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# Learning is sitting: student and staff perspectives on sitting less at Maastricht University

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University students are often sedentary due to classroom designs that limit opportunities for movement. However, more activity can improve students' mental-health and academic results. This study investigates the needs of students and teachers in terms of 'less sitting' at Maastricht University (the Netherlands). Furthermore, it explores whether standing desks are feasible and acceptable interventions for 'less sitting' in the context of Problem-Based Learning. Two focus groups of five students and eight interviews were used to investigate the needs of students and staff, and 108 students from three different study modules filled out a questionnaire to address the feasibility and acceptability of standing desks. Students and staff of six faculties and 11 study programmes were included in the research. We find that students and staff at Maastricht University expressed the need for more active education. They flag the lack of appropriate educational spaces at Maastricht University for more active education and the necessity for socio-cultural norms change as largest limitations. Students and staff are furthermore mainly neutral in terms of the acceptability and feasibility of implementing standing desks at Maastricht University in a Problem-Based Learning setting. They report the same opinions in terms of dynamics, learning, health, and frequency of activity in the classroom as in more traditional university programmes. However, the participants in this study state that more attention for posture is needed during standing tutorials. They also comment that module design should make standing desks a logical element of the class dynamics. Our findings at Maastricht University indicate that an ambition for a more active classroom should go hand in hand with proper classroom and educational designs to make the most out of it.

KEYWORDS

**higher education, needs assessment, physical activity, sitting in class, standing in class, student perception**

## 1 Introduction

Students spend considerable time sitting during their education (Benzo et al., 2016; Chim et al., 2020; Golsteijn et al., 2021; Wu et al., 2023), largely due to conventional classroom setups with chairs and tables. Sedentary behaviour refers to sitting or lying while awake and expending little energy (Tremblay et al., 2017). This behaviour is common among university

students and strongly correlates with their educational activities (Carballo-Fazanes et al., 2020; Golsteijn et al., 2021). Specifically, more hours of scheduled classes correlate with the time students spend sedentary (Chim et al., 2020). Prolonged sedentary behaviour is associated with increased risks of both physical and mental health problems (Vance et al., 2005; e.g. Katzmarzyk et al., 2009; Dunstan et al., 2010). Therefore, for a healthy lifestyle, prolonged sedentary periods should be avoided and physical activity promoted (Dhahbi et al., 2025). At universities, sedentary behaviour often results from limited opportunities for movement during classes (Deliens et al., 2015; Carballo-Fazanes et al., 2020).

To counter prolonged sitting, various interventions have been explored. Among these, standing desks show promise in reducing sitting time and improving mental health outcomes (Hinckson et al., 2016; Visier-Alfonso et al., 2025). Although students generally perceive standing desks positively for both health and learning benefits, evidence remains limited and is mostly based on North American institutions with traditional programmes (e.g., Jerome et al., 2017; Chrisman et al., 2020; Frost et al., 2020). This study had two aims: (1) to identify students' and staff's needs for reducing sedentary behaviour at Maastricht University, which applies Problem-Based Learning (PBL), and (2) to assess the feasibility and acceptance of standing tutorials as a specific intervention in PBL sessions.

Hitherto, standing desks appear to be an attractive option to increase students' activity (Visier-Alfonso et al., 2025), since studies so far show a decrease in their sitting time and an increase in standing (Jerome et al., 2017; Chrisman et al., 2020; Chim et al., 2021b; Moulin et al., 2022). Other active workstations, such as cycling desks or Swiss balls, have also been explored and, in some cases, preferred over standing desks (Grosprêtre et al., 2021). The question what conditions students and lecturers need for more activity in the classroom is largely uncharted territory. In addition to workstation preference, little data exists on potential limitations on implementing standing desks in an institutional setting and their impact on social interactions. There is only some data on how product attitude and intended usage influence the purchase of active workstations by institutions (Goodrich et al., 2021).

Besides the need for more activity in the classroom, students and lecturers should find the intervention acceptable and feasible in the context of their educational module. Studies show university students want more opportunities to stand during class (e.g., Benzo et al., 2016; Jerome et al., 2017; Moulin et al., 2022; reviewed in Visier-Alfonso et al., 2025). However, these studies were done at universities that have more traditional study programmes. Maastricht University's PBL involves small-group problem-solving with high interpersonal interaction (Dolmans et al., 2005). This raises questions about whether more dynamic classroom setups, like standing desks, are acceptable and feasible in this context. With respect to sedentary behaviour, much is known about the intrapersonal factors for this behaviour but not much is known about the interpersonal factors influencing it (Castro et al., 2018), although Chim et al. (2021b) reported that constructive and social-constructive learning were not affected by the use of standing desks.

In this study, we performed focus groups amongst Maastricht University students and staff to find out more about their needs to adapt the university environment to decrease sedentary behaviour. Furthermore, we use a questionnaire to find out more about the feasibility and acceptance of PBL standing tutorials. We hypothesised that both students and staff would support more opportunities for activity but identify specific challenges related to PBL dynamics and classroom design.

# 2 Materials and methods

## 2.1 Participants and setting

Two datasets were collected in different years due to academic schedules and institutional constraints. While not ideal, this temporal separation was the only feasible path to achieving adequate sample sizes. Although collected at separate times, the intervention design and delivery remained consistent, allowing for combined analysis. We assert that the acceptability and feasibility identified with respect to standing in the classroom remained sufficiently stable to justify combination with the data set on the needs assessment.

### 2.1.1 Needs assessment

Convenience sampling was used, ensuring diversity by recruiting participants from six faculties of Maastricht University (UM; the Netherlands), various study programmes, and different ages and nationalities. The study was done during April and May in the second semester of the academic year 2018–2019. Teaching staff were invited via email, with additional recruitment via snowball sampling. Students were approached via email, social media, student organisations, and in person. The students represented a diverse range of study disciplines and years of study. Students were allocated to a focus group based on their primary location of education (UM Randwyck or Inner-city campus). Participants were excluded if they were distance learners or not based at the UM Randwyck or Inner-city campus. Interviews and focus groups were conducted within UM buildings, in quiet locations.

### 2.1.2 Acceptance and feasibility

Convenience sampling included 133 students from three modules (General Botany, Academic Skills I, and Creative Problem Solving) at three different programmes, taught for the first time in standing classrooms during the first semester of 2016–2017.

Two standing tutorial rooms equipped with adjustable standing desks and instructional posters (Supplementary Figure 1) were used. One of the rooms featured five whiteboards, the other room had one movable whiteboard. The standing-tutorials have been running at a small scale at UM since academic year 2014–2015; they were not solely imposed for the current study's interest. Students participating in this study had not used them before. This study introduced the anonymous survey, maintaining voluntary participation, with students given an opt-out option without facing any consequences. Each group had two 2-h tutorial sessions per week where they worked on problem tasks via Problem Based Learning (PBL; Dolmans et al., 2005).

## 2.2 Procedures

### 2.2.1 Needs assessment

Interviews and focus groups with 6–10 students were conducted within UM buildings, in quiet locations. Interview and focus group guides were based on the Grid of Environments Linked to Sedentary Behaviour (GELS) Framework (Owen et al., 2010; Nieuwendyk et al.,

2016), integrating determinants from the Systems of Sedentary behaviours (SOS) Framework (Chastin et al., 2016) and Analysis Grid for Elements Linked to Obesity (ANGELO) Framework (Swinburn et al., 1999), covering individual, micro, and macro levels. The individual level represents factors, such as health status or level and quality of motivation. The micro level represents the institutional setting, i.e., the university, and the macro level represents all factors above exerting influence over the other levels. Each system of clustered determinants is placed in one of six systems of the SOS system [Chastin et al., 2016; being the System for: (1) Psychology and Behaviour, (2) Physical Health and Wellbeing, (3) Institutional and Home Settings, (4) Social and Cultural Context, (5) Built and Natural Environment or (6) Politics and Economics].

Data was audio-recorded with permission of the participants, and the researcher took notes to provide an additional record of the interview and record non-verbal communication (Bourgeault et al., 2010). Participants were informed about sedentary behaviour definitions. They reported faculty, country of birth, age, and teaching staff provided departmental affiliation. Data collection and transcription took place during April and May 2019, with all transcription completed before June 2019.

All six faculties from Maastricht University were represented in the data collection. The Randwyck and Inner-city campus focus-groups each consisted of five students. Data saturation was considered achieved after six staff interviews, two student focus groups, and two final student interviews. No distinction was made between full-time and part-time students or employees.

#### 2.2.2 Acceptance and feasibility

To monitor students' perceptions about standing tutorials, a survey (Supplementary Data 1) was developed and distributed at the end of the last tutorial session of the academic period. The survey included demographics, physical characteristics, and 25 Likert-scale statements covering attitudes, learning, group dynamics, and health outcomes. Students also provided open-ended feedback. This questionnaire was not validated since we solely aimed at describing students' experiences and beliefs and investigate whether the answers clustered around several factors.

### 2.3 Data processing and analysis

#### 2.3.1 Needs assessment

Audio recordings were transcribed verbatim and coded in NVivo10 (QSR International, Burlington, USA) using a coding tree based on the SOS Framework (Chastin et al., 2016). A deductive thematic analysis (Braun and Clarke, 2006) was performed, and themes were grouped at individual, micro, and macro levels level. Coding was reviewed by a second researcher along with 15% of the coded interviews. No Kappa for inter-coder reliability was calculated.

#### 2.3.2 Acceptance and feasibility

Survey data were analysed in IBM SPSS Statistics for Windows (version 25.0, Armonk, NY, USA). Descriptive statistics summarised demographics. Principal Component Analysis (PCA) was applied, with Bartlett's test of sphericity to check for the correlations between items. Furthermore, oblique rotation (direct oblimin) was used. Kaiser-Meyen-Olkin (KMO) was utilised to measure sampling adequacy for factor analysis. Kaiser's criterion was used to retain the factors with a loading of >0.512, considered to be significant (Stevens, 2002). Open-ended responses were thematically coded with high inter-rater reliability (86.3%).

### 2.4 Reflexivity

The multidisciplinary research team ranged from early-career to senior academics, with prior experience in standing tutorial research. Reflexivity steps were taken to minimise bias through regular discussion and critical reflection.

### 2.5 Research ethics and integrity

Participants provided informed consent, and confidentiality was ensured by de-identifying transcripts via anonymisation. Data was securely stored, and no identifying information was included in the transcriptions of the audio recordings. No formal voice anonymisation software (e.g., voice distortion) was applied, but access to raw audio files was strictly limited to one member of the research team, and no audio excerpts were shared or published. We acknowledge that complete anonymisation of voice data is inherently limited in qualitative research. Although audio recordings do not eliminate the possibility of bias or misconduct, they provide an audit trail that enhances transparency and accountability in the data collection process. Interviews were conducted in private settings. Ethical approval was obtained for the needs assessment (FHML/HEP_2019.713); the acceptance and feasibility part followed internal EDLAB guidelines not requiring separate approval.

## 3 Results

### 3.1 Needs assessment

The results are presented according to the SOS framework (Chastin et al., 2016), distinguishing between individual, micro, and macro levels.

#### 3.1.1 Sample population

Students came from four faculties and eight programmes, with an average age of 23.6 ± 3.3 years. Two focus groups (32 and 46 min) and two individual interviews were conducted. The students represented the following nationalities: Brazilian, Bulgarian, Chinese, Dutch, English, German, Indian, Luxembourgian, Moldovan, and Romanian. Six teaching staff from three faculties also participated. The interviews lasted between 23 and 40 min. Representatives from all six faculties were present either in the student or the staff interviews.

#### 3.1.2 Factors at the individual level

In the context of systems of Psychology and Behaviour, high levels of sitting time amongst students were reported by all participants. Most participants agreed that they sat for proportionally more time at university than when outside of the university environment and spent most of their time outside of contact hours in the library to study. Students associated sitting with focus and comfort for studying,

*"When you are learning something where it requires a lot of concentration where you have to read a lot or learn some very difficult complex material then perhaps actually sitting down is good because you are able to focus a bit more"* (TS-1, FHML). In contrast, standing was mostly related to breaks or reorientation. *"I think that you know you sit down, and you work but then you stand up and you are just taking a break or reorienting"* (S-1, SBE).

In the context of the Physical Health and Wellbeing System, interrupting long sitting periods was perceived as beneficial (mood, energy). "*When you get up there's other things that you think about and then- it just feels good I do not know*" (S-2, FPN). However, students had limited knowledge of the specific health effects of sedentary behaviour. "*I think I'm aware that it's not good, that it has negative influences, but I do not really know what exactly*" (S-3, SBE).

### 3.1.3 Factors at the micro level

In the contexts of the systems for Institutional and Home Settings four issues were raised. Firstly, a lack of standing options was mentioned (few height-adjustable desks, sometimes poorly located). "*You go into a classroom you have a desk that is at a sitting height, you have all the chairs displayed around the desk and students are immediately primed towards sitting down*" (TS-1, FHML). Secondly, institutional policies interfere with active education. "*We had a policy that we are not allowed anymore to go outside with our tutorial groups so for example if something happens, a fire breaks out or whatever and then they cannot trace where the groups are*" (TS-1, FASoS). Thirdly, large group sizes limited initiatives such as walking tutorials or active breaks. "*/think if you are a bigger group and then walking around, like obviously there's going to be, like, sub-groups forming with, like, people discussing things in their own, like, kind of circle because it's hard to communicate with 73 people while walking*" (S-1, FPN). Lastly, many reported that the type of work requires them to sit. "*The requirement to read a lot of texts and also the requirement to write long papers for classes and then the thesis at the end which again requires hours spent in the library or reading texts at home or online so it's sitting*" (TS-1, FASoS).

### 3.1.4 Factors at the macro level

Educational and societal norms strongly influence sitting behaviour, with sitting perceived as the standard in both academic and daily life settings. *"If you go to somebody, you still be invited to sit down, if you go to the doctor or the dentist, you go to the waiting room there you can sit.* […] *So, it's how we have organised our society, and the university's part of it*" (TS-2, FHML). From early education onwards, sitting is the norm, and standing during tutorials is often perceived as unusual unless the whole group participates. *"One of the things that happens in a sort of standard tutorial room especially of course in a traditional lecture hall is there's something like social pressure to remain seated, in a calm, student-like fashion. This sort of social protocol is loosened up a bit when you move outside"* (TS-2, FASoS). Peers play a significant role in influencing standing behaviour, with positive experiences encouraging others to try standing tutorials, while social conformity often prevents individuals from standing alone. *"In tutorials or something that it's 'normal' that everybody sits, because in my last tutorial we had, like, for the brainstorm everybody stood up and then it was normal, and everybody did it"* (S-2, FHML).

Two main issues were reported by both students and teachers in the context of the System for Built and Natural Environment. Lecture halls are not designed for standing, often obstructing views and limiting notetaking. "*/would really like to have at least a couple of places inside the lecture hall where I could stand, I would not do that in the middle of the lecture hall because the room of people behind me*" (S-3, FHML). Outdoor spaces lack appeal except in specific locations. "*/think it's really nice that it's* [Tapijn Learning Spaces] *in nature, so you can actually go and walk in the park and I think in the law faculty that's not really possible and the Inner-city library*" (S-2, Law).

Lastly, topics in the system for Politics and Economics Show that reducing sedentary behaviour is not a university-wide priority, with limited institutional support and bureaucratic barriers to structural changes. *"a very small section of the university is encouraging the reduction of sedentary behaviour but it's just a small group of maybe let us say five teachers or so trying to promote this"* (TS-1, FHML).

### 3.1.5 Potential adaptations

Problem-Based Learning (PBL) sessions were identified as most adaptable for integrating standing, with positive experiences reported in departments already experimenting with standing tutorials. *"It's always after the first week it's normal and they find out what they can do, they can move around and not sitting and they are less drowsy"* (TS-1, FSE). Lecture halls pose challenges for standing, and while initiatives like STUFF (Stand Up For Fitness; Rutten et al., 2013) are seen as engaging by some, others find them distracting, suggesting the need for tailored implementation.

Awareness campaigns focusing on productivity and learning benefits, rather than health alone, are likely to be more accepted and effective. This is echoed by the experience of one member of teaching staff who specifically mentioned that the health argument received some resistance from students but that they were receptive for the benefits to the class atmosphere, learning process and overall educational value.

## 3.2 Acceptance and feasibility

### 3.2.1 Sample population

One hundred eight students answered the surveys (Programme 1: 87 (response rate 87%), Programme 2: 14 (response rate 100%), Programme 3: seven (response rate 100%)). Six surveys with missing data were omitted from further analysis. The sample included 75 female and 33 male participants (approximately representing the gender balance at the investigated programmes), 17–28 ± 2.2 years. The students' height varied between 1.54 and 1.97 ± 0.09 m. On average, the students self-reported that they sat for 8.0 ± 2.0 h/day, stood for 80.6 ± 51.9 min/day, walked for 52.2 ± 37.1 min/day, biked for 26.4 ± 22.1 min/day, and exercised for 3.5 ± 3.2 h/week.

### 3.2.2 Likert-scale questions

In a preliminary analysis we found that two questions singularly formed one factor and these were removed. PCA was carried out with the remaining 23 items. This resulted in four factors with eigenvalues above 1 (Kaiser's criterion) but the fourth factor only had two items conceptually similar to the items in the first factor. Therefore, three factors were chosen to represent the underlying dimensions of this survey. These factors represent "experienced impact on learning performance," "expected health benefits," and "acceptance of standing tutorials" (Table 1). All three factors had a Cronbach's $\alpha$ ranging from 0.86 to 0.94, indicating high internal consistency. The variabilities explained by the factors were 54.1, 7.8, and 5.7%, respectively. The

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TABLE 1 Summary of exploratory factor analysis results for the survey ($n$ = 102).

| 1: Experienced impact on learning; 2: Expected health benefits; 3: Acceptance of standing tutorials (ST) | 1 | 2 | 3 |
|---|---|---|---|
| I think that standing in tutorials made discussions more interactive. | **0.889** | | |
| I think that ST improved my contributions to discussions. | **0.866** | | |
| I think I was able to focus better in ST. | **0.854** | | |
| I think that the ST made me more alert. | **0.815** | | |
| I think that ST made discussions less focused.[A] | **−0.773** | | |
| I think that the ST improved the quality of the discussions. | **0.772** | | |
| I think that ST made me participate more actively. | **0.698** | | |
| I believe students were more easily distracted in ST.[A] | **−0.696** | | |
| I think that the ST increased the length of the discussions. | **0.469** | | |
| I think that ST fitted format of the course. | 0.457 | | −0.418 |
| ST raised my consciousness on the effects of my sitting behaviour. | | **0.821** | |
| I think incorporating standing elements into tutorials is good for my health. | | **0.700** | |
| The posters on good and bad posture were useful to me. | | **0.696** | |
| I think that standing in tutorials had a positive effect on my mental health. | | **0.588** | |
| I think I felt healthier on the I day had the ST. | | **0.549** | −0.463 |
| I consider ST as unnecessary.[A] | | −0.413 | |
| I would prefer less standing time in a 2 h long tutorial.[A] | | | **0.895** |
| In my opinion 2 h are too long for ST.[A] | | | **0.810** |
| I wish all my tutorials were ST. | | | **−0.719** |
| I would like to have more ST in the future. | | | **−0.598** |
| I think that the ST helped me being less tired. | | | **−0.577** |
| Generally, I like ST. | | | **−0.552** |
| I think that the ST have a good effect on my posture. | | 0.451 | **−0.514** |
| Eigenvalues | 12.5 | 1.8 | 1.3 |
| % of variance | 54.1 | 7.8 | 5.7 |
| $\alpha$ | 0.94 | 0.86 | 0.93 |

ST = standing tutorials. Significant factor loadings >0.512 appear in bold.
[A]These variables were reversed-scored before the reliability analyses (Cronbach's $\alpha$).

Kaiser-Meyer-Olkin measure was 0.914 indicating sample size to be most adequate.

The responses that contributed to each factor are detailed in Table 2. In terms of their experienced impact on learning, the students reported negative to positive responses, with many at the neutral point. Responses on expected health benefits were neutral to positive (with one negative). Finally, acceptance of standing tutorials elicited mainly neutral responses. On average, the students report that they would prefer 34.3 ± 2.8% of their tutorial sessions to be standing tutorials. The largest number of students preferred half of the tutorials to be taught in this format, although there is large variability in preference (Figure 1).

### 3.2.3 Open-ended questions

Per open-ended question several thematic clusters were derived (Supplementary Table 1, also for an explanation of the meaning of the themes). Students highlighted benefits of the standing tutorials including increased alertness, improved focus and concentration, greater physical activity, and enhanced interaction and engagement among peers. Students' concerns about the standing tutorials centred on issues such as fatigue from extended duration, physical discomfort or pre-existing health conditions, distractions that hindered learning, and questions about the suitability of the educational design. In their suggestions for improvement, students emphasised the need for clearer guidance on the purpose of standing tutorials and correct posture, recommended re-evaluating the duration and frequency of sessions, called for more thoughtful classroom design, and expressed a desire for greater flexibility in choosing between sitting and standing. In their final comments, students reflected on aspects of educational and classroom design, shared insights about their physical comfort, and discussed how the tutorials influenced their movement patterns. From the results (Supplementary Table 1; individual statements per study programme in Supplementary Table 2) it is clear that students like the opportunity to walk in the classroom ($N$ = 18), that they feel this keeps them awake ($N$ = 12) and gives them more focus ($N$ = 15). A student said "*that I am more dynamic and I actively participate more because I'm more focused, if you sit down it's easier to get distracted.*" They also comment on higher interaction with peers ($N$ = 14) and a better contribution to the discussion ($N$ = 10). As one of them remarked "*you can more easily look/turn towards others in the group - makes the discussion more active.*" Students comment on the general

TABLE 2 Number of responses (*N*), median (Med), and interquartile range (1st and 3rd quartile) per factor, ranging from 1 (completely disagree) to 5 (completely agree).

| Experienced impact on learning | *N* | Med | 1st quartile | 3rd quartile |
|---|---|---|---|---|
| I think that standing in tutorials made the discussions more interactive. | 107 | 3 | 2 | 4 |
| I think that ST improved my contributions to discussions. | 108 | 3 | 2 | 4 |
| I think I was able to focus better in ST. | 108 | 3 | 2 | 4 |
| I think that the ST made me more alert. | 108 | 4 | 2 | 4 |
| I think that ST made discussions less focused. | 108 | 2 | 2 | 3 |
| I think that the ST improved the quality of the discussions. | 107 | 3 | 2 | 4 |
| I think that ST made me participate more actively. | 108 | 3 | 2 | 4 |
| I believe students were more easily distracted in ST. | 108 | 2 | 2 | 3 |
| I think that the ST increased the length of the discussions. | 107 | 3 | 2 | 3 |
| I think that ST fitted format of the course. | 108 | 4 | 3 | 4 |
| **Expected health benefits** | ***N*** | **Med** | **1st quartile** | **3rd quartile** |
| ST raised my consciousness on the effects of my sitting behaviour. | 108 | 4 | 2 | 4 |
| I think incorporating standing elements into tutorials is good for my health. | 108 | 4 | 3 | 4 |
| The posters on good and bad posture were useful to me. | 107 | 3 | 2 | 4 |
| I think that standing in tutorials had a positive effect on my mental health. | 108 | 3 | 2 | 4 |
| I think I felt healthier on the I day had the ST. | 108 | 3 | 2 | 3 |
| I consider ST as unnecessary. | 107 | 2 | 1 | 3 |
| **Acceptance of standing tutorials** | ***N*** | **Med** | **1st quartile** | **3rd quartile** |
| I would prefer less standing time in a 2 h long tutorial. | 107 | 4 | 2 | 4 |
| In my opinion 2 h are too long for ST. | 108 | 3 | 2 | 4 |
| I wish all my tutorials were ST. | 108 | 2 | 1 | 3 |
| I would like to have more ST in the future. | 108 | 3 | 2 | 4 |
| I think that the ST helped me being less tired. | 108 | 3 | 2 | 4 |
| Generally, I like ST. | 108 | 3 | 2 | 4 |
| I think that the ST have a good effect on my posture. | 108 | 3 | 2 | 4 |

positive aspects of standing tutorials ($N = 3$) or on the perceived health benefits ($N = 15$). Students noted the raised awareness about the amount of sitting "*it made me reflect on how much i sit per day, so it did make me feel better by standing*." Students, furthermore, report that standing tutorials increased their physical activity and improved their general health. The explanations given for why the students liked standing tutorials included *"the good feeling during and after the tutorial with regards to health improvement."* However, other students do not report any positive aspects educational approach ($N = 13$), giving responses such as "*nothing*" ($N = 6$) or "*the break to sit down.*"

The most disliked part of standing tutorials is the fatigue ($N = 35$) and physical discomfort ($N = 18$) (Supplementary Table 1). For example, students mentioned that *"at some point you get distracted by your legs and feet aching…"* This could be related to wellbeing issues unrelated to the class ($N = 10$) or to the design of the class ($N = 13$). For the latter, students commented that "*sometimes you share a table with someone who is much taller, table does not suit height*" and: "*it did not work for academic skills as it was more like listening than discussing.*" Students also comment on the fact that for them the standing tutorials distract from learning ($N = 12$) because of discomfort. Few students mention general negative aspects of standing tutorials ($N = 5$) or make no negative comments ($N = 2$).

To improve the quality of standing tutorials, students mention shortening the class time or lowering the frequency ($N = 17$), change the educational design of the class or physical design of the classroom ($N = 26$), and provide students more room to self-regulate their sitting/standing behaviour ($N = 25$). Examples of respective responses were: "*shorter standing time* "and "*maybe a few chairs to be added to be able to take a break from standing in the breaks*." This could be combined with a better explanation of why standing tutorials are used in the context of the class ($N = 9$). For this, students commented "*give a 10-min introduction on how to stand at the beginning of a course! what is a good table height? why is it important?*" and "*educate people on good posture more, not just put up poster*." Students also make some general positive ($N = 4$) and negative ($N = 4$) comments.

Lastly, students commented positively ($N = 8$) or negatively ($N = 2$) in general terms on standing tutorials but also commented on changing the educational design of the class ($N = 9$) or the classroom

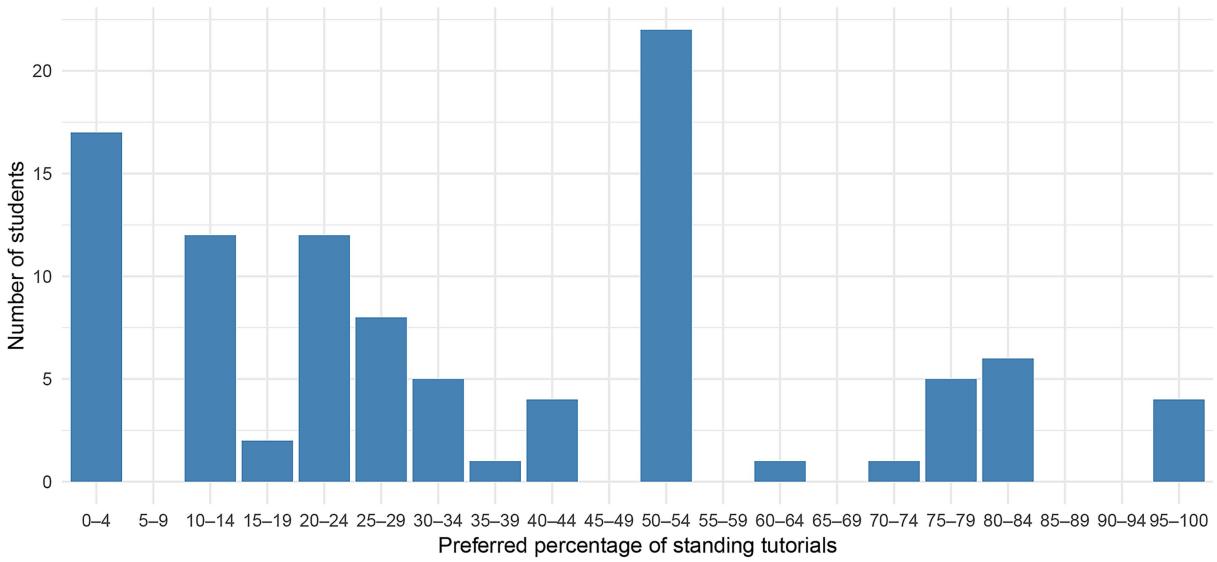


FIGURE 1
Number of students preferring a certain percentage of standing during tutorials ($N$ = 108).

environment ($N$ = 2). Some reported how their movement patterns were influenced ($N$ = 3) or that physical circumstances prior to the class influenced the perception of the standing tutorials ($N$ = 1). These comments were similar to the responses to the other questions described above. Two students provided comments that had no relation to the study or standing tutorials.

# 4 Discussion

This study aimed to identify needs to reduce sedentary behaviour at university and to assess acceptability of standing tutorials, especially within Problem-Based Learning.

## 4.1 The need for more active education and its perceived limitations

In this study, students and staff expressed interest in incorporating more physical activity into their classrooms in line with previous investigations that showed enthusiasm for this approach (Benzo et al., 2016; Jerome et al., 2017; Frost and Terbizan, 2018; Chrisman et al., 2020; Goodrich et al., 2021; Grosprêtre et al., 2021; Sengupta and Kuilan, 2023). However, incorporation is limited by the culture of "*learning is sitting*" and infrastructural constraints.

### 4.1.1 Alternative educational space design

Facility management policies sometimes restrict access to alternative (outdoor) spaces or standing desks, despite limited evidence of health risks (only Waters and Dick, 2015 show these so far). Classroom design does strongly influence acceptance. It is known that students' willingness to try more active educational approaches is influenced by the physical arrangement and characteristics of the classroom environment (e.g., seating arrangements, lighting; Evans and Lovell, 1979; Schilling and Schwartz, 2004; Fullerton and Guardino, 2010; Guardino and Fullerton, 2010). The university should see this investment as one in educational quality and not only wellbeing.

In our study interviewees highlighted improvements to educational rooms, such as more space for movement, the essentiality of multiple whiteboards for Problem-Based Learning discussions, options to work in smaller groups of 3–4 students to increase interaction, and reconsidering lecture halls and their design despite costs.

Study areas like libraries could also promote physical activity, since they are popular spaces for studying outside class time, in our sample and elsewhere (Applegate, 2009). The Maastricht University library is experimenting with alternative designs and tools to promote physical activity while sitting (e.g., exercise balls instead of chairs or desk bikes), although awareness of such options is limited among the students in our sample.

### 4.1.2 Changing the socio-cultural norm of sitting

Our research found that socio-cultural norms must be addressed alongside the physical aspects of the educational spaces. The prevailing idea was that sitting is the norm since that goes with studying (Deliens et al., 2015) or (academic) work (e.g., working behind a computer; George et al., 2014). These preconceptions might hinder the acceptance of more standing in class since standing while classmates are sitting can be socially uncomfortable (Moulin et al., 2022; Brownhill, 2023). Such peer pressure, however, seems a less prominent social influence amongst our sample of students then reported before (Deliens et al., 2015; Moulin et al., 2022). The reason for this remains unclear.

The basis for socio-cultural norms-change at Maastricht University is present (Supplementary Table 1; Deliens et al., 2015; Chim et al., 2021a; Chim et al., 2021b). Since the optimal ratio between sitting and standing has not been thoroughly researched (except for Gallagher et al., 2014), it might be best to leave the choice

between sitting and standing to the students. Teaching staff can be educated on how to promote frequent breaks from sitting in their class room (Chrisman et al., 2021).

It is known that the design of working spaces significantly influence the behaviour of people in them (Mahdavi and Unzeitig, 2005). Nudging students towards frequent position changes can be done by purposeful designing classrooms and removing barriers to physical activity without additional effort of the individual (Neuhaus et al., 2014). This might be the best way to stimulate more classroom activity since even with ample campus facilities for active posture students might not automatically make use of these (Deliens et al., 2015; Grosprêtre et al., 2021).

With respect to the needs for more standing education we can support our hypothesis that students and staff see the need for more activity during class time. They also see specific limitations, mainly being a lack of appropriate educational spaces for more active education and the need for socio-cultural norms change.

## 4.2 The feasibility and acceptance of standing tutorials

There seems to be a wish for more physical activity in the classroom at Maastricht University (UM). This can be done by introducing height-adjustable desks (Maeda et al., 2014; Benzo et al., 2016; Jerome et al., 2017; Smetaniuk et al., 2017; Tardif et al., 2018; Frost et al., 2020; Goodrich et al., 2021; Moulin et al., 2022; Sengupta and Kuilan, 2023) to create standing tutorials (Chim et al., 2021a; Chim et al., 2021b). The small-scale PBL sessions have a proper group size for the implementation of such desks (Benzo et al., 2016). Indeed, height-adjustable desks were mentioned as a modification to increase physical activity and reduce sedentary time. Students attending standing-tutorial meetings show less sedentary behaviour and more light physical activity than those attending conventional, seated meetings (Chim et al., 2021b). In other settings, standing desks also significantly increased class standing-time (e.g., to 9.3% of class time; Jerome et al., 2017).

### 4.2.1 Perceived effects on tutorial-group dynamics and learning

Students (and one lecturer) in our study reported that group dynamics improved and Problem-Bases Learning discussions were overall more interactive with better contributions to the discussions, a more personal atmosphere and students feeling more awake, alert, and focused (Supplementary Table 1). This finding confirms earlier studies with similar effects (Knight and Baer, 2014; Benzo et al., 2016; Jerome et al., 2017; Chrisman et al., 2020; Chrisman et al., 2021), although not all studies find these effects (Sengupta and Kuilan, 2023). Knight and Baer (2014) attribute these effects to increased activity in the sympathetic nervous system, creating heightened arousal levels during standing meetings.

We did not objectively establish whether this heightened level of attention also led to better study performance. Most students in our study did perceive standing tutorials as having a neutral to positive effect on their learning. Previous studies found no significant change in objectively measured cognition or learning performance (Bantoft et al., 2016; Finch et al., 2017; Chim et al., 2021a), while others found a subjective increase in cognitive performance (Frost and Terbizan, 2018; Frost et al., 2020). Given the mixed results, it is currently unclear what the impact of the heightened level of attention is on cognitive and learning performance.

### 4.2.2 Perceived effects on health

Students had low awareness of the potential negative effects of prolonged sitting. Those who were more aware, expected that health impact of standing tutorials was neutral to positive (Table 2; Supplementary Table 1). Previous studies reported that replacing sitting with light physical activity benefited physical and mental health (Duvivier et al., 2013; Dempsey et al., 2016; Torbeyns et al., 2016; Amagasa et al., 2018; Goodrich et al., 2021) and positively influenced cardiometabolic risk factors (Butler et al., 2018). The effect size of standing in the classroom on health, however, might be relatively small (Chim et al., 2021b). Since people in general tend to underestimate their sedentary time (Chastin et al., 2014; Chastin et al., 2018) increased awareness of the consequences of prolonged sitting is a prerequisite for change (Martínez-Ramos et al., 2015; Salmon et al., 2018; Jochem et al., 2023).

### 4.2.3 Issues lowering feasibility and acceptability of standing tutorials

Based on the experienced learning and health benefits, standing tutorials seem to be a feasible option to reduce sedentary behaviour in students at Maastricht University. However, regarding the acceptance of standing tutorials, the students' reactions were either neutral or negative (Table 2; Supplementary Table 1). The duration and the frequency of the standing tutorials were the main contributors to the students' negative reactions. Most students preferred a duration of less than 2 h per session (Supplementary Table 1), in line with previous reports (Benzo et al., 2016; Sengupta and Kuilan, 2023). There was a broad range of preferences for the percentage of time per week to be standing tutorials (Figure 1), expressed in the open-ended questions as well. Most students reported preferring between 0 and 50% of their academic schedule to be standing tutorial (Figure 1). The conditions causing the neutral or negative reactions included scheduling issues and having no opt-out possibility when selecting modules for those who absolutely dislike standing tutorials.

Bodily conditions were another barrier for more active education, such as experiencing menstruation, lacking sleep, or being ill, and these have been reported before (Chrisman et al., 2020). Students stressed that physical discomfort was sometimes associated to wellbeing issues unrelated to the class. Options for sitting or leaning as well as sitting breaks could help alleviate these discomforts. A mixture of furniture is therefore preferential to meet students wishes (Chrisman et al., 2020; Grosprêtre et al., 2021).

### 4.2.4 Proper posture during standing tutorials

Posters were employed that illustrated what ideal posture should be like. Students found these posters only moderately useful. This may explain why almost half of the sampled students judged their posture unfavourable during standing tutorials. Future interventions should provide more instructions on proper posture but refrain from focussing on a single ideal posture as was done here. Promoting one posture can have adverse effects. It promotes muscle fatigue and discomfort since variability in movement patterns is important for optimal health (Dhahbi et al., 2024; Dhahbi and Saad, 2024). Indeed,

several students reported pain in their feet, back and knees, and signalled tiredness and lack of comfort. Previous studies made similar observations (Benzo et al., 2016; Wilkerson et al., 2019; Grosprêtre et al., 2021), although low or alleviated musculoskeletal discomfort was also reported (Ee et al., 2018; Frost et al., 2020). It is unclear whether a longer adjustment period to the practice of standing tutorials could alleviate such discomforts (Wilkerson et al., 2019).

### 4.2.5 Educational design changes

A lack of clarity for the use of standing tutorials, was mentioned as a reason for low acceptance of this form of education (Supplementary Table 1). Students furthermore indicated that standing tutorials were only a fit with educational activities that required a great amount of discussion, such as Problem-Based Learning tutorials. All these students took a so-called skills module where they worked more individually and did not need to interact with other students. These points emphasise the importance of a good educational design and an explanation of it to the students. To our knowledge, the optimal educational design to maximise the use of standing tutorials has not been determined.

We hypothesised that students and staff would find it acceptable and feasible to implement standing desks at Maastricht University in a Problem-Based Learning setting. We found that students had a neutral to positive acceptance about the specific standing-desk intervention used (Table 2; Supplementary Table 2). We did not find specific wishes in the context of Problem-Based Learning, something we did hypothesise, but confirmed opinions reported in literature. Two novel findings are the need for (1) more attention for dynamic posture during standing tutorials and (2) explicitly addressing standing in class as part of the educational design of a module.

## 4.3 Strengths and limitations

A strength of the needs assessment is the emphasis on the university environment and the focus on sitting behaviour alone, which is lacking from previous research. Also, the data came from real tutorials, being more generalisable than an unrealistic setting of a controlled laboratory. For the whole study it is a strength that two distinctly different campuses from Maastricht University (UM) were represented may increase the generalisability of the findings to universities with both older and more modern facilities.

Participants understood the explained difference between physical inactivity and sitting behaviour, which diminished their tendency to talk about physical inactivity as found in a previous qualitative study (Deliens et al., 2015). The use of focus groups allowed participants to react to and build upon others' responses. Since prolonged sitting was often not considered by the students, this setup could give rise to data that might not have been revealed in individual interviews (Bourgeault et al., 2010; Frey, 2018). Interviews from teaching staff gave insights that the students could not. The students were given various options to express their perception of standing tutorials. They were first prompted with survey questions, before given the freedom to express their thoughts in open-ended questions. Furthermore, the responses are assumed to not be affected by a sense of novelty, because data was collected after the students had participated in standing tutorials for 7 weeks. Therefore, the students should have familiarised themselves with the standing tutorials. Finally, audio-recording and note taking of interviews reduced the potential for interviewer-recall bias.

This study is not without limitations. We did not use a validated questionnaire. This means we were restricted to a mainly exploratory and descriptive interpretation of results.

The use of a single university in the Netherlands can be seen as limiting. However, since prior research was mainly done in Northern America, there is only limited data from Europe. Other published studies on this topic are also carried out at one institution only and this study fits with that pattern. Furthermore, the use of Problem-Based Learning at UM may restrict the generalisability of the findings to universities that conduct more traditional study programmes.

The sample size for the acceptability and feasibility part of the study is larger than most studies so far (Visier-Alfonso et al., 2025). The desired sample size for the needs assessment consisted of three focus groups, with 6–10 participants per group, as at least 80% of all themes are thought to be detected within this number (Guest et al., 2017). Students from different faculties and courses were sought, and so they did not share similar schedules and often had other extra-curricular commitments. Scheduling a time where enough students could attend was challenging and heavily impacted recruitment, an issue experienced in other research (Smetaniuk et al., 2017). A further limitation was that the findings were not compared against a control group, limiting the interpretation of the results. However, the participating students did attend other classes in a sitting setting, whether from another course or from previous years. Therefore, we assume that the responses given by the students in this study were made after a comparison against the conventional sitting classes.

There seems to be an imbalance in gender that could influence the results. We acknowledge this. Although the gender balance in this study does reflect the actual gender balance in the programmes studied, it is possible that gendered norms around posture, classroom participation, or physical activity could have shaped responses or engagement with the intervention. We have no evidence of this, but future studies should examine such dynamics more explicitly.

Finally, we did not perform a long-term follow up. While our study captures perceptions after 7 weeks, long-term behavioural change and satisfaction were not assessed. In the future, a matched control-group or a mixed-methods approach over a longer period should be used to better assess the impact and sustainability of standing tutorials in the university classroom.

# 5 Conclusion

In our exploratory study, students and staff of Maastricht University reported limited opportunities to stand during classes, mainly due to the current physical setup of university spaces. Both groups expressed interest in incorporating more physical activity into their classrooms, especially in smaller educational settings, seemingly showing a need for this kind of education. Lecture halls may pose more challenges (such as limited space for movement). Redesigning common study areas, like those in libraries, could offer more flexibility according to the participants. In such areas, exercise balls or desk bikes instead of chairs could be introduced to increase options for more active behaviour. Students specifically wanted greater autonomy in

managing their sitting and standing behaviour, suggesting a need for adaptable classroom designs.

Based on our participants opinions it seems that a strong cultural norm of sitting dominates Maastricht University life, with little emphasis on promoting physical activity. Awareness for this can be increased by offering training opportunities to staff or explanatory videos for students at the start of modules. Our findings show that peers influence openness to alternative formats like standing tutorials. Increasing awareness of the risks associated with prolonged sitting may help management prioritise more dynamic learning environments. Such changes could be framed as investments in both student wellbeing and educational quality.

The inquiry into standing tutorials showed mixed responses. Some students viewed them positively, reporting health and learning benefits, while others were more negative, reporting that two-hour sessions led to discomfort. Many students did appreciate the option to sit less and move around more freely. Acceptance of standing tutorials was neutral to negative, but relatively straightforward actions can be taken to improve acceptance and feasibility of standing tutorials. These include the introduction of a variation in furniture and regular breaks for students.

In summary, students and staff at Maastricht University see the needs for more standing education but see the lack of appropriate educational spaces for more active education and the need for socio-cultural norms change as largest limitations. Students and staff furthermore find it acceptable and feasible to implement standing desks at Maastricht University in a Problem-Based Learning setting and that they have the same opinions in terms of dynamics, learning, health and frequency of activity in the classroom as in more traditional settings. There should be more attention for dynamic posture during standing tutorials (via for instance training programmes) and the educational design of modules using this approach.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by the Research Ethics Committee, Faculty of Health, Medicine and Life Sciences, Maastricht University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

RE: Conceptualization, Data curation, Funding acquisition, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. HC: Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. NP: Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. SW: Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. HS: Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Publisher's note



## Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1626953/full#supplementary-material

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