Sit-Stand Storage Solutions

User Research Report

November 17, 2017

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Prepared for:
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November 17, 2017

James Intriligator
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Dear Professor Intriligator,

We are excited to share our user research report with you. We used our data collection experience to identify important user needs for our design. Specifically, we conducted a literature review, questionnaire, competitive analysis, expert review, and discussion with our client.

In this report, you will find an introduction, a list of our methods, the results from those methods, and a discussion of those results, followed by a list of references and appendices.

We will use our results to motivate our three initial design concepts, which you can expect in our next report on December 8.

If you have any questions, please feel free to contact our project manager, Lexie Kirsch, at akirsc01@tufts.edu.

We look forward to hearing from you.

Sincerely,
Chad and Lexie
Sit-Stand Storage Solutions

INTRODUCTION

Sit-Stand Storage Solutions intends to create a desk with sit-stand and storage functionality to promote collaboration in classroom settings. We are designing this desk for our user group of college students, ranging in age from 17 to 25, because we believe these students are more likely to collaborate on large projects and will benefit most from our collaborative workstation. In order to create design concepts for this station, we must first identify the needs of our users.

The most basic needs are the following functionalities:

- Allow the user to sit.
- Allow the user to stand.
- Allow the user to store projects and materials.
- Allow the user to collaborate with others.

We are also interested in exploring the following themes:

- Work environment preferences.
- Collaboration environment preferences.
- Desk preferences.
- Duration of sitting.
- Desires for breaks from sitting.
- Desires for standing and sit-stand functionality.
- Storage preferences.

In order to explore these user preferences and needs, we conducted user research in the form of a literature review, questionnaire, competitive analysis, expert review, and discussion with our client.

METHODS

SIT STAND SOLUTIONS STORAGE

In order to identify all user needs, we used the following methods: a questionnaire, literature review, competitive analysis, expert review, and discussion with client.

First, we created an anonymous questionnaire using Google Forms to gather information about users' preferences directly. Specifically, we asked our users about our themes of work environment preferences, collaboration preferences, desk and storage preferences, break desires, and thoughts about sitting compared to standing. We distributed this online questionnaire to our college-aged friends and acquaintances, because they represent our user group.

As we waited for responses to our questionnaire, we conducted a literature review to collect background information to motivate our design. We explored sitting workstations, standing workstations, sit-stand products, and environments conducive to collaboration.

We also conducted a competitive analysis and expert review to compare our product concept with similar workstations and to identify the best and worst qualities of these similar designs. We hope to incorporate the best attributes of similar products while avoiding their worst attributes.

We did not conduct a task analysis for the transition between sitting and standing at a desk because that process relies heavily on the design of the station, which has yet to be decided.

Finally, we discussed with a client any other needs, themes, or goals to keep in mind before we start creating our three initial design concepts.

RESULTS

SIT
SOLUTIONS
STAND
STORAGE

Questionnaire

The goal of the questionnaire was to gather information about users' preferences directly. Thirty-two people completed the questionnaire, ranging in age from 19 to 23. Twenty-nine of these responders were students, and three were not.

In addition to questions of demographics (i.e., "How old are you?" and "Are you a student?"), the questionnaire consisted of the following ten questions:

- How often do you work at a desk? (Always, Most of the time, Rarely, or Never)
- When you collaborate with someone else, how do you prefer to sit? (Side by side, At a corner (at a square table), At a round table, Across from them, or Other)
- How many hours do you spend sitting at a desk in class each day? (1-3 hours, 4-6 hours, 7-9 hours, or 10+ hours)
- What do you appreciate in a good desk? (Lots of space, Drawers, Mobility, Legroom below desk, Other)
- Do you get tired of sitting during class? (Often, Sometimes, Rarely, Never)
- Are you familiar with the concept of a sit-stand desk? (Yes I have one, I have heard of it, or What's that?)
- If you had a sit-stand desk, would you use the stand option? (Yes, No, or Maybe)
- If you could (safely) store physical projects or materials in the classroom, would you? (Yes, No, or Maybe)
- Where at a desk would you prefer to store work supplies? (Drawer above my desk, Drawers on the sides of the desk, Drawers on the sides below the desk, or Other)
- Is there anything else you would like to add regarding your work preferences?

In our analysis of results (see Appendix A), we found the following themes:

- Most respondents work at a desk “Always” (28.1%) or “Most of the time” (53.1%).
- Most respondents prefer to collaborate with someone else while seated “Side by side” (50%) or “Across from them” (31.3%).
- Most respondents spend “1-3 hours” (68.8%) or “4-6 hours” (25%) sitting at a desk in class each day.
- Most respondents appreciate “Lots of space” (93.8%) and “Legroom below desk” (71.9%) in a good desk.
- Most respondents get tired of sitting in class “Often” (40.6%) or “Sometimes” (46.9%).
- Most respondents are familiar with the concept of a sit-stand desk (75%).
- If provided a sit-stand desk, most respondents would use the stand option (43.8%) or consider using it (34.3%).
- Most respondents would store materials in the classroom (28.1%) or consider storing them there (46.9%).
- Most respondents prefer to store work supplies in the “Drawers on the sides below the desk” (56.3%) or in the “Drawers on the sides of the desk” (34.4%).
- Finally, one respondent added a preference for desk strength and stability, and two respondents mentioned preferring enough desk space for one or more computer monitors.

Literature Review

The goal of the literature review was to collect background information to motivate our design. We explored sitting workstations, standing workstations, sit-stand products, and environments conducive to collaboration. We read six articles, which we have summarized using bullet points below.

Thorp, A. A., Kingwell, B. A., Owen, N., & Dunstan, D. W. (2014). Breaking up workplace sitting time with intermittent standing bouts improves fatigue and musculoskeletal discomfort in overweight/obese office workers. *Occupational and Environmental Medicine*, 71:11, 765-771. http://dx.doi.org/10.1136/oemed-2014-102348

- Self-report of fatigue is significantly higher amongst sitting participants than those who alternate between sitting and standing every 30 minutes.
- Sitting is associated with significantly more lower back musculoskeletal discomfort, slightly more focus, and less overall work productivity than alternating between sitting and standing every 30 minutes.

Deros, B. M., Senin, N., & Khamis, N. K. (2013). A Study on Ergonomic Workstations for standing operators at a manufacturing factory in Malaysia. *Applied Mechanics and Materials,* 471, 172-177. http://dx.doi.org/10.4028/www.scientific.net/AMM.471.172

- Holding a static standing posture for a prolonged duration can lead to musculoskeletal disorders.
- Common musculoskeletal disorders for standing participants are shoulder pain, leg pain, and upper back pain.

Toomingas, A., Forsman, M., Mathiassen, S. E., Heiden, M., & Nilsson, T. (2012). Variation between seated and standing/walking postures among male and female call centre operators. *BMC Public Health*, 12, 154. http://dx.doi.org/10.1186/1471-2458-12-154

- More and more occupations involve extensive periods of sitting.
    - This primarily affects people between the ages of 18 and 65 who spend a large amount of their wake time at work.
- Extensive computer use is a risk factor for musculoskeletal disorders.

- Public health research indicates that sedentary behavior (extensive seated work) is associated with several potentially serious health problems.
    - Health risks include obesity, hypertension, type II diabetes, metabolic syndrome, venous thromboembolism, cardiovascular diseases, cancer, and increased mortality.
    - Health problems are mainly of a cardiovascular and metabolic nature.
- These health problems persist independent of the individual's physical activity!
- Physical variation is important to break up this sitting time.
- The ergonomic recommendation is that workers should take a break from sitting for at least 5 to 10 minutes every hour.

Deros, B. M., Senin, N., & Khamis, N. K. (2013). A Study on Ergonomic Workstations for standing operators at a manufacturing factory in Malaysia. *Applied Mechanics and Materials*, 471, 172-177. http://dx.doi.org/10.4028/www.scientific.net/AMM.471.172

- Collaborative learning (CL) has numerous benefits and typically results in higher achievement and greater productivity, psychological health, social competence, and self esteem.
- CL promotes positive societal responses to problems and fosters a supportive environment within which to manage conflict resolution.
- CL helps students resolve differences in a friendly manner.
- CL teaches students how to challenge ideas and advocate for their positions without personalizing their statements.
- CL develops higher-level thinking, problem solving, and oral communication skills.
- CL actively involves students in the process of learning.
- CL reduces classroom anxiety created by new and unfamiliar situations faced by students.

Karakolis, T., & Callaghan, J. P. (2014). The impact of sit–stand office workstations on worker discomfort and productivity: A review. *Applied Ergonomics*, 45:3, 799-806. https://doi.org/10.1016/j.apergo.2013.10.001

- Prolonged seated work has been shown to result in increasing worker discomfort with respect to time.
- Adjusting posture at an increased frequency throughout the workday is a proposed strategy used in an attempt to reduce discomfort.
- Sit-stand workstations are effective in reducing local discomfort reported in the low back.
- Sit-stand workstations are associated with increased productivity.
- Ideal wrist position while standing is different than ideal wrist position while sitting.
- Less upper limb discomfort is experienced while standing.

Laal, M., Naseri, A. S., Laal, M., & Khattami-Kermanshahi, Z. (2013). What do we Achieve from Learning in Collaboration? *Procedia - Social and Behavioral Sciences, 93*, 1427-1432. http://doi.org/10.1016/j.sbspro.2013.10.057

- Collaborative learning (CL) increases performance by creating a supportive environment in which members help each other.
- CL increases self-esteem and significantly reduces anxiety in students.
- CL improves class attendance of students.
- CL promotes innovation in teaching and techniques.
- CL improves productivity.
- CL improves the skills of problem solving and higher-level thinking.

Competitive Analysis

In order to differentiate our product from the competition, we felt it necessary to compare and contrast systems currently available on the market. We compared the top four standing desks, as decided by Reviews.com (see Appendix B). The desks were chosen as top performers based on **desk height**, **ease of assembly**, **wobble factor**, and **convenience of conversion**.

Desk Height

It is important that our desk be accessible and usable by people of all shapes and sizes. For this reason, we must take into account the variability of the desk's height. Current top sellers are able to reach at least 48 inches, with a 20-inch sit-to-stand range. This enables ergonomically effective use for people up to 6 feet 7 inches tall. Our product will consider these measurements and even more anthropometric data to ensure comfortable use by all.

Ease of Assembly

Current top products boast fairly pain-free assembly, separating themselves from those products that ship with missing parts, missing assembly tools, or design imperfections that lead to difficult construction. Our product will need to avoid the aforementioned issues and offer seamless assembly in order to gain an edge over the competition.

Wobble Factor

A stable base and wobble-free frame are important qualities of any usable desk. Products that pay attention to simple factors such as these are immediately classified as superior to those that do not. We will ensure that our product employs a stable and wobble-free base to ensure complete user satisfaction.

Convenience of Conversion

Arguably the most important factor of a sit-stand desk is its ability to conveniently switch between functionalities. Most of the top brands we researched utilize electric height adjustments, initiated via buttons located on the underside of the desk. However, some models are adjusted via a mechanical hand-crank or foldable components, so it will be important for us

to determine which designs work best when considering cost, speed, noise, and smoothness of transition.

Final Analysis

Overall, many of the industry leaders incorporate similar designs effectively. The top products offer large work desks, capable of accommodating many projects and items at once. We will be sure to consider similar-sized desktops when designing our product. With regards to electric or mechanical conversion systems, we will consider all possible options during preliminary ideation and conceptualization.

Additional important aspects to consider that were not present in competitive products are mobility and storage capabilities. None of the top products examined utilize a mobile or wheeled base to enable convenient relocation. Similarly, none of the explored products offered any type of storage capability. We will consider incorporating mobility and will be sure to incorporate storage in our design.

Expert Review

We also conducted an expert review by interviewing James Intriligator, who owns and operates a sit-stand station. Our goal for this interview was to identify the best and worst qualities of the sit-stand station since it incorporates similar attributes of our design.

Intriligator obtained his sit-stand station per request. The desk platform is adjustable using buttons on the right side, and these buttons also allow Intriligator to program his height preferences (i.e., a specific height for sitting and a specific height for standing).

Although Intriligator has not used the stand feature of his sit-stand station recently, in the past he would set a timer to remind himself every hour to stand for half an hour. Intriligator noticed that sitting for a prolonged duration would cause grogginess and a hunched posture, whereas standing would sharpen his focus, keeping him more alert, clear-headed, energetic, and less stiff. Standing also made Intriligator feel better because he was familiar with research on how standing burns more calories and is better for circulation. However, Intriligator also noted that it was tiring to stand for a prolonged duration.

The good points of this sit-stand station are the following:

- The height is easily adjustable using the buttons, which store the user's preferences.
- There is a built-in powerstrip.

The bad points of this sit-stand station are the following:

- Standing is better on a mat, but it is a hassle to move the chair and take out the mat, and leaving out the mat interrupts the mobility of the chair.
- There is no incentive or reminder to alternate work positions from the station.
    - I.e., it would benefit from a timer that indicates when to switch positions.
- The powerstrip on the bottom of the desk is only accessible by climbing under the desk. And the wiring would be better located along the legs of the station.
- The desk does not provide storage space, so it is cluttered.
- It is uncomfortable to have a conversation with someone who is sitting while you are standing.

Discussion with Client

Our client, Ryan Koch, is a student at Tufts University who uses a sit-stand station. Before we continue our design process and create our three initial design concepts, we consulted with Koch to identify any other needs, themes, or goals to keep in mind.

He provided the following recommendations:

- It should be easy to move from sit to stand.
- Storage shouldn't interfere with the sit-stand feature or the tabletop real estate.
- Storage should have a lock of some sort if it's in a public space, so only designated collaborators can gain access.

DISCUSSION

The questionnaire, literature review, competitive analysis, expert review, and discussion with client provided us with ample data to both classify our users and inform preliminary design considerations.

Users

Basic demographic data from the questionnaire helped identify user age, while targeted questions sought to reveal characteristics related to specific goals, tasks, and desired usability of an expected product.

Questionnaire data suggests that our target users will be between the ages of 19 and 23, though we can classify them more broadly as college students. More than 75% of those questioned do the *majority* of their work at a desk, and 31% of respondents report spending *four or more* hours sitting in desks in class each day. Additionally, 41% of respondents reported that they *often* get tired of sitting during class. This data, coupled with studies from the literature review that point to health risks associated with extended sitting, motivates the need for a sit-stand desk.

Goals

Our users have a variety of goals when discussing an improved desk environment. They expect a good product to include:

- Lots of desk space.
- Sufficient and safe storage.
- Mobility.
- Ample legroom.
- Adjustable height.
- Accessible power supply.

Tasks

Specifically, our users hope to be able to perform the following tasks:

- Spread out their work to not feel cramped or confined.
- Securely store projects and materials in drawers, preferably on the sides of the desk.
- Move the product.
- Stretch and spread their legs to remain comfortable while sitting.
- Adjust the height of the product to accommodate a sitting or standing position.
- Collaborate with others at the product.
- Access a power supply.

Criteria for a useful and usable product

Based on these goals and tasks, we created the following list of user needs, which we hope to incorporate in our design solution:

- A large desk surface to allow for un-cramped work.
- Desk storage (capable of storing large and small items) with the ability to be locked.
- A mobility feature, such as in a base with wheels.
- Limited under-desk features to allow for ample legroom (we will utilize data from both anthropometric sources and competitive analysis to specify this space size).
- A safe and efficient way to both sit and stand at the desk.
- A means for effective collaboration.
- A power source that is easily accessible.

REFERENCES

Deros, B. M., Senin, N., & Khamis, N. K. (2013). A Study on Ergonomic Workstations for standing operators at a manufacturing factory in Malaysia. *Applied Mechanics and Materials,* 471, 172-177. http://dx.doi.org/10.4028/www.scientific.net/AMM.471.172

Karakolis, T., & Callaghan, J. P. (2014). The impact of sit–stand office workstations on worker discomfort and productivity: A review. *Applied Ergonomics*, 45:3, 799-806. https://doi.org/10.1016/j.apergo.2013.10.001

Laal, M., & Ghodsi, S. M. (2011). Benefits of collaborative learning. *Procedia-Social and Behavioral Sciences*, 31, 486-490. https://doi.org/10.1016/j.sbspro.2011.12.091

Laal, M., Naseri, A. S., Laal, M., & Khattami-Kermanshahi, Z. (2013). What do we Achieve from Learning in Collaboration? *Procedia - Social and Behavioral Sciences, 93*, 1427-1432. http://doi.org/10.1016/j.sbspro.2013.10.057

Thorp, A. A., Kingwell, B. A., Owen, N., & Dunstan, D. W. (2014). Breaking up workplace sitting time with intermittent standing bouts improves fatigue and musculoskeletal discomfort in overweight/obese office workers. *Occupational and Environmental Medicine*, 71:11, 765-771. http://dx.doi.org/10.1136/oemed-2014-102348

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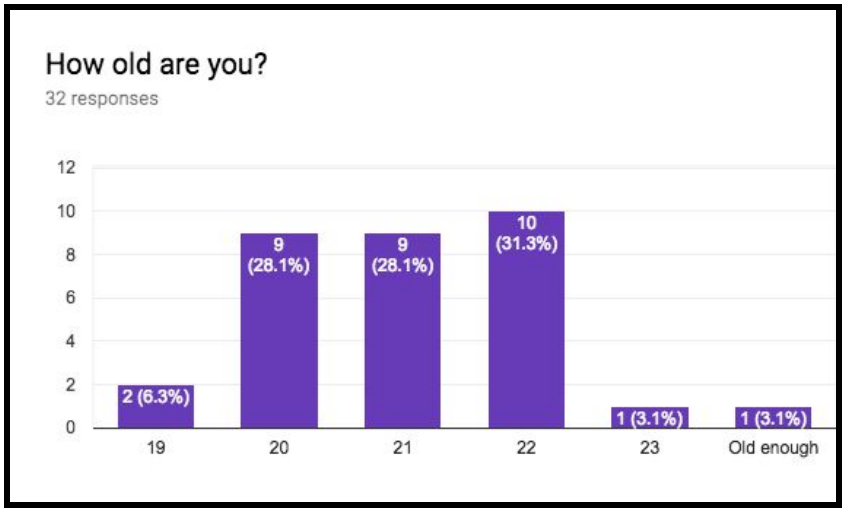
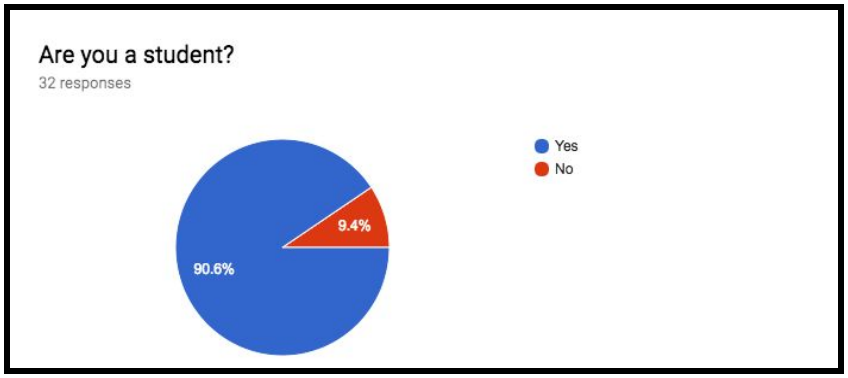
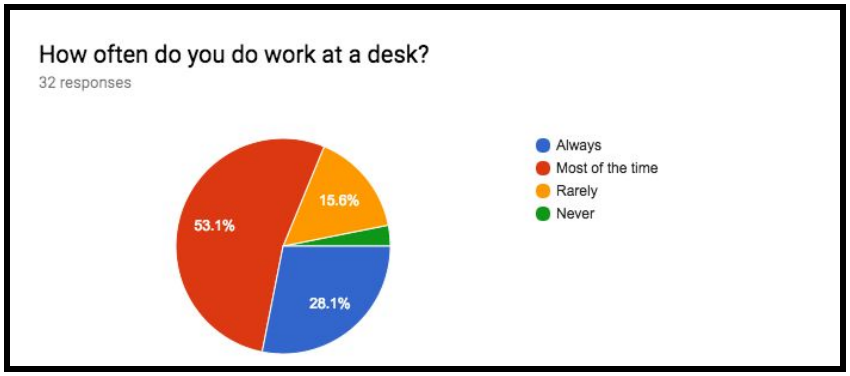
APPENDIX A

Questionnaire response data



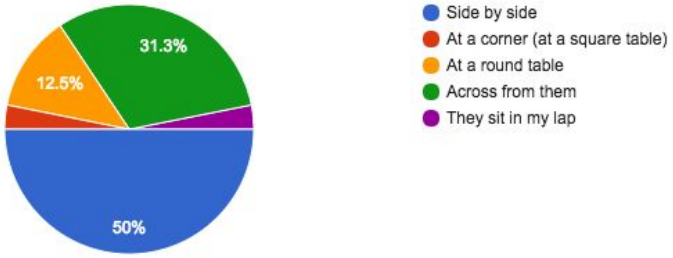




SIT STAND STORAGE SOLUTIONS

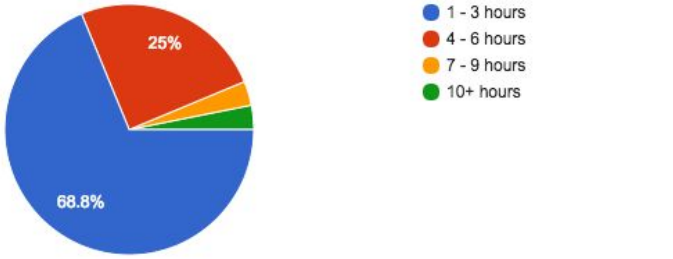
When you collaborate with someone else, how do you prefer to sit?

32 responses



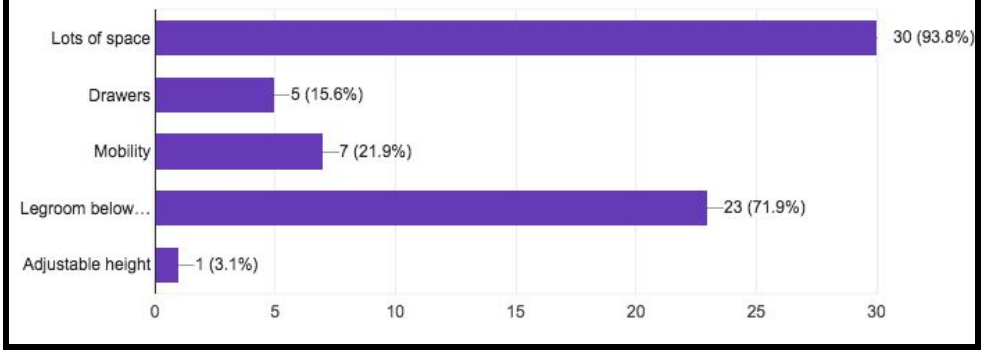
How many hours do you spend sitting at a desk in class each day?

32 responses



What do you appreciate in a good desk?

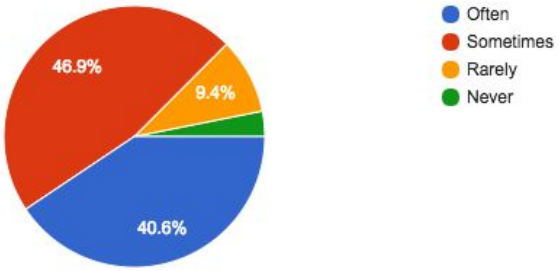
32 responses



SIT STAND SOLUTIONS STORAGE

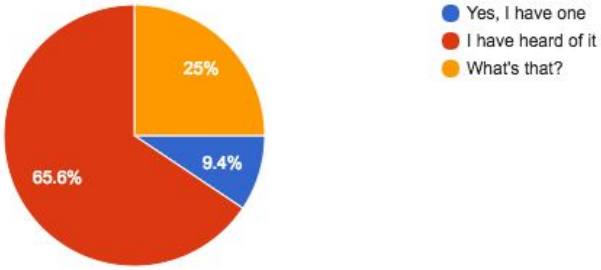
Do you get tired of sitting during class?

32 responses



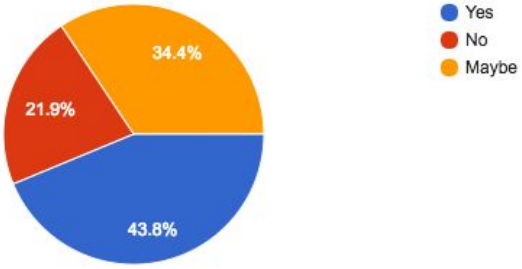
Are you familiar with the concept of a sit-stand desk?

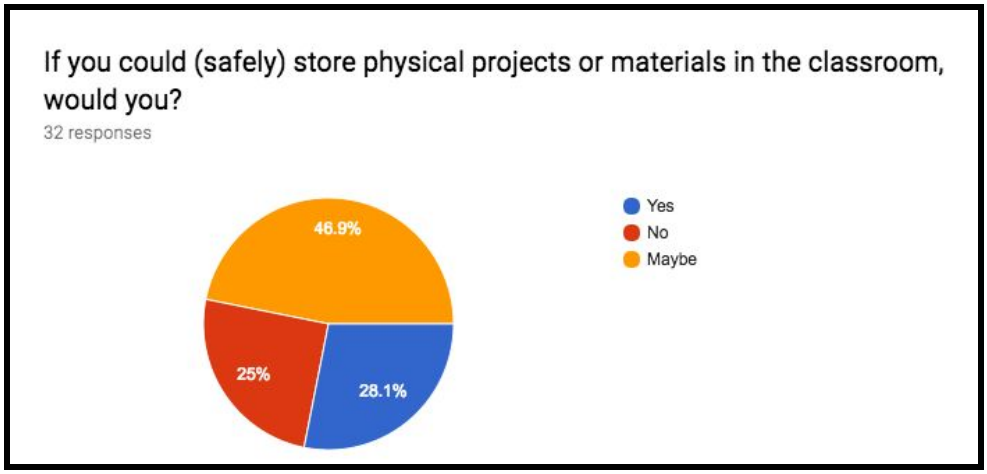
32 responses

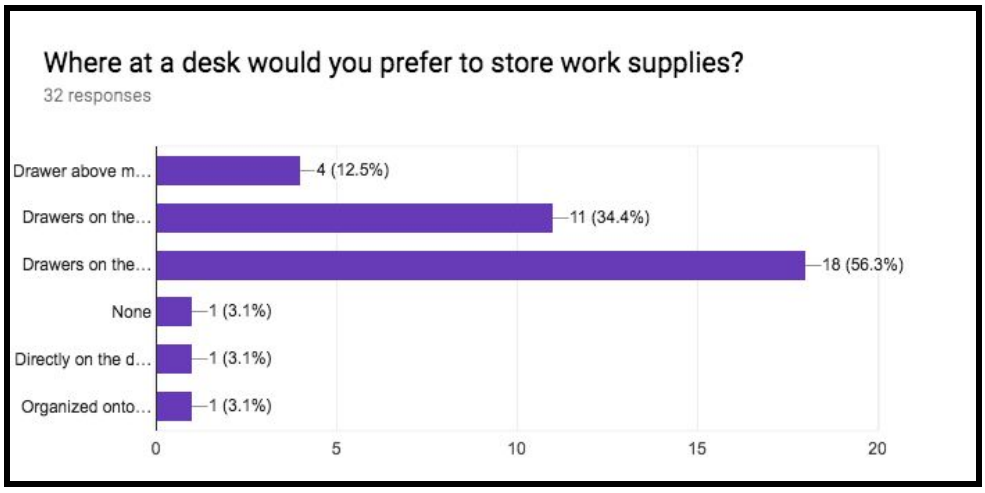


If you had a sit-stand desk, would you use the stand option?

32 responses




If you could (safely) store physical projects or materials in the classroom, would you?
32 responses
46.9%
25%
28.1%
Yes
No
Maybe


Where at a desk would you prefer to store work supplies?
32 responses
Drawer above m...
Drawers on the...
Drawers on the...
None
Directly on the d...
Organized onto...
4 (12.5%)
11 (34.4%)
18 (56.3%)
1 (3.1%)
1 (3.1%)
1 (3.1%)
0
5
10
15
20

APPENDIX B

Source: https://www.reviews.com/standing-desk/

Best Overall

Fully Jarvis Bamboo Adjustable Height Desk

A reasonably priced desk that is more furniture than office fixture.

Starting at $435

Runner-Up Best Overall

Uplift Height Adjustable Sit Stand Desk

Nearly dollar-for-dollar and feature-for-feature with the Jarvis, but not quite as lovely to work at.

Starting at $495

SIT STAND SOLUTIONS STORAGE

Best Large Desk on a Budget

ApexDesk

A roomy desk that's $100 cheaper than comparable sizes from our top picks.

$600 on Amazon

Best Small Desk on a Budget

The Stand Up Desk

A two-tiered desk with a handcrank. The wobbliest of our picks, but also the cheapest.

$330 on Amazon