

Feasibility and acceptability of “active” classroom material among French university students and lecturers: a pilot study

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Abstract

Background: Sedentary lifestyles are a plague of today's society in terms of physical, psychosocial and cognitive health. Students are particularly at risk because they spend most of their daily time sitting and inactive. The current pedagogical model must be rethought in order to promote their health, well-being and therefore their success. The objective of this project was to equip one classroom of the sport university with various active workstations (steppers, pedalboards, cycling desk, Swiss-ball, etc...) and to evaluate the feasibility and the influence of this type of material on cognitive and psychological factors of the students and to collect the feedback of lecturers during this experience. The global adherence to such material among students and lecturers also need to be assessed before generalizing the use of such material, which represent a certain cost for institutions.

Methods: A total of 663 students and 14 lecturers took part in a survey that aims at evaluating various aspects of lecture's quality after their first experience in the classroom.

Results: The majority of students and lecturers reported positive effects of such material, by a reduction in fatigue, distraction and boredom. The most plebiscited materials were the cycling-desks and the swiss balls. Finally, 89.4 % of students were in favor of using active material in future lectures if they had the possibility to, as well as 71% of lecturers, demonstrating the global acceptance of such material.

Conclusion: The present study brings promising results toward a more general implementation of such material in universities. Once a familiarization period is observed, such material in classroom could help prevent the deleterious effect of sedentary behavior as well as promoting a more active daily life for the future workers represented by students.

Background

Students' success is one of the university's main challenges. It is mostly expressed through academic results and precise success criteria (e.g., percentage of admitted students, employability), and is only possible through the general well-being of the student. Promoting physical and mental health of students is therefore a paramount aspect to be developed and maintained. As stated by the World Health Organization, "*Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" (WHO, 1946). Therefore, this definition illustrates a holistic model taking into account different components of health. Improving students' life habits such as quality of sleep and diet, physical activity, prevention of addictions, reduction of stress etc... appears crucial. However, due to our current lifestyles, these habits are particularly affected. Students, because of inherent consequences related to their status (distance from parental home, limited financial resources, important personal work, exams' stress, etc.) are a particularly at risk group ². This influences their general health and well-being and therefore their success and fulfillment.

Although proposing concrete health initiatives throughout the students' curriculum in order to promote their personal fulfillment (sport activities outside of lectures, balanced menus at the refectory, etc..) the

university and more generally our current pedagogical model may unintentionally compromise these health actions. Indeed, sedentary behaviors (i.e., activities that do not increase energy expenditure substantially above the resting level, namely < 1.6 Metabolic Equivalent of Task, Pate et al. 2008) are a plague of our current society with dramatic consequences in terms of health. Indeed, many studies have highlighted the positive association between the time spent in sedentary activities and increased cardiometabolic risk⁴⁻⁶. Also, maintaining a seated position for several hours in a day, regardless of a person's level of physical activity, constitutes a real health hazard and many scientists have therefore noted the importance of regularly interrupting this position even for the most active and/or sporty people⁷⁻⁹. In addition, sedentary behaviors can be associated with increased boredom, decreased alertness, memory, concentration, motivation, sleep quality, etc... All of which can result in reduced academic and social abilities¹⁰⁻¹⁴

It is recognized that, due to the nature of our professional and leisure activities, we spend more and more time in a seated position (e.g. TV, computer, reading, transport...). Above all, this is particularly true for students who are required to remain in this position for long hours during the day (lectures, lunches, public transports, revisions, etc.)^{15,16}. Yet, it is commonly accepted that regularly interrupting sedentary times in a day (getting up, fidgeting, carrying out low-intensity activities...) is beneficial for physical, psychological and cognitive health. While scientific studies on active work places are increasingly numerous in the professional environment, those targeting students remain fragmented. In a study published in 2017, Jerome et al. proposed desks that allow standing and sitting for 6 weeks to nearly 500 students at a Midwestern university¹⁷. Their results showed that the use of these desks increased the time spent standing during classes. At the same time, more than half of the students noted an increase in attention and a decrease in agitation during class and more than a third noted an improvement in engagement and a reduction in boredom and fatigue. Similarly, a Canadian study showed the feasibility of implementing standing or pedal-operated workstations in university libraries¹⁸. While such

However, to our knowledge, no study has been conducted on the implementation of such devices in French universities. By equipping a classroom with different active stations and setting up a survey that each student who followed a lecture, and each lecturers who delivered the courses, in this room could be able to fill, this study aimed at testing the feasibility and acceptability of such material in terms of pedagogy.

Method

A classroom has been equipped with active material at the sports faculty of Besançon, France. Lectures in this room mostly involved first grade students. This material was free to use; given that a certain amount of traditional workstations, i.e. "traditional" chairs and desks, were still present so that students were not required to solely use active stations. At the beginning of each lecture, instructions were given for the proper use of each active station installed. A total of 4 types of stations were installed:

- *Standing desks* (Skarsta, Ikea, Plaisir, France): desks at adjustable height were installed in the room (Fig. 1A). Recommended posture was: while standing, the desk level should be set up so that the elbows can rest on at 90°. Chairs were at disposal with those desks so that students were able to sit at any moment. It was recommended not to stay motionless but slightly and frequently change the support foot and/or fidget.
- *Swiss ball* (Domyos, Décathlon, Villeneuve-d'Ascq, France): three size of balls (S, M and L) were at disposal and height adjustable desks installed (Fig. 1B). The recommendations were to sit on the ball in order to have the desk at the level of the sternum and hip and knee joints at 90°. Automated electrical inflators were also at disposal if necessary.
- *Cycling-desks* (Tek Active, Paris, France): specific desks mixed with ergometers were used for this type of stations (Fig. 1C). These cycling-desks have saddles with adjustable height and a tablet with adjustable deportation. Students were instructed to adjust the saddle so that their legs were fully extended in extreme position of the crankset. The tablet had to be adjusted so that student did not have to lean forward to write.
- *Pedal- or stepper-boards* (Décathlon, Villeneuve-d'Ascq, France): portable cranksets and steppers were set up in front of traditional chairs (Fig. 1D). Height adjustable desks were also used for this station so that participants did not shock their knees while pedaling or stepping. Students were instructed to put the board on the floor in front of them in order to have their legs fully extended in extreme position of the crankset.

Instructions were reminded on cards fixed on the wall next to each station. At the beginning of each lecture, a 10-min installation procedure was observed. The choice of one or the other type of station has been let free, as we also wanted to test the spontaneous attractiveness of each material. Each lecture lasted 2 hours in a row and students were required to remain on the same material during the whole duration of the lecture. At the end of each lecture, fifteen minutes have been observed with students who have volunteered to answer an anonymous online survey on their phone or computer about this material.

The survey tested the feasibility and acceptability of the material. Questions focused on different aspects: i) demographic characteristics (age, weight, height, gender, level of education), ii) level of sports activities (per week) and time spent sitting during the day, iii) type of active equipment used during the course ("standing desk", "stepper", "pedals", etc...), "(iv) estimation of the duration of use of the equipment (during two hours of classes), (v) subjective feelings about the use of the equipment, both on physical aspects (energy, comfort, pain, etc...), psycho-cognitive aspects (attention, boredom, anxiety, participation, distraction (cell phone), etc...) and academic aspects (memorization of the lecture, understanding, etc...). Finally, a last part targeted the students' intention to reuse this type of material in future courses. Questions on subjective feelings have been adapted from the study of Jerome et al. (2017), and students were asked to report whether the utilization of active material during lecture "decreased", "increased" or "did not change" each aspect considered compared with similar lecture performed with traditional equipment.

Lecturers who performed a certain amount of lecture in the active classroom (minimum 2 lectures) were also asked to answer a specific survey. Questions were about the same aspects than those previously described for student but from teacher's perspective.

Results

Students' inquiry

The population

Responses from 663 students to the survey have been included in the present study. The global characteristics of the participants are depicted in Table 1.

Table 1
General characteristics of students population

	Mean
Age (years)	18.7 ± 1.6
Weight (kg)	65.5 ± 10.0
Height (m)	1.74 ± 0.09
BMI (kg.m ⁻²)	21.6 ± 2.2
Data are mean ± SD	
BMI : Body Mass Index	

In terms of physical activity level, the participants are predominantly "active" (the recommendations for adults being 150 min of moderate activity/week). Indeed, 39.5 % of participants reported to practice more than 10 hours of physical activity per week, and 49.8 % between 5 and 10 hours a week. Regarding time spent in sitting position, despite the high level of physical activity of the participants, 81.7 % reported to spend 4 hours or more sitting in a day and 25 % more than 7 hours.

« Active » lectures

When asked how long they think they have spent "active", a third reported being active more than an hour (50% of the lecture duration), the others responses varied between 15 minutes and 45 minutes (Fig. 2A). In terms of equipment, gym ball and cycling-desks were the most spontaneously used (Fig. 2B).

As compared to a traditional lecture, 34.4% noted a decrease in their perceived fatigue, 57.4% admitted a decrease in boredom and 40.2% a decrease in stress with the active material (Fig. 2C). For 35.4% of the participants, there was an increase in turbulence during the lecture with the active equipment. Regarding

more 'academic' parameters, a large majority of students did not feel any difference in attention and interactions with the teacher. However, distractions (use of mobile phone, social networks, etc.) seemed reduced for 35.2% of them.

When crossing variables, no specific difference has been established regarding gender, age or anthropometric variables. Similarly, no difference has been found between sedentary behaviors (i.e. number of hour spent sitting per day) and the different effects of active materials. However, the level of physical activity impacted differently the perceived pain after a lecture with active material. Indeed, the less physically active students were more likely to report an increase in pain and discomfort associated to the use of active material (40% of the participants who practice less than 2h/week, against 19.4% of participants who reported practicing 10h/week). No association has been established between time spent in sitting position per day/physical activity level per week and the time spent active during the lecture. When looking at the different tested materials, few differences have been pointed out. More particularly, cycling-desks were more likely to decrease pain and perceived fatigue, while stepper board showed the opposite trends (Fig. 3).

Finally, 89.4 % of students were in favor of using active material in future lectures if they had the possibility to.

Lecturers' inquiry

Fourteen teachers (8 men and 6 women) from the university answered the survey about their first experience in lecturing in the active classroom. They have been interrogated on their perception of student's turbulence, fatigue, boredom, stress, attention, participation, distraction and academic success. While some results were similar to the feeling of the students, some widely differed.

For example, while 35.4% of students perceived themselves to be more agitated, only 21.4 % of lecturers (4 out of 14) noted an increase in students turbulence as compared to an habitual lecture (50.0 % no difference and 28.6 % a decrease). 71.4 % of lecturers (10 out of 14) felt that student were less tired at the end of the lecture than usual (28.6 % no difference and 0.0 % an increase of fatigue). They also felt for 85.7 % of them (12 out of 14) a decrease in boredom among students. In terms of students' attention, lecturers' results are more varied (35.7 % found a decrease, 35.7 % an increase and 28.6% no differences). Lecturers found in majority (71.4%, 10 out of 14) no effect of active material on students interaction during the lecture as compared to their usual lectures, while no one found a decrease. However, they were unanimous (100% of the lecturers) in the fact that active material reduced student's distractions (chatting with other students, use of mobile phone, etc.).

Finally, lecturers were 50% to feel that their lectures were not impacted in quality, while 35.7% found an increased quality and 14.3% a decrease. 78.6% of them (11 out of 14) felt that it has no particular impact on students' success to understand the lecture. 42.9 % of them (6 out of 14) found the lecture more difficult to deliver, because it required more attention and concentration. However, despite this difficulty, they were 71.4 % (10 out of 14) willing to use the classroom with active workstation again.

Discussion

This research intended to collecting first impressions and feelings of students and lecturers regarding the use of active workstations in a French university context. Students and lecturers were globally positive about such material, although some pitfalls could have also been revealed.

First of all, one should remind that the targeted population, students and lecturers of a sport university, can be considered as open-minded regarding physical activity and are probably more likely to accept such experience. However, regularly practicing sport does not prevent to exhibit important amount of sedentary behaviors which are considered as independent risk factors for cardiometabolic diseases regardless of physical activity level ^{4,6,19}. Indeed, regarding the sedentary time, despite the high level of physical activity of the participants, 81.7 % reported to spend 4 hours or more sitting in a day and 25 % more than 7 hours. It seems thus crucial to take action to modify the lifestyle habits associated with increased sedentary time (e.g. transportation, time at work, school, etc.).

For 35.4% of the participants, there was an increase in turbulence during the lecture with the active equipment. This can be explained by the "novelty" factor and it should be investigated whether this phenomenon persists with the increase in the utilization of this type of material. This can also explain the difficulty that lecturers reported to face when conducting their lecture. However, students as lecturers were unanimous regarding a decrease in distractions, such as using mobile phone or chatting with their partners. One could say that active material can represent a distraction itself, therefore it seems important to observe a period of familiarization with the material in order to optimize its long term implementation .

Further the experiment of the effects of active workstations on a daily basis could bring clues on a reduction in turbulences. The objective of active material is not necessarily to increase attention or concentration, but at least to not deteriorate it rather, while interrupting sedentary behaviors and/or increasing the level of physical activity. The results of the present survey show that this mission seemed to be accomplished for most of the students and types of active material. In the long term, maintaining the common model of passive sitting workstations contributes, in an involuntary way, to the alteration of the physical, psychological, social and cognitive health of students. It is thus crucial to modify this model and to enable students to learn in conditions that promote their success in terms of their personal skills and know-how in the short, medium and long term. Indeed, by their status, students are the bridge between adolescence and the adult world and are therefore characterized as the adults of tomorrow with an educational, cultural and health legacy to pass on. Therefore, the university has a real role to play in enabling the student to develop and succeed, but also to instill good working methods, and general lifestyles, for the rest of his or her life. Work habits acquired at school and during college are likely to persist during future employments. The actual situation seems at the exact opposite, since student are know to increase sedentary behaviors during these periods? ^{20,21}. Even worst, the daily sitting time has been shown to increase over the years of studies ²². Therefore, the objective of implementing this type of learning setup at early stages of life is also relevant to educate the future workers to healthier working habits, and overall, life habits.

Regarding the type of material plebiscited, cycling-desks and Swiss ball seemed the most populars. They were also the ones that provided less perceived fatigue and discomfort, while causing as little perturbation as possible on cognitive capacities. The fact that such material allows to stay sitting can explain such results, since maintaining the standing position at standing desks tends to increase discomfort in low back and legs. The use of pedal and stepper board was not plebiscited much, maybe also because they were only portable devices placed on the floor and the traditional chairs used were not ergonomically optimal to practice as compared to standing cycling. In order to optimize the implementation of any classroom material, it appears important to work beforehand on product ergonomics to adapt it to the specificity of classroom environment. Nonetheless, one of the important aspect regarding the implementation of such material at University remains the cost, each material having to be purchased in large quantities. On that matter, even if cycling standing are optimal since they did not require servicing (such as Swiss ball that need regular reinflating) and are far the most popular material, they represent a very important cost.

To that aim, while keeping the standing position may tend to increase fatigue and discomfort, simply allowing the students to break sitting times by standing on a spontaneous basis can appear an interesting option. When offer the opportunity to stand during lectures, it was shown that the total time spontaneously spent standing was on average of 7.2 min per hour, even after a familiarization of several days²³. Therefore, although the use of specific materials such as sit-to-stand desks could increase this time by a little, this setup seems to provide a low amount of physical activity, and could not appear as the optimal solution. However, this type of solution appeared to have a great popularity over students^{15,17}. However, standing requires voluntary action that could also represent a break in attention and concentration and may simply be not automatized like pedaling, or maintaining balance on a Swiss-ball.

One of the main limit of the present study lied in the subjective evaluation of some characteristics such as physical activity level, physical and mental fatigue. However, the present study focused on analyse the feelings of students at a large scale, and lecturers, toward the acceptance of such type of classroom setup. An other important limit of the present study, preventing from generalizing to all type of students, was the great homogeneity of the population tested, which were already widely physically active and open-minded to sport (sport university students). This study was a pilot study and thus a first step toward more reluctant population, as it is known that some other populations of student are far less physically active²⁰. Having the same investigation lead in a population of less active students could bring relatively different results.

Finally, 89.4 % of students were in favor of using active material in future lectures if they had the possibility to, as well as 71% of lecturers, demonstrating the global acceptance of such material. This was in accordance with previous investigation reporting an important proportion of students (83%) and lecturers (87%) in favor of introducing sit-to-stand desks in the university classrooms of Midwestern university, USA¹⁵. Yet, in this previous study only 2.8 % over a total population of 993 interviewed students already used this type of material, showing that this is far to be a commonly used tool. Considering the beneficial effect of the use of active material on health, by "breaking sedentary

behaviors" which are major during the academic work, it seems appropriate to continue the development of this type of pedagogy. However, in order to perpetuate and optimize it, it is necessary to understand the feelings on the "physical" and "restlessness" aspects and to modify and/or adapt, if necessary, the implementation. The ultimate challenge is to find the optimal amount of physical activity, which allows to stay physically active while allocating sufficient cognitive resources to follow the lecture. These results show us the importance of accompanying students and lecturers in the implementation of such a system, while noting both the difficulty of changing habits rooted in our lifestyles and the positive aspects of this pedagogy with a marked desire, both on the student and teacher sides, to perpetuate it.

Conclusion

As a conclusion, the first experience of active workstations in a university classroom was globally positive and well accepted by students as well as lecturers. While noticing some difficulties at the beginning to adapt to this material, the majority of questioned participants were positive regarding the effect of such material on either their perceived fatigue, boredom or attention. Then, the choice of the material appears crucial to obtain an optimal increase in physical activity without deteriorating the quality of the learning, as well as the comfort of the students. More in depth analysis of cognitive abilities and energetic cost during lectures with such material could allow to objectively characterize those results. Anyhow, the present study brings promising results toward a more general implementation of such material in French universities.

Declarations

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Authors' contributions

LI, GE and SG designed research. SG and SP collected data. SG and LI conducted the data analysis and wrote the manuscript. LI, SP and GE assisted with manuscript write up. All authors have read and approved of the manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The project received approval by local university ethics committee (*Comité d’Ethique pour la Recherche-CER*). All participants were more than 18 years old. They gave their informed consent on the first page of the online form prior to completing the online survey. All methods were carried out in accordance with the latest version of the Helsinki declaration.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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