with sporadic opportunities for movement as they switch between these activities each day. It is currently unknown if the wave of newly designed desks would have a positive impact on classroom sitting time or will be liked by college-aged students. Therefore, the purpose of the study was to determine the pattern of sit-stand desk usage over the course of a semester, the relationship to movement outside of class, and if the participants liked using the sit-stand desks.

2. Methods

2.1 Participants

Participants were recruited from two sections of a human anatomy & kinesiology course at a public university in central Minnesota. The class sections were randomly assigned as either standing or control group prior to participant recruitment. A total of 23 students (14 standing; 9 control) signed informed consent to participate in the study prior to data collection. Prior approval of the study protocol was obtained from the university IRB (institutional review board).

2.2 Sit-Stand Desks

The sit-stand desks (Learn Fit model, Ergotron Inc., St. Paul, Minnesota) provided a work surface measuring $24" \times 22"$ (61 cm × 56 cm) and height adjustment from a minimum height of $33.3"$ (85 cm) to a maximum height of $49.3"$ (125 cm). Each sit-stand desk setup had a high chair ($24"$ or $29"$) with a back on it for the participants to use when seated and an $18" \times 24"$ anti-fatigue foam mat to stand on.

2.3 Study Design

Data were collected during spring semester (January-April, 2016). The class met three days per week (Monday and Wednesday for 110 minutes and Friday for 50 minutes). One section began at 10:00 am (control group) and the other at 1:00 pm (standing group). During the first four weeks of the semester all students utilized sitting only desks; control group participants utilized sitting desks the entire semester which did not allow any standing. There were 14 sit-stand desks placed at the back of the classroom prior to week 5 of the semester that replaced some of the standard sitting desks so the total number of desks was the same as the room was previously set up. A sit-stand desk was assigned to each standing-group participant (no sit-stand desks were shared); if a participant dropped out of the class, their sit-stand desk was removed from the classroom. Data on daily in-class sitting and standing patterns were collected during weeks 5-15, accelerometer data were collected during weeks 7 and 14, and perception of use data was collected during weeks 7 and 15.

Standing-group participants were given instruction on how to adjust the height of the sit-stand desk at the beginning of week 5. They were told that it is believed sitting too much has a negative impact on overall health and standing can be good for your health in a variety of ways. The standing-group participants were instructed to use the sit-stand desks in the standing position as
much as they want and to shift from one position to the
other as they see fit and that any movement will not be
disruptive. Control group participants were assigned
typical sitting-only desks.

2.4 Standing and Movement Time

A video camera was used each class session to
record the participants using the sit-stand desks. The
camera only captured those subjects participating in the
study. Standing time was defined as any time the
participant’s legs were not in contact with the sitting
surface of the chair. The same observer recorded
standing time for all participants.

Actigraph GT3X+ accelerometers (ActiGraph LLC,
Pensacola, FL, USA) were used to record sitting,
standing, and movement duration and intensity during
two separate 7-day periods in the semester. Participants
were instructed to wear the accelerometers for all
waking hours during each 7-day collection period,
except for showering/bathing or swimming activities.
The GT3X+ model has been shown to be valid and
reliable in classifying movement into sedentary, light,
moderate, hard, and very hard intensities [14-16].
Wear/nonwear time was determined per criteria set by
Choi et al. [17] and the number of minutes spent in
each intensity category (e.g., sedentary, light, etc.) was
determined per criteria set by Freedson et al. [18].

2.5 Perception Questionnaire

A 16-item, five-point Likert-scale (1 = strongly
disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 =
strongly agree) questionnaire to assess the users’
attitudes toward the use of a sit-stand desk in a college
classroom and their feeling on potential use outside of
the classroom was administered in weeks 7 and 15
(adapted from Carr et al. [11]).

2.6 Statistical Analyses

All statistical analyses were conducted using SAS
(version 9.4; SAS Institute Inc., Cary, NC). Descriptive
statistics and correlations were conducted on the data
relating to participant age, year in college, height,
weight, credit load, exam scores, class grade, weekly
accelerometer determined minutes of MVPA, and daily,
weekly, total classroom standing time. Mixed model
analysis of variance was used to determine the
differences in the percentage of daily attendance time
spent standing (PSTAND) and the percentage of
weekly attendance time spent standing (WPSTAND),
as well as time spent in sedentary (SED), light
(LIGHT), and MVPA during the two accelerometer
collection periods. A heterogeneous compound
symmetry variance-covariance structure was
determined to be the best fit for the data. The data from
the perception of use questionnaire were used to
calculate medians and quartile scores. A level of
significance (α) of 0.05 was used for all analyses.

3. Results

A total of 23 participants (14 standing, 9 control)
started the study. Five students withdrew from the
course resulting in 18 participants (12 standing, 6
control) completing the study; descriptive statistics for
these subjects are in Table 1. Data on daily in-class
sitting and standing patterns were analyzed for the 12
standing participants, and all movement data measured
via accelerometer were analyzed for all 18 participants.
Accelerometer data for 4 standing participants were
excluded due to not meeting minimum wear time
requirements during the two collection periods, leaving
valid accelerometer data for 14 participants (8 standing,
6 control). There was no difference in age, height,
weight, or credits between the two groups.

The differences in standing for the standing group
are represented graphically based on percent of daily
attendance time for daily in-class standing (Fig. 1) and
weekly in-class standing (Fig. 2). There were
significant (p = 0.0043) daily differences in the percent
of daily attendance time spent standing. Post-hoc
analysis of all comparisons via Tukey-Kramer
procedure indicated the following significant (p < 0.05)
relationships: days 2 and 27 were higher than days 18

Daily and Weekly Standing Patterns When Using a Sit-Stand Desk in a College Class
Table 1  Participant characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Age (yr.)</th>
<th>Height (in.)</th>
<th>Weight (lbs.)</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6</td>
<td>23.8 (6.6)</td>
<td>65.5 (14.3)</td>
<td>153.0 (27.6)</td>
<td>13.7 (2.4)</td>
<td>3.3 (0.8)</td>
</tr>
<tr>
<td>Standing</td>
<td>12</td>
<td>21.2 (3.5)</td>
<td>66.7 (5.1)</td>
<td>157.8 (37.5)</td>
<td>14.0 (3.3)</td>
<td>2.3 (1.1)</td>
</tr>
</tbody>
</table>

Data are mean (SD).

Fig. 1  Daily in-class standing represented as a percent of daily attendance time. Data are adjusted means ± SE. 

a lower than days 15 and 27 (p < 0.05); b lower than days 2 and 27 (p < 0.05).

Fig. 2  Weekly in-class standing represented as a percent of weekly attendance time. Data are adjusted means ± SE. 

a lower than weeks 5, 9, 11, 13, and 15 (p < 0.05); b lower than weeks 5 and 9 (p < 0.05).
and 28, and days 15 and 27 were higher than day 9. There were also significant (p = 0.0016) weekly differences in the percent of weekly attendance time spent standing. Post-hoc analysis of all comparisons via Tukey-Kramer procedure indicated the following significant (p < 0.05) relationships: weeks 5, 9, 11, 13 and 15 were higher than weeks 8, and week 12 was lower than weeks 5 and 9.

Participant age (AGE) was correlated with the average daily standing percentage (APSTAND) (r = 0.86, p < 0.001). Also, the following significant correlations were found for the accelerometer and sleep measurements collected in week 7 and 14: the amount of sleep in week 14 (SLEEP14) with the amount of moderate-to-vigorous physical activity in week 14 (MVPA14) (r = 0.58, p = 0.031), the amount of sleep in week 7 (SLEEP7) with SLEEP14 (r = 0.77, p < 0.001).

The percentage of the total number of standing bouts is categorized by the length of the standing bout in Table 2, with the total number of standing bouts over the 29 class sessions (weeks 5-15) included in the last column. The total number of bouts was significantly correlated with APSTAND (r = 0.60, p = 0.039).

Participants averaged 2.4 standing bouts/day (range 0-16).

Data related to the average daily number of MVPA minutes (AMVPA) based on valid days of accelerometer wear are represented graphically in Fig. 3. There was no significant interaction (F[1, 12] = 1.31, p = 0.274), treatment (F[1, 12] = 1.51, p = 0.243), or week (F[1, 12] = 0.12, p = 0.737) effect for AMVPA. In addition, there was not a significant correlation between standing in week 7 (WPSTAND7) and MVPA minutes in week 7 (MVPA7) (r = -0.31, p = 0.454), or between standing in week 14 (WPSTAND14) and MVPA minutes in week 14 (MVPA14) (r = 0.04, p = 0.925). The average (± SD) number of weekly minutes spent in moderate-to-vigorous intensity physical activity (MVPA) for week 7 was 220 ± 157 min (range = 69-562) for the standing group vs. 208 ± 72 min (range = 115-314) for control, and for week 14 was 176 ± 78 min (range = 87-325) for the standing group vs. 233 ± 101 min (range = 102-369) for control.

Data from the 16-question Likert-scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) sit-stand desk perception questionnaire are contained in Table 3 and are represented as quartiles.

Table 2 Percentage of the total number of standing bouts categorized by bout length.

<table>
<thead>
<tr>
<th>ID #</th>
<th>≤ 0.3 min</th>
<th>≤ 1 min</th>
<th>≤ 2 min</th>
<th>≤ 5 min</th>
<th>≤ 10 min</th>
<th>≤ 20 min</th>
<th>Total # bouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>12.3</td>
<td>29.2</td>
<td>38.5</td>
<td>53.8</td>
<td>70.8</td>
<td>81.5</td>
<td>65</td>
</tr>
<tr>
<td>8</td>
<td>31.1</td>
<td>46.7</td>
<td>56.6</td>
<td>81.1</td>
<td>92.6</td>
<td>96.7</td>
<td>122</td>
</tr>
<tr>
<td>9</td>
<td>36.7</td>
<td>69.4</td>
<td>75.5</td>
<td>83.7</td>
<td>91.8</td>
<td>98.0</td>
<td>49</td>
</tr>
<tr>
<td>10</td>
<td>40.4</td>
<td>54.4</td>
<td>61.4</td>
<td>73.7</td>
<td>82.5</td>
<td>91.2</td>
<td>57</td>
</tr>
<tr>
<td>11</td>
<td>50.9</td>
<td>67.3</td>
<td>72.7</td>
<td>89.1</td>
<td>90.9</td>
<td>98.2</td>
<td>55</td>
</tr>
<tr>
<td>12</td>
<td>40.3</td>
<td>63.6</td>
<td>70.1</td>
<td>83.1</td>
<td>84.4</td>
<td>93.5</td>
<td>77</td>
</tr>
<tr>
<td>13</td>
<td>50.0</td>
<td>66.7</td>
<td>72.2</td>
<td>94.4</td>
<td>94.4</td>
<td>100.0</td>
<td>18</td>
</tr>
<tr>
<td>14</td>
<td>19.8</td>
<td>42.0</td>
<td>50.6</td>
<td>60.5</td>
<td>70.4</td>
<td>79.0</td>
<td>81</td>
</tr>
<tr>
<td>15</td>
<td>26.5</td>
<td>50.0</td>
<td>58.8</td>
<td>82.4</td>
<td>86.8</td>
<td>95.6</td>
<td>68</td>
</tr>
<tr>
<td>16</td>
<td>28.2</td>
<td>43.6</td>
<td>74.4</td>
<td>84.6</td>
<td>92.3</td>
<td>94.9</td>
<td>39</td>
</tr>
<tr>
<td>17</td>
<td>31.4</td>
<td>68.6</td>
<td>71.4</td>
<td>91.4</td>
<td>91.4</td>
<td>97.1</td>
<td>35</td>
</tr>
<tr>
<td>18</td>
<td>35.1</td>
<td>59.5</td>
<td>70.3</td>
<td>91.9</td>
<td>91.9</td>
<td>100.0</td>
<td>37</td>
</tr>
<tr>
<td>AVG%</td>
<td>33.6</td>
<td>55.1</td>
<td>64.4</td>
<td>80.8</td>
<td>86.7</td>
<td>93.8</td>
<td></td>
</tr>
</tbody>
</table>
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Fig. 3  Daily MVPA time (AMVPA). Data are adjusted means ± SE.

Table 3  Sit-stand desk perception questionnaire results.

<table>
<thead>
<tr>
<th>Questions (Italics = negatively worded)</th>
<th>Q1</th>
<th>Median (Q2)</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sit-stand desk is easy to use.</td>
<td>4.75</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>I could conduct normal class-related tasks while using the sit-stand desk.</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>I used the sit-stand desk more than I thought I would at the beginning of the semester.</td>
<td>2.75</td>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>I would use a sit-stand desk in my other classes if it was available.</td>
<td>4</td>
<td>4.5</td>
<td>5</td>
</tr>
<tr>
<td>My work-related productivity decreased while using the sit-stand desk.</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I was more tired after class on days I used the sit-stand desk.</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>I had more physical discomfort on days I used the sit-stand desk.</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
</tbody>
</table>

*Week 15 data are represented as quartiles. Italicized questions are negatively worded (questions 3-5 and 11-13). Values represent the following categories: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

4. Comment

The purpose of the study was to examine the pattern of sit-stand desk usage in a college class over the course of a semester, the relationship of sit-stand desk usage to movement outside of class, and if the participants liked using the sit-stand desks. The main findings revealed variable daily and weekly standing between subjects with some participants that stood for a higher percentage of their daily/weekly attendance time, had more standing bouts per class, and stood for a longer length of time per standing bout (i.e., they were “high-responders”) [19] and others who have very low values for percentage of daily and weekly standing, number of stand bouts, and standing bout length (i.e., they were “non-responders”). This variability was shown in the lack of a clear pattern of daily standing in Fig. 1. Expressing the data in weekly form shows the amount of daily standing by the standing group was significantly lower in the week before spring break (week 8) than the beginning of the intervention (week 5) and every other week after spring break (weeks 9, 11,
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13, and 15). The ability of the sit-stand desks to increase standing in some subjects shows that it may be useful in reducing sitting and be an effective mechanism to combat the independent deleterious effects sedentary behavior can have on health [20, 21].

A strength of the study is the objective measurement of actual standing for each class period during the 11-week study. In this study, the first week showed as high an amount of standing as several different weeks later in the semester. Had this intervention stopped after four weeks and only utilized pre-post measurements, the data would have suggested lower standing amounts than what occurred during the semester. Several workplace sit-stand desk interventions indicating increased standing and decreased sitting primarily collected measurements at baseline and the end of the intervention [8, 22-26]. In contrast, two treadmill desk interventions utilized post-session surveys to collect usage data from each session and show different week to week [27] or month to month [28] changes in workstation use over time, and an intervention investigating an under-desk pedal machine [11] utilized software to collect real-time data and displayed daily usage over four weeks. The different pattern of standing (or walking or cycling) seen in workplace and educational interventions may suggest that the environment creates, or the participants have, alternative motivations or incentives for using the desks in the “active” position. For example, it is possible the participants’ lower amount of standing before spring break in this study was the result of having more exams (e.g., midterm exams) in the week before spring break, since it was the middle point of the semester, which may have affected the amount of standing at that time. Regardless of the setting, it may be helpful to objectively quantify the amount of daily standing, walking, or pedaling, as opposed to only comparing pre-post data, as the patterns of use may provide insight to improving interventions to optimize desk use and any associated benefits.

There was not a pattern of less standing on Fridays (class sessions 3, 5, 8, 11, 13, 20, 23, 26, 29) compared to the previous Wednesday of that week. The standing data were calculated as a percentage of the daily attendance time to account for the shorter scheduled class time on Friday (50 min.), compared to Monday and Wednesday (110 min.) as well as differences in attendance. The actual class duration between Monday/Wednesday and Friday (75.0 vs. 45.1 min., respectively) may have been similar enough to prevent participants from needing to stand more on the longer days to relieve stress, anxiety, boredom, discomfort from sitting, or for other reasons. The fluctuations from one class period to another show a need for an intervention methodology that can promote consistent higher daily standing, if maximizing standing is the goal, as opposed to the repeated fluctuations seen in this study.

STS (Sit-to-stand) transitions were investigated during each hour of a workday by Dall and Kerr [29] and they found that workers most often had zero STS movements with a median of three. Although the overall time of a college class is much shorter, the standing bouts pattern seen in this study are similar in that some students exhibited no standing (range of standing bouts/day was 0-16) with an average of 2.4 standing bouts. An intervention attempting to increase the number of STS movements in a college setting may be advantageous as students often have no need to stand in class; however, this may oppose an intervention that tries to maximize standing time as it might act to decrease the total standing time of the “high-responders”, who displayed high amounts of standing. Based on the low number of standing bouts and the high number of short-duration bouts for many participants in this study, an intervention focused on increased STS movement may be useful for targeting the “non-responders” and thereby increase their standing time. The work of Rutten et al. [30] may serve as a basis for such an intervention. They created the acronym STUFF (stand up for fitness), in hope that it would be remembered and get people to stand when
they heard it, and gave an example of standing for five minutes after 30 minutes of sitting to implement STUFF, which received positive feedback after preliminarily applying it to lectures with health science students.

The MVPA data in Table 3 show that 9 participants (5 interventions) in week 7, met the 150 minutes of MVPA per week guidelines suggested by Haskell et al. [31]. In week 14, 8 participants (4 interventions) met the guidelines. There were 5 interventions and 2 control participants that met the PA guidelines in one measurement period but not the other, with some participants meeting the goal in the first and some in the second collection period. The daily number of MVPA minutes (AMVPA) was calculated by dividing the total number of MVPA minutes by the number of valid accelerometer wear days. These values show a trend of participants having similar amounts of daily MVPA in both collection periods (i.e., both were low or both were high) as opposed to having one high and one low value.

Work performance did not seem to be affected by the sit-stand desks as indicated by the answers to question 11 and 12 on the sit-stand desk perception questionnaire. Participants primarily marked “disagree” or “strongly disagree” for the following statements: I was more tired after class on days I used the sit-stand desk and I had more physical discomfort on days I used the sit-stand desk. These results are supported by several studies that have looked at work performance while using standing desks. Standing resulted in no change in self-rated work performance [23], reading and cognitive performance [32], and speech quality [33]. In addition, improvements while using combination sit-stand position were seen in work performance [34], transcription [35], or productivity [36].

Lastly, it is unknown why the positive feelings towards the sit-stand desks, as evidenced by the positive questionnaire scores, did not result in higher overall standing amounts. It is possible that the freedom of movement allowed by the sit-stand desk when sitting in taller than normal chairs was enough to provide a benefit to the user such that they did not feel compelled to stand. Anecdotally, there appeared to be more fidgeting in students sitting at the sit-stand desks as they could move their legs and adjust the desk up and down without having to stand. However, the exact amount of fidgeting was not measured in this study and may be difficult to measure accurately.

5. Limitations

There are several potential limitations in this study. First, there were a low number of subjects in this study. In addition, the students who chose to participate in the study may be more interested in standing during class and therefore may not accurately represent the standing patterns of all students. However, given the high variability in standing by the participants in this study, we feel it accurately represents the standing patterns of students when given the instructions to use the sit-stand desk as they see fit.

In addition, the use of video to capture standing time may affect the participants’ use of the sit-stand desks (specifically, they may use them more because they know they are being recorded). To address this issue, we placed the video cameras in the classroom during the baseline period but did not record. We feel this helped acclimate the students to having cameras in the classroom so that the impact of the cameras on standing and sitting patterns was minimized.

This class may not represent the typical college class format. The class used in this study was chosen because it provided additional class time, and potentially additional sitting time, as compared to a standard-length class (maximum of 270 vs. 150 min/week in a standard class format). However, as mentioned above, average class length on Monday and Wednesday was 75.0 min, which is not that much more than a typical class of 50 min. In addition, the students displayed a large variety of attendance time. The students could come and go as they saw fit by the
professor (i.e., attendance was not mandatory) and research staff were not allowed to mandate full attendance. To address the issue of varied attendance time, the daily standing time is represented as a percentage of the total time the participant attended that class session. A positive aspect is that it represents a more likely “real-world” exposure pattern to any classroom changes in a university setting.

Another potential limitation is the use of accelerometer data with 3 or more days of valid wear time (≥ 10 hours/day) over a 7-day measurement period, which differs from the typical requirement of needing at least four days of valid wear [37]. Tudor-Locke et al. [38] suggested a benefit to including accelerometer data from participants with at least one day of valid wear time because it is reasonable that people do not wear the accelerometer on days they are not active and, therefore, low wear time may still be a valid indicator of the amount and intensity of weekly movement. In addition to lowering the number of valid wear days, using accelerometers to measure movement during only two weeks of the study may not give an accurate measure of the participants’ movement during other points in the semester or how much they would move at other points during the school year (e.g., September-December). We feel that the time points selected, late-February and late-April, represent similar weather, school, and work patterns experienced by the participants throughout the school year and, therefore, are representative of how much activity they engage in while attending college in Minnesota.

6. Conclusions

The sit-stand desks in this study were well liked and did not appear to be related to the amount of movement outside of class (did not increase SED or decrease MVPA). However, the overall daily fluctuations, as well as between-subject fluctuations, of sit-stand desk use in this study highlight the need to find intervention protocols that are immune to these fluctuations in use that we see when participants have the choice to stand or sit as they see fit, which previous research has indicated should be given to intervention participants [4, 39]. However, perhaps taking that freedom of when and how much they use the device away may be best for maximizing its use (e.g., achieving 90-100% of class time spent standing) and evaluating if this would have any effect on the perceptions of the sit-stand desks, any relationships to the amount of movement outside of class, or any other possible beneficial health impacts.

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References


Daily and Weekly Standing Patterns When Using a Sit-Stand Desk in a College Class

the American Heart Association.” Circulation 116 (9): 1081-93.


