Stretch-a-little

Take a break from your computer

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1 INTRODUCTION

Modern work and education environments encourage long periods of sitting, which has many side effects like premature death, cardio-metabolic disease, type 2 diabetes, obesity, coronary artery disease, musculoskeletal disorders, and some types of cancer. It is important to notify the users to take regular breaks based on their preferences to help promote a healthy lifestyle and improve their overall productivity and well-being. Our desktop application, Stretch-a-Little's aim is to help address a few problems given by this sedentary modern lifestyle by encouraging users to take regular standing breaks throughout their workday. The end users are diverse and include office workers, students, gamers, remote workers/freelancers, people with sedentary lifestyles.

Primary Hypotheses: The users using the Stretch-a-little application will perceive a greater ease-of-use and control over notification frequency, resulting in overall higher level of satisfaction of using the application. In other words, the users will feel they have more control over their breaks and will lean toward taking breaks when compared to the existing system, Workrave.

Primary Null Hypotheses: There will be no significant difference in the perceived ease-of-use and control over notification frequency, and overall satisfaction of using Stretch-a-Little application and Workrave application.

Secondary Hypotheses: a) Users who customize their standing break preferences and receive regular prompts using Stretch-a-Little application will exhibit better adherence to standing breaks tracked and measured based on the survey users fill in after using each application.
b) The users will show a significantly lower level of reported fatigue or discomfort when using the Stretch-a-little application when compared to Workrave.

Secondary Null Hypotheses: a) There will be no significant difference in adherence to standing breaks between users who customize their preferences using Stretch-a-Little and Workrave applications.
b) There will be no significant difference in the reported fatigue or discomfort when using the Stretch-a-Little and Workrave applications.

2 INITIAL DESIGN

Our design is a desktop application designed to encourage users to take regular breaks during their work. It sends users notifications to stand up, providing customizable options for more user-friendly and personalized experience. The user interviews and surveys, user-centered design principles and existing solutions combined with our research factored the initial and final design elements and features.

We included two main features in our design: a more friendly interface with user personalization and quick basic stretches for the users to do. The main feature is to have more user-friendly interfaces that give users the control to receive the notifications based on their preferences and personalization rather than setting some fixed schedule. This helps encourage a better lifestyle by giving users a greater sense of control over the application and their work-life balance. For a more interactive and user-friendly approach, the users can easily edit their preferences and receive notifications as they like.

The second main feature we included is a few basic stretches along with the instructions to perform them to help improve their active lifestyle. We have also included few articles related to the stretches. The combination of these features is not being offered in the applications available today. Another unique feature we included in our initial interface is the "read" notification that tells the users to stand up based on the set goal.

Considering the user interviews and our research, we created a high-fidelity prototype that represents the final product. After our initial design presentation, our design was appreciated and the feedback we received was very positive with a few suggestions to improve the design. Reviewers noted that our design could benefit from more organization and hierarchy, suggesting that we should separate the notification type from the stretch and improve the interaction. Also, while editing the schedule, the reviewers noticed navigating to multiple screens was redundant as the purpose was same i.e., editing the preferences. Additionally, there were questions about how the articles connected to the stretches and whether they would be sent with every stretch notification. We decided to improve our design based on the feedback we have received. We have finalized our design based on the feedback and made the above-mentioned updates to our design. [Fig.1] shows the initial login page the users see upon opening the applicatinon. The final design is discussed in detail in the next section.

Figure 1 – Home screen with Signup and Login options

3 SYSTEM

The desktop application prompts the users to take a break and stretch for a minute based on their preferences. Our final design implementation closely matches our high-fidelity prototype. Though the overall feedback we received was very positive, we decided to include the improvement points for a better design and user-experience.

All the screens are similar to the prototype with a few minor tweaks in some screens. The initial/home screen has two options for the users to choose from Signup (for first-time users) and Login (existing users) [Fig 1]. Upon clicking Signup, the users will be asked to fill in a registration form with their First Name, Last Name, Email address, Password and confirm Password (serve as their login credential and store customization preferences), Gender (options- Female, Male, Other). Two buttons – Back and Signup will let the users go to the previous screens and complete their registration respectively [Fig 2].

Upon signing up, the users will be able to see the Welcome screen and have two options – Set up Custom Settings or Set up Later. The Set up Custom Settings will allow the users to customize their preferences and the Set up Later will let them use the default settings of the application (discussed in the later part of the section). [Fig. 3].

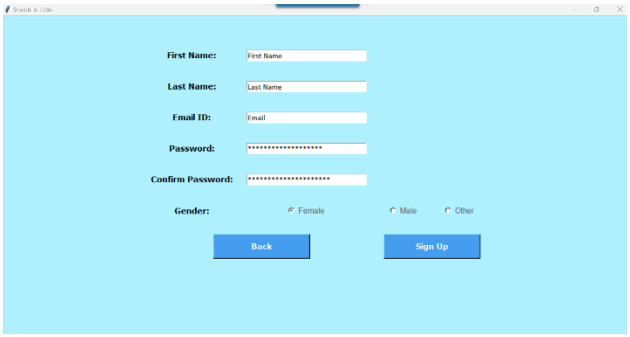

Figure 2 – Signup registration form with Back and Signup buttons

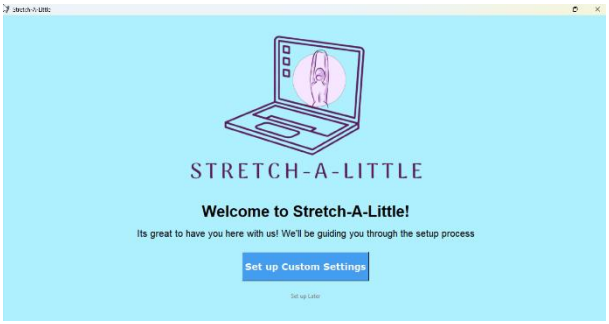

Figure 3 – Welcome page with Custom and default settings buttons

Upon clicking the Set up Custom Settings button, the users will have to enter their custom preferences – their work schedule period [Fig. 4], their individual workday start and end time (HH:MM – 24-hour formatHHH), along with their notification frequency/interval. The users have 15, 30, 45, 60 minutes as options to choose from the drop-down [Fig. 5].

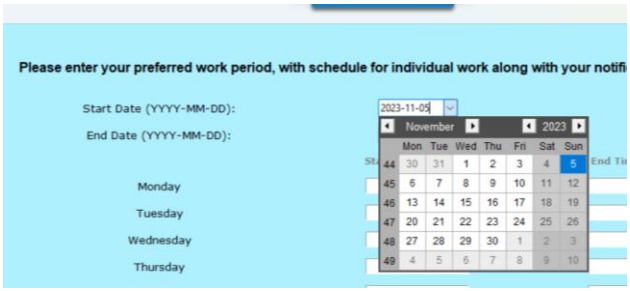

Figure 4 – Work schedule period using calendar

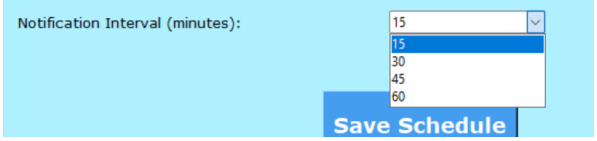

Figure 5 – Notification interval dropdown options

The users can then opt-in for voice prompts by checking the check-box. Upon clicking the Save Schedule button [Fig. 6], the users schedule will be saved in the database.

Figure 6 – Setup Custom Settings screen with Save button

The user will receive feedback from the system stating their schedule has been save successfully [Fig. 7] and will be led to the Main screen. Here, the users also have a Log out button on the top right which lets them log out of the application and be routed to the Home page [Fig. 1] where they can Login again by clicking the Login button.

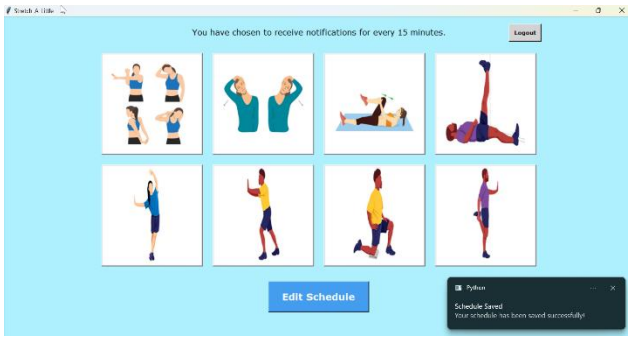

Figure 7 – Main screen with system feedback on saving the schedule

Upon clicking the login button, they will have to enter their credentials [Fig. 8], which upon verification will lead the user to the Main screen with their set preferences [Fig. 9].

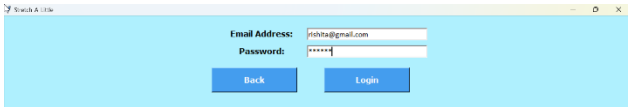

Figure 8 – Login screen to enter credentials

On the top of the Main screen, the users will be able to view what their notification interval preferences are. They are also able to view 8 different basic/easy stretches to perform at home or in the office setting [Fig. 9]. Upon clicking on the stretches, a new window pops up with the steps to do the stretch along with an article to read more about the stretch if interested [Fig. 10] [Fig. 11].

When the user selected interval is up, the user receives a notification (voice prompt too if selected) to stretch for a minute [Fig. 12]

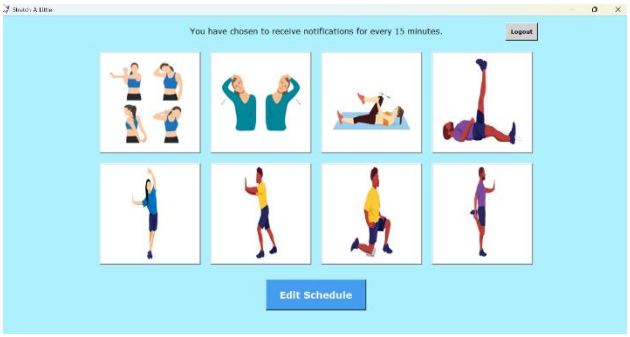

Figure 9 – Main screen after Logging in with the credentials

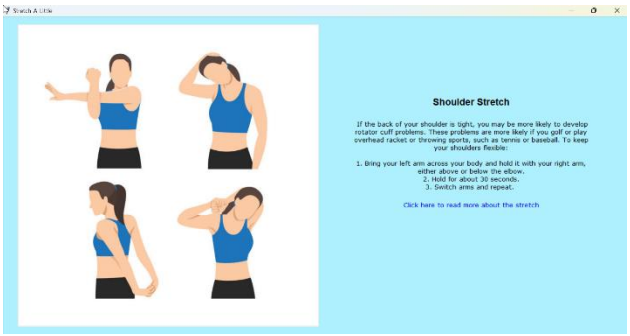

Figure 10 – Steps to be followed to perform the stretch

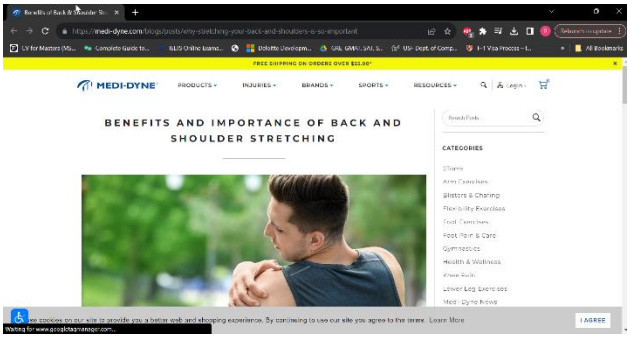

Figure 11 – Upon clicking the link, stretch related article opens in browser

On the same screen, the users also have a button to Edit Schedule, which lets the users to edit their preferences and work schedule [Fig. 13]. Upon clicking the Save Schedule button, the user will be directed to the Main page with their new preference being displayed [Fig. 14].

Now, if the user, upon signing up, chooses Set up Later, the below default settings will be applied [Fig. 15].

Start date – 2023-11-15 (for instance)
End Date – 2200-12-31
Monday – Friday – 09:00 – 18:00
Notification Interval – 60 minutes
Voice Prompts – Uncheck (doesn't receive them)

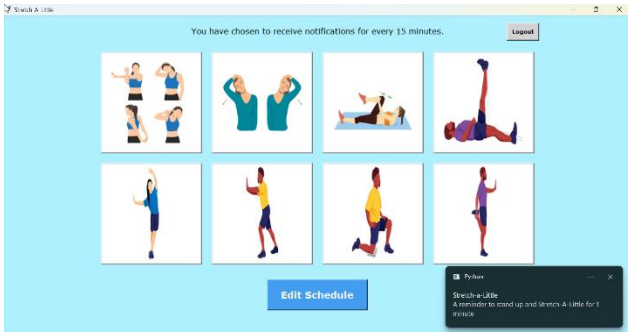

Figure 12 – Desktop notification prompting the user to stretch for a minute

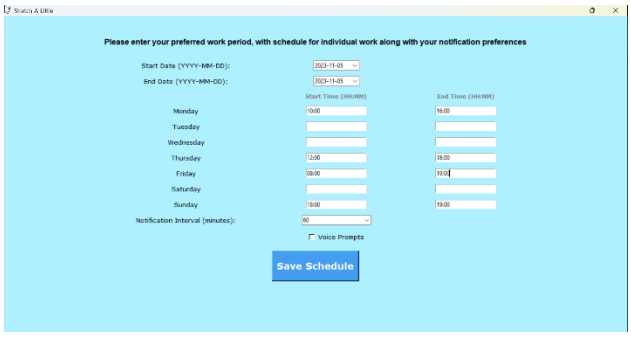

Figure 13 – Edit Preferences screen

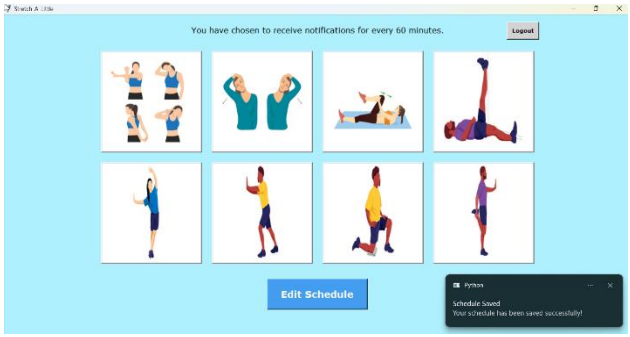

Figure 14 – Edited preference reflecting on the Main screen (15 minutes to 60 minutes)

The Main screen remains the same for the default setting, with the basic 8 stretches, edit preferences button and the Log out button. The user can edit their preferences using this button in the process similar as outlined above and the users will be receiving the notifications or prompts with the default setting unless modified.

3.1 Front-end:

The front-end interface is built using Python Tkinter library for a more consistent design with a robust and user-friendly graphical user interface. Different components like frames, labels, entries, buttons, grids, pop-up windows along with custom formatting features like width, height, color, font, font size, font weights are used to build. Grid is especially used to enforce a structured format for the signup and login forms.

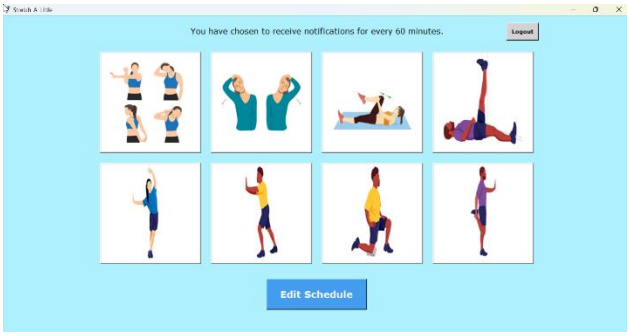

Figure 15 – Main screen with default setting

These components allowed a more structured and appealing interface for the application and maintain consistent color coding and format across the interfaces. Few libraries have also been used for some front-end components. More details on the libraries used is in the later part of the section.

3.2 Back-end:

SQLite database is used as the backend to store and update the data related to the users and their preferences. Python is used to implement the backend logic. The SQLite3 module in python is used to connect to the SQLite database and handle the database operations. The operations like Create, Update and Retrieve as performed on the different tables in the database. Three tables – users, user_schedule and day_schedule are the tables being created and utilized to store and retrieve the user details and preferences. To check and validate the database, its tables, their schema and records, the DB Browser for SQLite was installed and used. This is to help identify if the tables are being populated as expected.

3.3 Database schema:

Three tables have been implemented in the database schema to store the user details and their preferences.

Users: This table stores the user details like the first name, last name, email address, password and gender. This enables the application to differentiate the users and store and retrieve their preferences from the other 2 tables.

User_schedule: This table stores a part of the user preferences – Start date, end date, notification interval and voice prompt options. This table also has a field, user_id, from the Users table to map the user and their preferences.

Day_schedule: This table stores the individual workday schedule with the start time and end time. This table also has columns for the user_id and schedule_id to store and map the individual workday preferences for the users in the user and user_schedule tables.

Below is the illustration of the table schemas

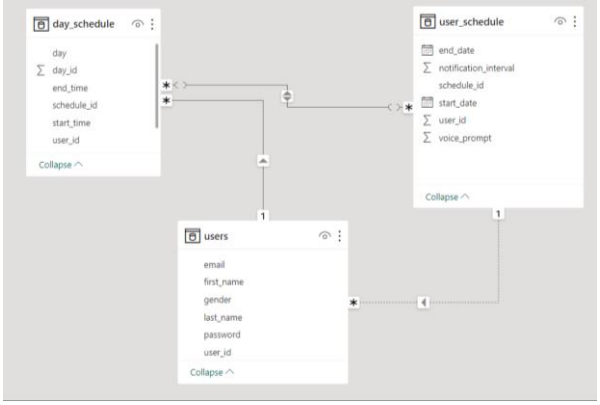

Figure 16 – Database schemas

3.4 Tools and libraries for the project extension and replication:

Python: For both front-end and back-end implementations

Tkinter: For the creation of Graphical User Interface of the desktop application and to use different the front-end components like label, entry, etc.

PIL/Pillow: The PIL (Python Imaging Library) is installed to use the images (logo and stretches)

Tkcalendar: Installed this library to use the calendar in the Start Date and End Date while entering the schedule

Notification from *Plyer:* Installed this library to send desktop notifications

Pyttsx3: Installed this library to send voice prompts. This library is for text-to-voice conversion

Webbrowser: To open the stretch related articles in web to let the users learn more information about them

SQLite3: Used this in python for seamless integration with the SQLite database

VSCode (Visual Studio Code): IDE used to code

DB Browser for SQLite: The application to check and interact with the database, its tables and records

All the above-mentioned libraries and modules are to be installed to be able to implement and replicate the project.

4 EVALUATION

4.1 Method

4.1.1 Participant Procedure

Our evaluation method was be divided into two parts. Firstly, the participants have agreed to participate in the questionnaire. There were no children under 18 years [Fig. 17] and no consent was needed from the parents or guardians. For the first part of the evaluation, the participants interacted with the two interfaces to assess them. As planned previously, to balance out the data and any biases, half of the participants ran the existing system first and the remaining half ran our proposed system first and then the other one. The participants interacted with the systems for 2 hours each by setting up their personalized preferences and performing their day-to-day activities. In the next part, after interacting with each system, the participants filled out a questionnaire by answering some questions regarding their experience using the applications and over-all experience.

4.1.2 Equipment

The participants only needed a Windows laptop or computer with internet access to download the desktop applications, use them and continue their work.
Upon interacting with the interfaces, the users filled out the questionnaire online provided by us, by using either a mobile phone or a computer.

4.1.3 Location

Most of our participants participated in the study on campus, based on a previously agreed time when approached on campus or virtually. We provided them with the applications details, relevant documentation and provided them with the survey link to fill out post using the applications. Few of our participants participated virtually, interacted with the applications and filled out the survey virtually through MS Teams.
This flexibility empowered participants to select a time and location that suits them, thus alleviating any undue stress or pressure.

4.1.4 Time

Every participant had to allocate approximately 4 hours and 15 minutes for the entire process. During this time, 4 hours was dedicated to using both the applications (2 hours for each application), followed by the subsequent 5 minutes each devoted to complete the questionnaires (10 minutes in total for both). We had a buffer of 5 minutes for the participants to take a break after interacting with one interface and filling out the first questionnaire before moving on to the next one. Though the time for the study took around 4 hours and 15 minutes per participant, it had little to no impact on their daily activities, as setting up the custom settings took less than 5 minutes and the users proceeded with their work and breaks, and interacted with the system when prompted, based on their preferences. We emphasized the significance of immediate feedback, which is why we encouraged participants to engage with the applications first.

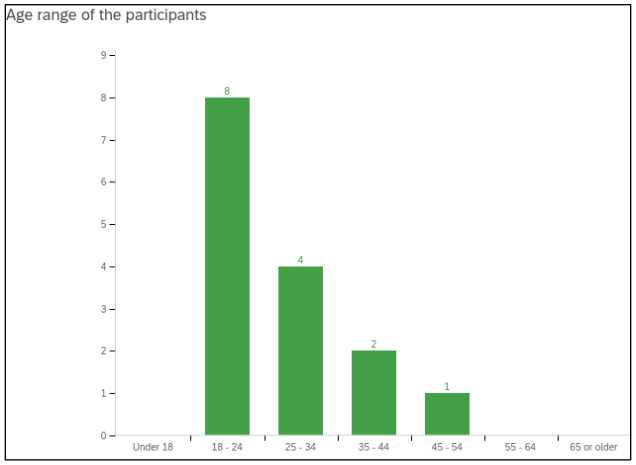

Figure 17 – Age range of participants

4.2 Participants

We employed a convenience sampling technique to select our participants. We approached our target audience in person in campus buildings like libraries, dining spaces and among classmates. Additionally, we chose our target audience among our friends who are employed in the IT sector. We provided them with all the details of our study. Upon determining a time that worked well for both for the evaluation, we conducted the evaluation immediately when the participant expressed willingness and had time. We included participants from different age groups and gender to foster a diverse range of perspectives. We recruited a total of 15 participants visiting the USF campus and reaching out to our friends to gather a wide range of feedback. No specific skills were needed to take part in our study.

Of the 15 participants, 7 were male, 7 were female and 1 participant wished not to disclose their gender [Fig. 18]. Majority of the participants were (around 53%) of the age group 18-24 and the next highest group were 25-34 [Fig. 17]

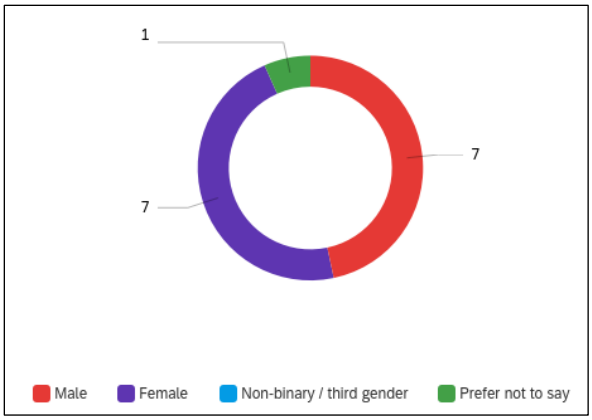

Figure 18 – Gender distribution of participants

4.3 Results

Based on the survey results collected and our statistics, below are the conclusions:

1. Our proposed solution showed more satisfaction to the customization options provided when compared to the existing solution
2. The participants adhered to the breaks more while using the proposed solution when compared the existing solution
3. The participants demonstrated less reported fatigue or discomfort using our proposed solution when compared to the existing system
4. Using our proposed system, the participants performed stretches more frequently and found them more effective when compared to using the existing system
5. The overall satisfaction rate of our proposed solution, Stretch-a-Little was higher when compared to the existing solution, Workrave

4.4 Statistics

Using the results of the online survey, several statistics were gathered and a few deductions were made for each of the application being run and used. Firstly, the participants were asked to customize their preferences when using the applications, if needed. It was noticed that few participants felt it was very difficult to understand and even use the customization options provided in the existing system, Workrave when compared to the proposed system, Stretch-a-Little and were not satisfied with the provided options. [Fig. 19 and Fig. 20] show if the participants used the customizations or not and [Fig. 21 and Fig. 22] show the participants satisfaction level of the customization ootions for the existing system and proposed system respectively.

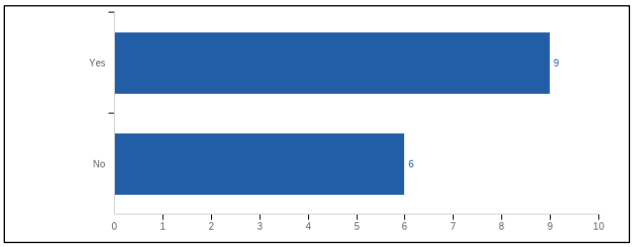

Figure 19 – Participants response to whether or not they used the customization when using the existing system

It was also noticed that when the users used the proposed solution, majority of them complied better with the breaks [Fig. 23 and Fig. 24] and stretching session [Fig. 25 and Fig. 26] when prompted by the system than when compared to the existing solution. Also, based on the data provided by them, it was also noticed at least half

of the participants did not like the stretches or the application was complicated to understand, which led them to skip the stretching session and not use the personalization as preferred by the participants. Additionally, based on their responses, it was also seen that the stretches provided were effective and the stretch-related articles were quite insightful for a few users (see Appendix for the user response data).

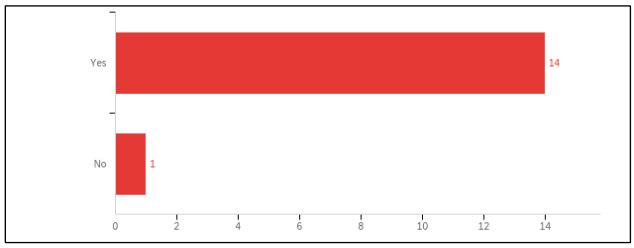

Figure 20 – Participants response to whether or not they used the customization when using the existing system

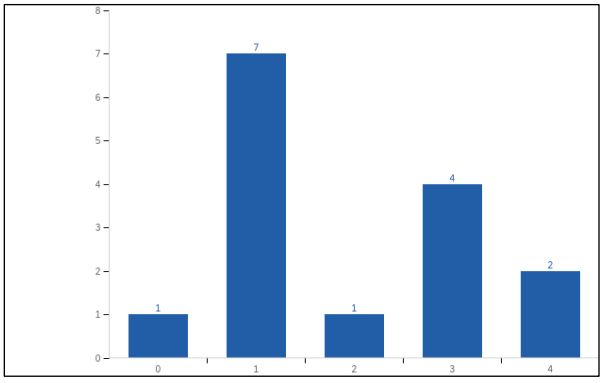

Figure 21 – Participants degree of satisfaction with customization options provided for the existing system (0 being not satisfied to 5 being fully satisfied)

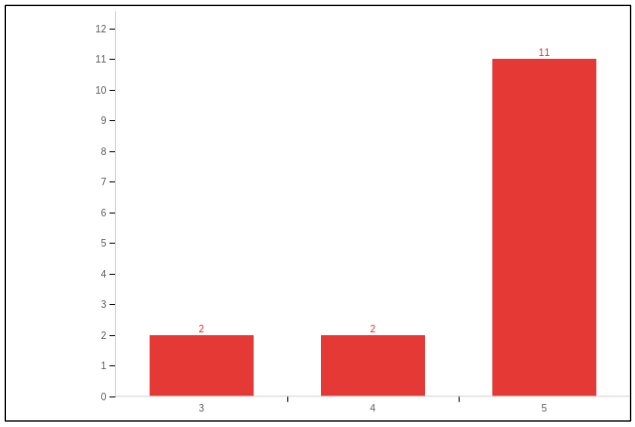

Figure 22 – Participants degree of satisfaction with customization options provided for the proposed system (0 being not satisfied to 5 being fully satisfied)

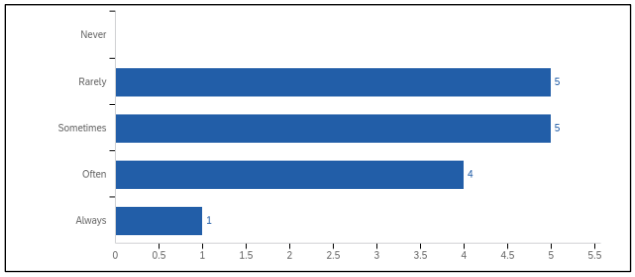

Figure 23 – Participants response to the frequency of complying to the breaks prompted by the existing solution

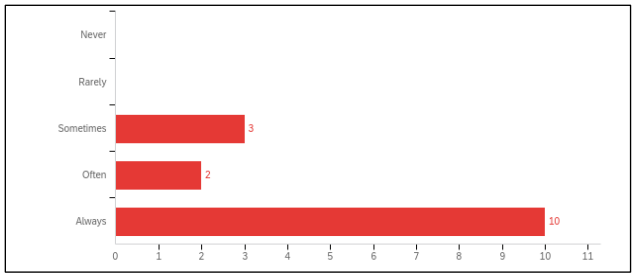

Figure 24 – Participants response to the frequency of complying to the breaks prompted by proposed solution

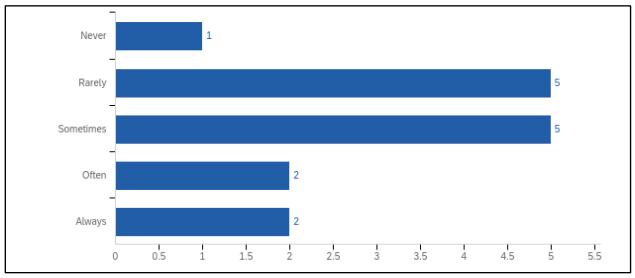

Figure 25 – Participants response to the frequency of completion stretching sessions as prompted by existing solution

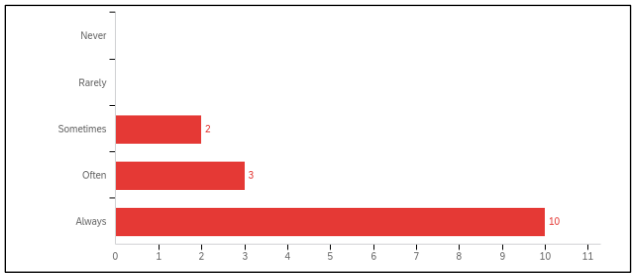

Figure 26 – Participants response to the frequency of completion stretching sessions as prompted by proposed solution

From [Fig. 27], it can be seen that the level of fatigue or discomfort faced/reported by the users while using the existing system is more when compared to that of the proposed solution [Fig. 28]. We can see that around 12 of them reported their level of fatigue or discomfort to be 3 or above and while using the proposed solution, 7 of them reported it to be 1 or 0, which is quite a low when

compared to that of the existing solution. Here, 0, indicating No fatigue or discomfort gradually increasing to 5, indicating extremely higher level of fatigue or discomfort.

[Fig. 29 and Fig. 30] show the level of satisfaction of the participants with the ease of use of the applications and interface. It can be seen that majority of the participants were dissatisfied with the existing solution where 2 of them gave it a rating of 0 and 4 of them gave it a rating of 1 where as for the proposed solution, 7 and 5 of the participants gave it a rating of 4 and 5 respectively. Here, 0 being extremely dissatisfied to 5 being extremely satisfied. Looking at the statistics, the major takeaway is that the users felt less fatigued as they took their breaks in a timely manner and felt extremely satisfied with the customization options and the application as a whole with our proposed solution.

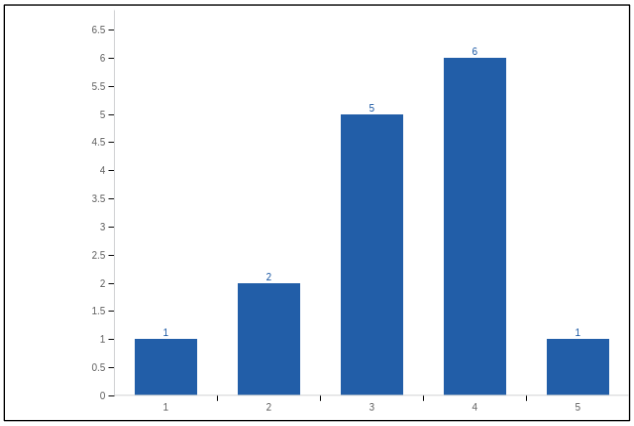

Figure 27 – Participants reported level of fatigue or discomfort while working when using the existing solution (0 being no fatigue or discomfort to 5 being feeling extremely fatigued or discomforted)

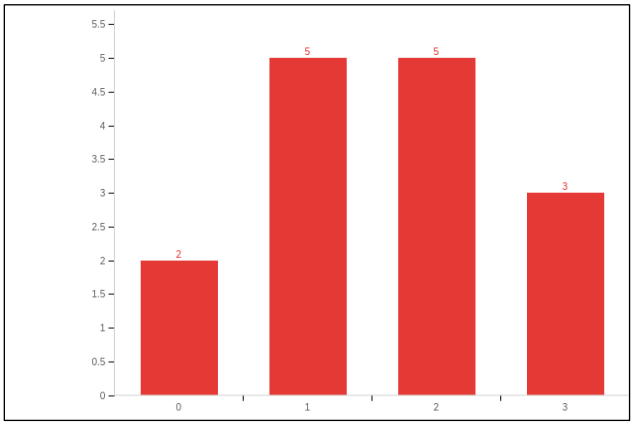

Figure 28 – Participants reported level of fatigue or discomfort while working when using the proposed solution (0 being no fatigue or discomfort to 5 being feeling extremely fatigued or discomforted)

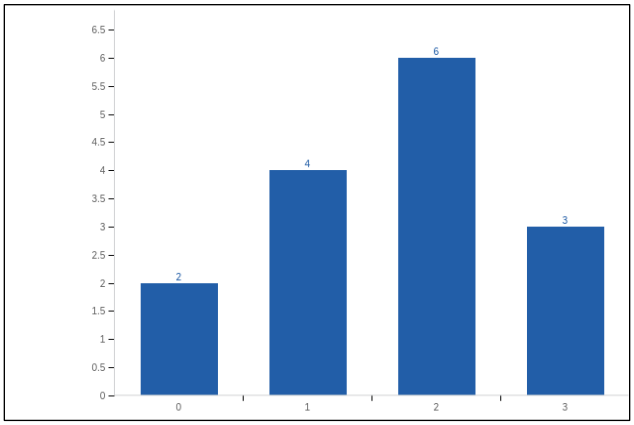

Figure 29 – Participants degree of satisfaction using existing solution (0 being not satisfied to 5 being fully satisfied)

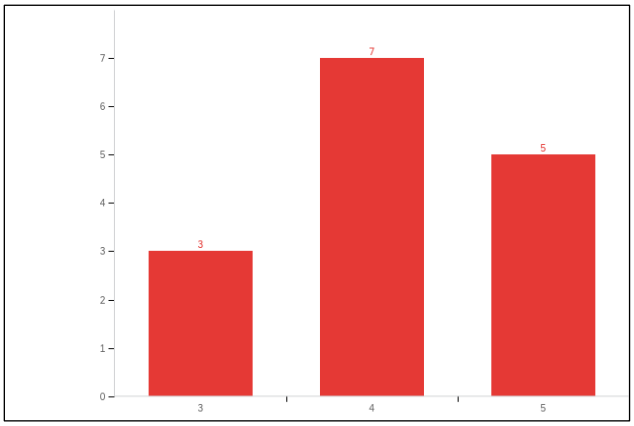

Figure 30 – Participants degree of satisfaction using proposed solution (0 being not satisfied to 5 being fully satisfied)

Furthermore, a paired two-sample t-test was performed to determine if the users perceived a greater ease-of-use and control resulting in overall higher level of satisfaction when using the proposed solution (primary hypothesis) [Fig. 31]. As $p = 0.000001118$ (<0.05), we accept our hypothesis and reject the null hypothesis, concluding that our solution did give the users a higher level of overall satisfaction including a greater perceived ease-of-use and control over the notification frequency and ultimately the application.

Additionally, 2 more paired two-sample t-tests were performed to check our secondary hypotheses – if the users adhered to breaks better when using our solution and if the users reported lesser levels of fatigue or discomfort when using our proposed solution [Fig. 32 and Fig. 33] respectively. From the results, we reject our secondary null hypotheses and accept our secondary hypotheses ($p = 0.000863555 < 0.05$ and $p = 2.38E\text{-}06 < 0.05$). While evaluating if the users experienced any reported fatigue, as the user responses were not quantitative, we converted them to quantitative responses

by assigning values to each option. The legend details are in [Fig. 32], where we indicated what each user response corresponds to its quantitative equivalent value for evaluation. Hence, we conclude that our solution allowed the users to have control over their notification frequency coupled with an appealing and easy to understand interface resulted in higher user satisfaction and better compliance with their scheduled breaks and stretching.

Question: How satisfied are you with the overall user interface and ease of use of the application?

Participants	Current	Proposed
1	0	5
2	2	4
3	2	4
4	2	4
5	1	3
6	1	4
7	0	5
8	2	3
9	2	4
10	3	5
11	1	5
12	1	3
13	2	4
14	3	5
15	3	4

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	1.666666667	4.133333333
Variance	0.952380952	0.552380952
Observations	15	15
Pearson Correlation	-0.032826608	
Hypothesized Mean Difference	0	
df	14	
t Stat	-7.667555741	
P(T<=t) one-tail	0.000001118	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.000002236	
t Critical two-tail	2.144786688	

Figure 31 – T-test performed to find if our system and interface resulted in overall higher level of user satisfaction

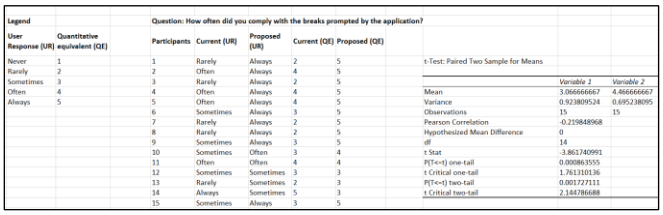

Figure 32 – T-test performed to find if our solution resulted in better break compliance by the participants

Question: Rate the fatigue or discomfort you faced during your work hours when using the application

Participants	Current	Proposed
1	3	2
2	4	1
3	5	3
4	3	0
5	4	2
6	2	1
7	3	1
8	4	2
9	3	2
10	2	2
11	4	3
12	4	3
13	1	0
14	3	1
15	4	1

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	3.266666667	1.6
Variance	1.066666667	0.971428571
Observations	15	15
Pearson Correlation	0.603462958	
Hypothesized Mean Difference	0	
df	14	
t Stat	7.17430054	
P(T<=t) one-tail	2.38E-06	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	4.75134E-06	
t Critical two-tail	2.144786688	

Figure 33 – T-test performed to find if our solution resulted in lower level of reported fatigue or discomfort

5 DISCUSSION

Our findings indicate that our proposed system enhances participants' motivation to adhere to stretching routines when utilizing the application. Our experiments show that users are satisfied and found our proposed solution more useful when compared to the existing solution. Survey responses in Q4 and Q5 highlights users' high satisfaction with the customized system options, including its straightforward setup processes and effectively management notifications. On the other hand, the results obtained in Q6 and Q7 show that our proposed system encourages users to comply with rest periods and stretch periods. These are aligning with our anticipated outcomes and facilitating effective body stretching and relaxation.

Finally, our hypotheses were proved right based on the survey questions Q6, Q13, and Q16, where the users complied better with the breaks, reported lesser fatigue and found a higher level of satisfaction when using the proposed solution. This is also backed by the T-test performed and discussed in the previous section. Thus, we can say that everything went well and according to the plan.

5.1 Expected Outcomes

From the very beginning of the project, we had a clear picture on what needs to be done and how it needs to be done. Our proposed solution – planning and design included many factors including the user surveys and requirements gathering, research on the existing solutions and other design-related guidelines along with the class critiquing on our initial design. The overall feedback received was very positive with quite insightful suggestions which were included in the final design and evaluation. Our evaluation results showed that our proposed solution was indeed what the users expected and delivered.

Emphasizing further on the stretch-related articles, we found that most of the existing trackers/reminders only remind people not to sit too long, rather than informing them of the health risks. Though the Apple watches and Fitbits allow user customization, tracks user activity and also lets users receive notifications to inform them to stand up but doesn't provide any insights on why that is helpful [1]. Bort-Roig el [2] stated that extensive occupational sitting is associated with an increased risk of cardiovascular disease, type 2 diabetes, and musculoskeletal disorders. These have been our motivation to include the health-related articles, which have been proven useful to and by the users based on our survey results. Survey questions Q11 [and Fig. 8b] and Q12 showed that the health-related articles in the app were indeed useful for most of the users and helped increase awareness among them. It reminds the user of the importance of health and can deepen the user's enthusiasm for stretching and will contribute to increased user engagement and motivation to adopt a healthier lifestyle. This was another known and expected outcome of the study.

5.2 Unexpected Outcomes

Though everything went as expected and according to the plan, there were a few issues faced by the participants while evaluating the system. Most of the participants took a lot of time to understand the existing system, Workrave, including trying to identify how to navigate to the customization options which was not expected. Few participants faced difficulty in understanding what the different options were in the existing system, as they felt the interface was

not user-friendly. These issues were resolved by asking the participants to go through the official documentation made available to them in the email sent with the test steps along with the survey links. When evaluating and discussing the proposed solution, we received very valuable feedback from one of the participants to include an option for a larger font in the application to further help the users with limited accessibility. As this could not be implemented immediately, the valuable and unforeseen insight helped us have a more progressive outlook on the projects being developed along with helping us understand there is always room for improvement no matter how good or user-friendly the system and application is. This unexpected yet insightful feature could be included as a part of the future work.

Finally, the feedback provided by the 15 participants revealed a unanimous absence of complaints about the proposed system. All participants expressed satisfaction, citing the system's convenience and appreciating the user-friendly design of the interface. It's worth noting that the high satisfaction results might be attributed to the relatively small number of participants involved in the study.

6 CONCLUSION AND FUTURE WORK

The paper outlines the findings of our evaluation of the proposed solution, Stretch-a-Little. We surveyed the participants on their experience using both the existing system, Workrave and our proposed system. Comparing the two, we concluded that the users feel more in control, complied better with breaks resulting in lower levels of reported fatigue, stretched better and found the stretch-related articles insightful when using our solution. Additionally, the overall satisfaction rate was higher for our solution when compared to the existing one.

As a part of the future work, security measures need to be prioritized to enhance the overall integrity and trustworthiness of the system, as the applications could be installed on work systems and could make them vulnerable to malicious attacks if proper measures are not taken. Furthermore, more research can be done to include additional features to enhance the application for the people with limited accessibility. The application could be expanded to support multiple platforms/operating systems, as it only supports Windows systems for now. Additional user surveys and feedback could be collected as the user interface enhancement process is essential, and refinement of the existing features could make the application more user-friendly.

Thus, we can conclude that the using the Stretch-a-Little application might not solve all the issue by the sedentary lifestyle, but it could be a small step towards a healthier lifestyle by prompting the users to take regular breaks and improve their physical and mental health ultimately their overall well-being.

REFERENCES

[1] Andrew Miller. 2013. *Fitness trackers*. XRDS 20, 2 (Winter 2013), 24–26.
DOI: https://doi.org/10.1145/2543611

[2] Judit Bort-Roig, Anna Puig-Ribera, Ruth S. Contreras, Emilia Chirveches-Pérez, Joan C. Martori, Nicholas D. Gilson, Jim McKenna. *Monitoring sedentary patterns in office employees: validity of an m-health tool (Walk@Work-App) for occupational health*, Gaceta Sanitaria, Volume32, Issue 6, 2018, Pages 563-566, ISSN0213-9111,
DOI: https://doi.org/10.1016/j.gaceta.2017.05.004.

APPENDIX

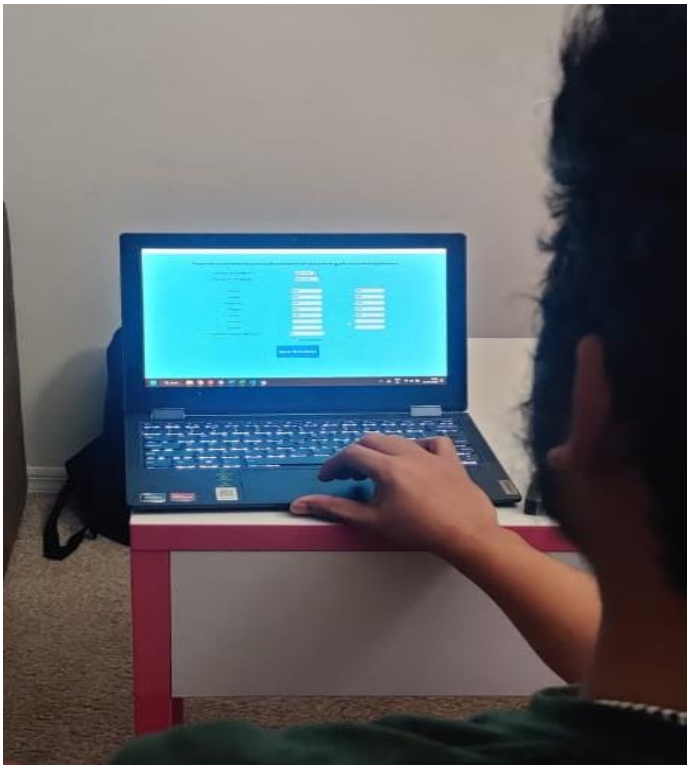

Figure A1 – Participant evaluation of the proposed system

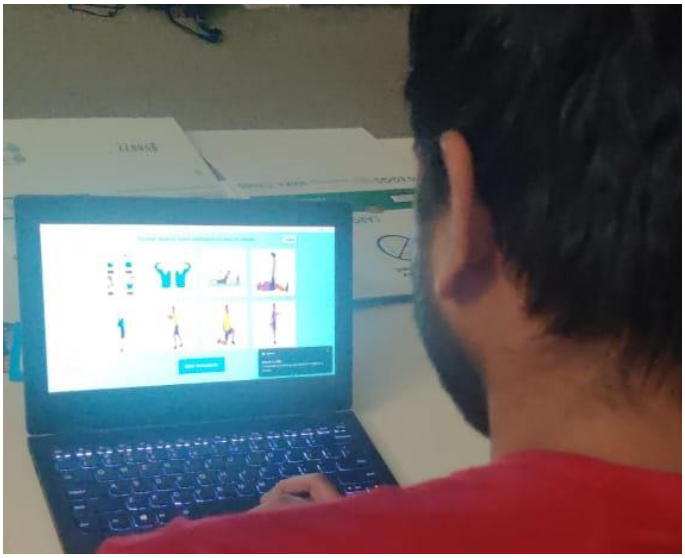

Figure A2 – Participant evaluation of the proposed system

Stretch-a-little - take a break from your computer

Current Solution Evaluation Report

Quiz Evaluation Questionnaire - December 3rd 2023, 10:42 am EST

Q1 - Please select your age group

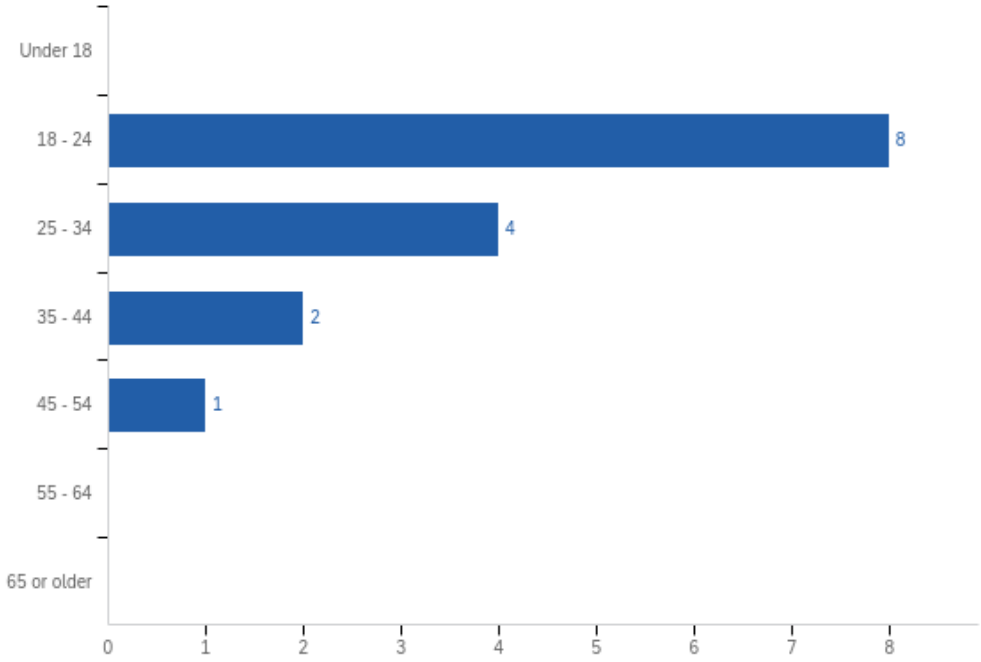

Figure 1a

#	Answer	%	Count
1	Under 18	0.00%	0
2	18 - 24	53.33%	8
3	25 - 34	26.67%	4
4	35 - 44	13.33%	2
5	45 - 54	6.67%	1
6	55 - 64	0.00%	0
7	65 - 74	0.00%	0
8	75 - 84	0.00%	0
9	85 or older	0.00%	0
	Total	100%	15

Stretch-a-little - take a break from your computer

Q2 - Please select your gender

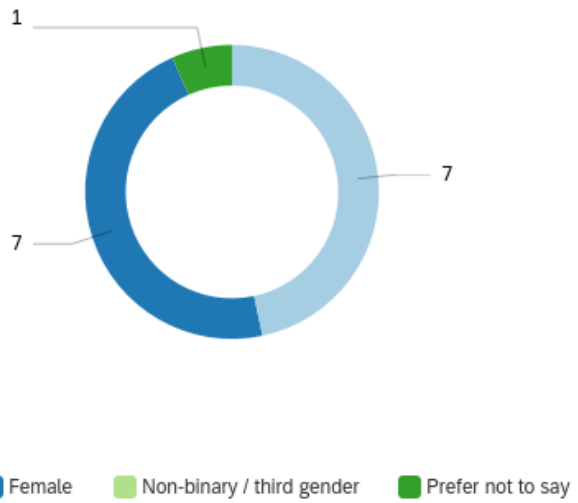

Figure 2a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Please select your gender	1.00	4.00	1.67	0.79	0.62	15

#	Answer	%	Count
1	Male	46.67%	7
2	Female	46.67%	7
3	Non-binary / third gender	0.00%	0
4	Prefer not to say	6.67%	1
	Total	100%	15

Stretch-a-little - take a break from your computer

Q3 - Did you use the customization features available in the application?

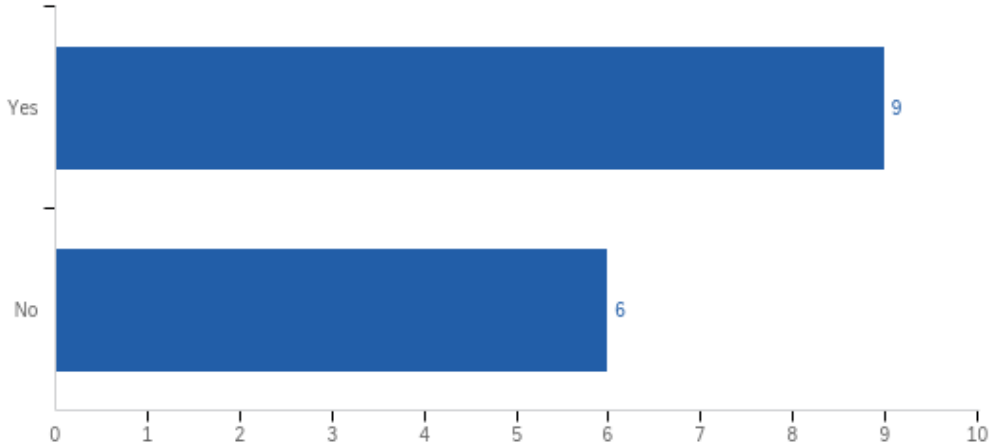

Figure 3a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Did you use the customization features available in the application?	1.00	2.00	1.40	0.49	0.24	15

#	Answer	%	Count
1	Yes	60.00%	9
2	No	40.00%	6
	Total	100%	15

Stretch-a-little - take a break from your computer

Q4 - Did the customizations help you maintain control over the application, such as receiving notifications in your preferred frequency and manner?

Did the customizations help you maintain control over the application, such as receiving notifications in your preferred frequency and manner?
No I just used the default settings.
Yes, it did. It took sometime to understand but I was able to set the preferences as I liked
Customizations were ineffective in providing control; notifications were not customizable enough to suit my preferences, impacting the overall user experience.
The customizations did not enhance control; notifications were inconsistent and failed to align with my preferred frequency and manner.
Customizations made application too complex , I didn’t like it
Yes, customizations gives user a good amount of control over the application.
No, the app was not customizable and I didn't find the relevant options
The interface made it a bit challenging to find and adjust the settings to my liking and it was not as straightforward as I hoped
I did not utilize any customization options
No, the customizations did not help me maintain control over the application, and I did not receive notifications in my preferred frequency and manner.
Absolutely, the ability to customize notification settings gave a sense of control and help me focus during crucial work periods
the customizations allowed me to tailor notifications to my preferred frequency and was helpful without being disruptive
No, had to spend a lot of time to find the customization features and understand which is what. Felt like wasted a lot of time to navigate and customize
It did, but trying to understand and navigate through the application consumed quite a bit of my time
I had difficulty navigating through the app and could not find the desired settings

Stretch-a-little - take a break from your computer

Q5 - How satisfied are you with the customization options provided by the application?

#	Answer	%	Count
0	0	6.67%	1
1	1	46.67%	7
2	2	6.67%	1
3	3	26.67%	4
4	4	13.33%	2
	Total	100%	15

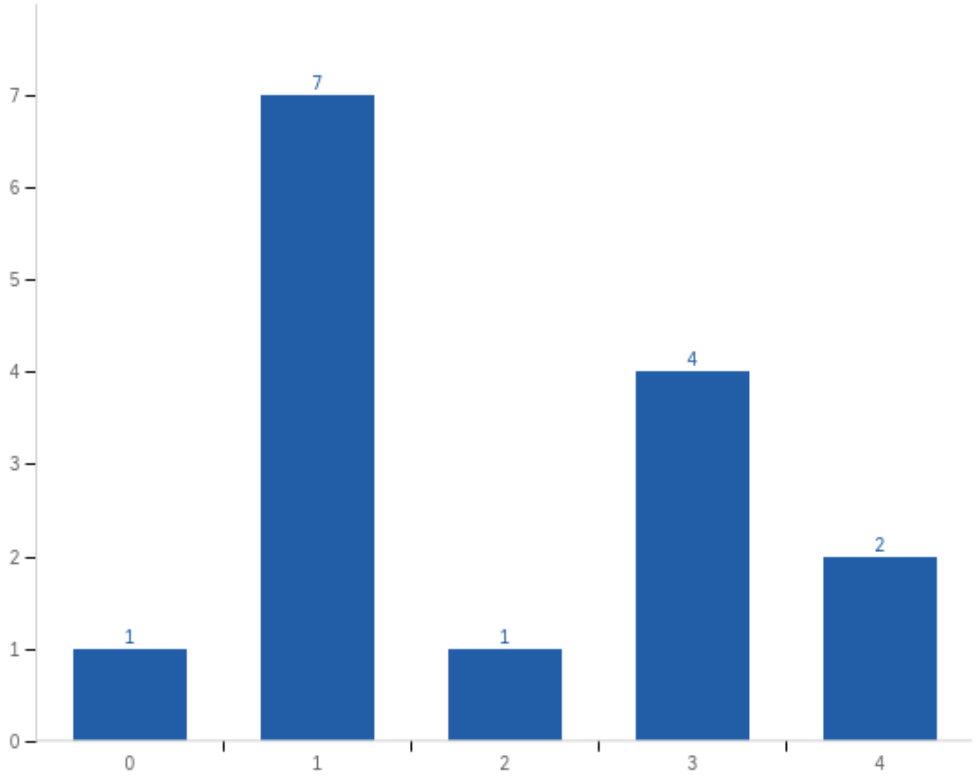

Figure 4a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied - 5: Fully Satisfied	0.00	4.00	1.93	1.24	1.53	15

Stretch-a-little - take a break from your computer

Q6 - How often did you comply with the breaks prompted by the application?

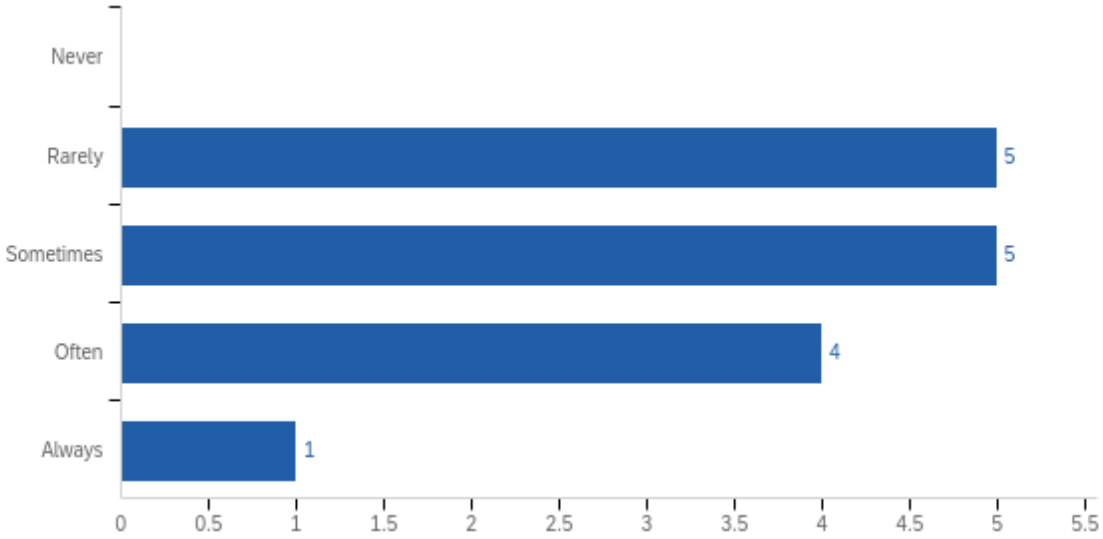

Figure 5a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How often did you comply with the breaks prompted by the application?	7.00	10.00	8.07	0.93	0.86	15

#	Answer	%	Count
6	Never	0.00%	0
7	Rarely	33.33%	5
8	Sometimes	33.33%	5
9	Often	26.67%	4
10	Always	6.67%	1
	Total	100%	15

Stretch-a-little - take a break from your computer

Q7 - How frequently did you complete the stretching session as prompted by the application?

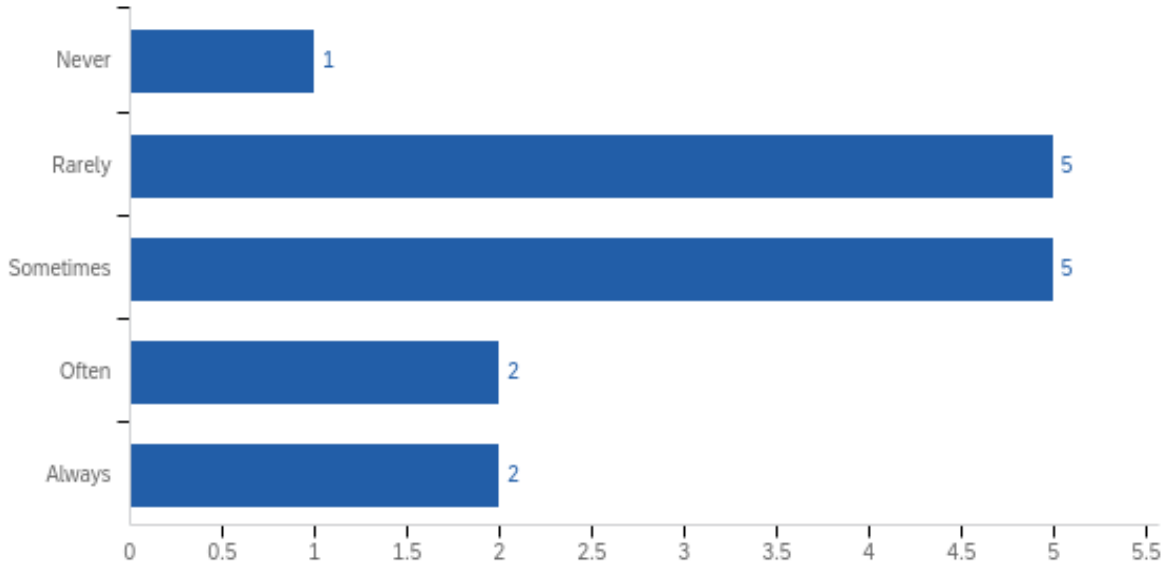

Figure 6a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How frequently did you complete the stretching session as prompted by the application?	5.00	9.00	6.93	1.12	1.26	15

#	Answer	%	Count
5	Never	6.67%	1
6	Rarely	33.33%	5
7	Sometimes	33.33%	5
8	Often	13.33%	2
9	Always	13.33%	2
	Total	100%	15

Q8 - If you have skipped the stretching session, what factors influence the decision?

If you have skipped the stretching session, what factors influence the decision?
Sometimes I was too lazy to stretch
None
The decision to skip stretching was influenced by factors such as time constraints and a perceived lack of benefits, leading to a neglect of the recommended session.
Skipping the stretching session was influenced by a lack of awareness and competing priorities, hindering commitment to the routine.
No I didn’t skip
Concentrating too much in work
Tight deadlines and the redundant stretches which I didn't feel were that effective
The personalization was not to my liking and didn't feel like it was personalized right for me
I have not skipped any prompted stretching sessions
Unfortunately, competing priorities and a busy schedule took precedence, leading to the neglect of the stretching routine.
N/A. Didn't skip the stretches
didn't think the stretches were necessary and would have preferred some stretches with movement as well
Got the notifications way too frequently than intended. The app was not easy to understand
Didn't feel like the stretches were good and doing anything
The break setting was not as desired by me and I had to stretch in between whenever I felt sore

Stretch-a-little - take a break from your computer

Q9 - How satisfied are you with the stretches provided by the application?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied - 5: Fully Satisfied (5)	1.00	4.00	2.47	0.96	0.92	15

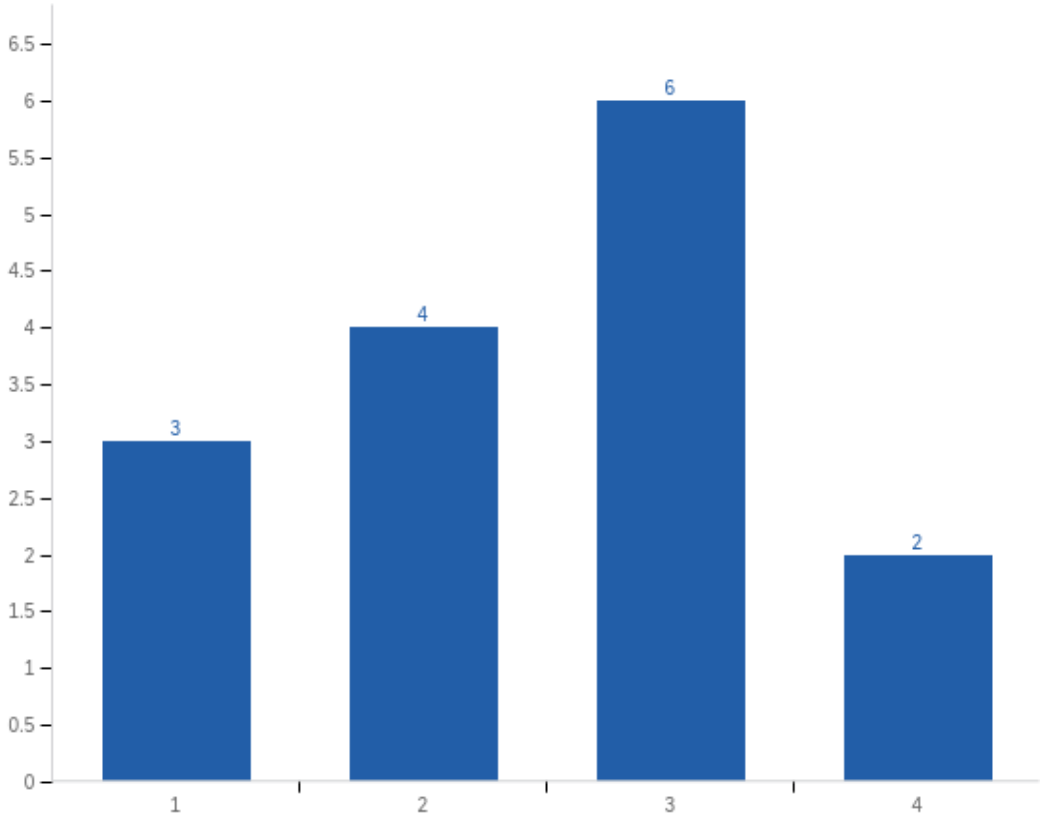

Figure 7a

#	Answer	%	Count
1	1	20.00%	3
2	2	26.67%	4
3	3	40.00%	6
4	4	13.33%	2
	Total	100%	15

Q10 - Any comments on the effectiveness of the stretches suggested by the application?

Any comments on the effectiveness of the stretches suggested by the application?
Sometimes I feel it is good to stretch and sometimes I don't feel like to stretch
They were good and effective
The stretches recommended by the application were not effective; they lacked variation and failed to contribute positively to my overall well-being.
the suggested stretches were ineffective, offering little relief or improvement in addressing discomfort or tension.
No
The information provided regarding the stretchers is useful and It helps to regain the focus
They were ok
They were not effective for me. Would have preferred more personalization or at least something more insightful about the stretches.
No
I didn't find the stretches suggested by the application to be effective. The routine seemed impractical and did not align well with my specific needs or preferences. The stretches failed to alleviate any discomfort or tension, and the overall experience did not contribute positively to my well-being.
Th stretches were okay, could have been better
they were good. Could have been better if the stretches were not so limited
The stretches were good and effective
The stretches were not great for me. Would have preferred something with more movement
The stretches were good, but it would have been better if they were prompted when I wanted to stretch

Stretch-a-little - take a break from your computer

Q11 - How often do you read the stretch-related articles provided by the application?

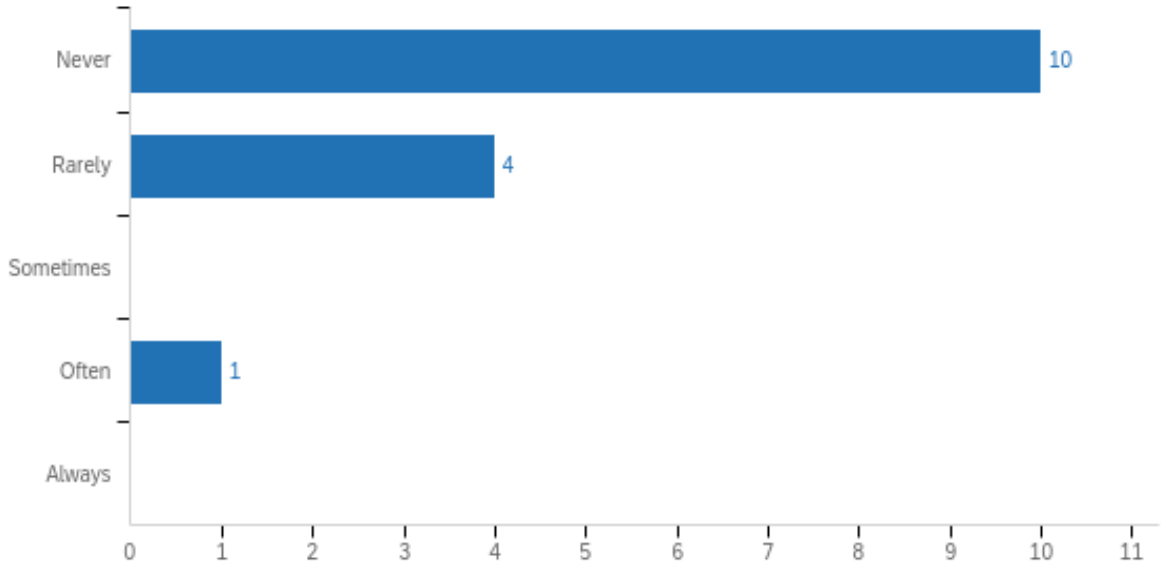

Figure 8a

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How often do you read the stretch-related articles provided by the application?	5.00	8.00	5.47	0.81	0.65	15

#	Answer	%	Count
5	Never	66.67%	10
6	Rarely	26.67%	4
7	Sometimes	0.00%	0
8	Often	6.67%	1
9	Always	0.00%	0
	Total	100%	15

Q12 - Did you find the articles useful?

Did you find the articles useful?
I feel it has necessary information required.
No articles
No
No, I did not find any articles
No
Yes
There were no articles
There were none
No
No, I did not find the articles provided by the application to be useful. The content seemed irrelevant and did not address my specific concerns or interests.
There were no stretches-related articles. Would've been nice to have them
nope. There were no articles
There were no articles, just the stretches
No articles in the app. Would have preferred them though
There were no articles in the app

Stretch-a-little - take a break from your computer

Q13 - Rate the level of fatigue or discomfort you faced during your work hours when using the application

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: No fatigue or discomfort - 5: Higher level of fatigue or discomfort	1.00	5.00	3.27	1.00	1.00	15

#	Answer	%	Count
1	1	6.67%	1
2	2	13.33%	2
3	3	33.33%	5
4	4	40.00%	6
5	5	6.67%	1
	Total	100%	15

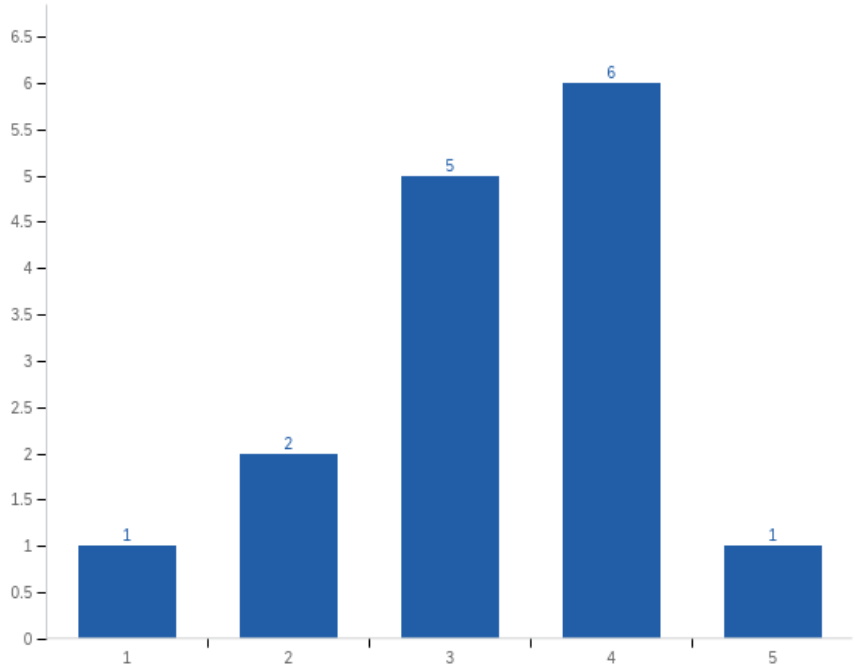

Figure 9a

Q14 - Any complaints you may have when using the application?

Any complaints you may have when using the application?
I didn't used all the features of the application.
The notifications were too intrusive and I was not able to control them/personalize them. If not, this is good
My complaints with the application include a non-intuitive interface, resource-heavy performance issues, and notifications that prove more disruptive than helpful.
I have several complaints when using the application, including a confusing user interface, resource-intensive performance, and intrusive notifications disrupting workflow.
Yes
Proposed use case of the application is working as expected.
The app was too small. I was not able to see the text in the app and did not understand how to use it for my preferences
The customization was very limited including the interface preferences
Yes
the user interface is confusing and not intuitive, making it challenging to navigate and customize settings
There are no insights and analytics and the app is very limited to provide any suggestions to improve work habits
the stretches were repetitive. The app was less engaging and not so friendly, felt the options were limited and not so clear
The app was complicated to understand and took me more time to navigate, identify and setup the preferences, which were not quite satisfactory
The application was not quite easy to understand at the beginning. Took me sometime to understand how to setup the timer preferences. The stretches could have been better
Yes, upon installing the app starting running with no additional info. The interface is too small to even understand what is going.

Q15 - Any comments on the overall application interface?

Any comments on the overall application interface?
User interface is good.
The interface could be better with more help on how to navigate through the app
lacking user-friendly design contributing to a frustrating user experience.
Unfortunately, the overall application interface is inefficient and unappealing, hindering usability and detracting from its effectiveness in promoting a healthy work routine.
Interference is complicated
The user interface is commendable but it will be more help full if user can be able to snooze the notification for minute or two,
The interface was unusable. It is too small and not intuitive at all and there were no personalization features
Its too complex and took a lot of time for me to understand it.
interface is too complex
It lacks user-friendly design and intuitive navigation, making it difficult to locate and use key features.
The design interface is inconsistent, not so engaging with least visual appeal
felt the i/f was cluttered and overwhelming with the info and controls. Was not so engaging as well
The interface lacks visual appeal. It is not so engaging and clumsy
The interface was quite small and not easy to use. Took me sometime to understand what micro-break and rest break are and I don't think there was any guide/documentation to help.
The interface is unusable!!! It's too small, a lot is going on with little to no info and help. I was not able to setup my custom settings and took up a lot of time trying to understand the app and interface.

Stretch-a-little - take a break from your computer

Q16 - How satisfied are you with the overall user interface and ease of use of the application?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied - 5: Fully Satisfied (5)	0.00	3.00	1.67	0.94	0.89	15

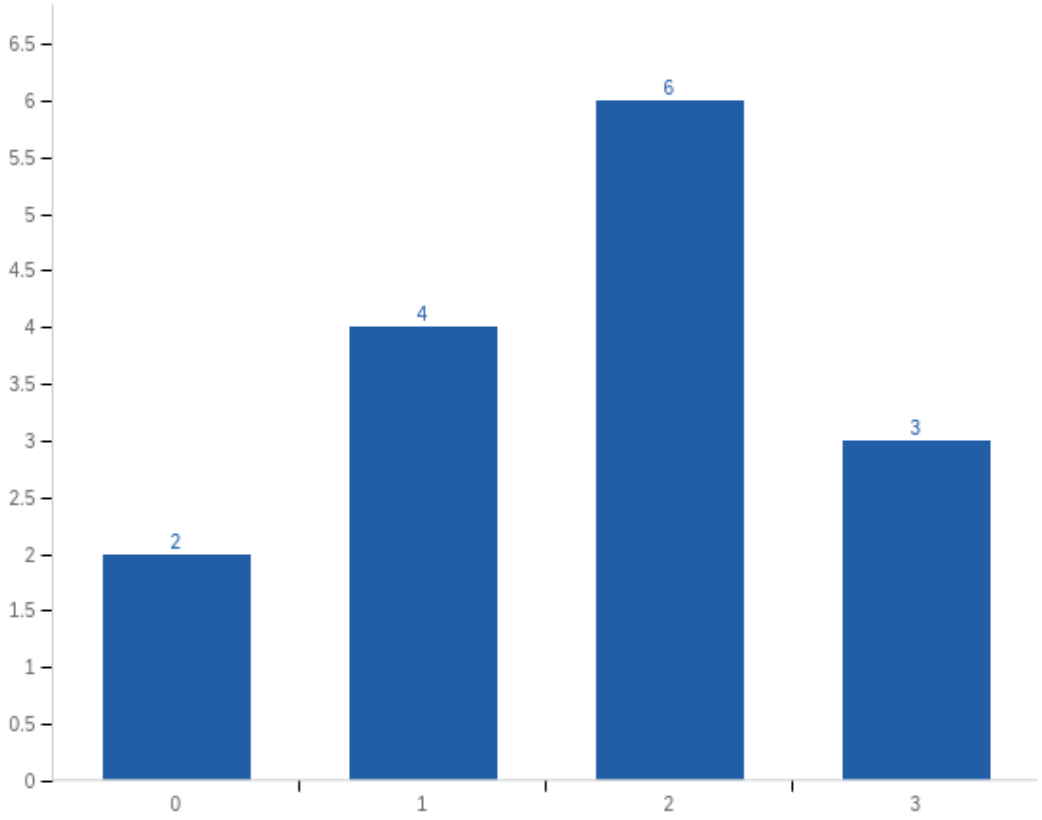

Figure 10a

#	Answer	%	Count
3	3	20.00%	3
2	2	40.00%	6
1	1	26.67%	4
0	0	13.33%	2
	Total	100%	15

Stretch-a-little - take a break from your computer

Proposed Solution Evaluation Report

Quiz Evaluation Questionnaire - December 3rd 2023, 10:53 am EST

Q1 - Please select your age group

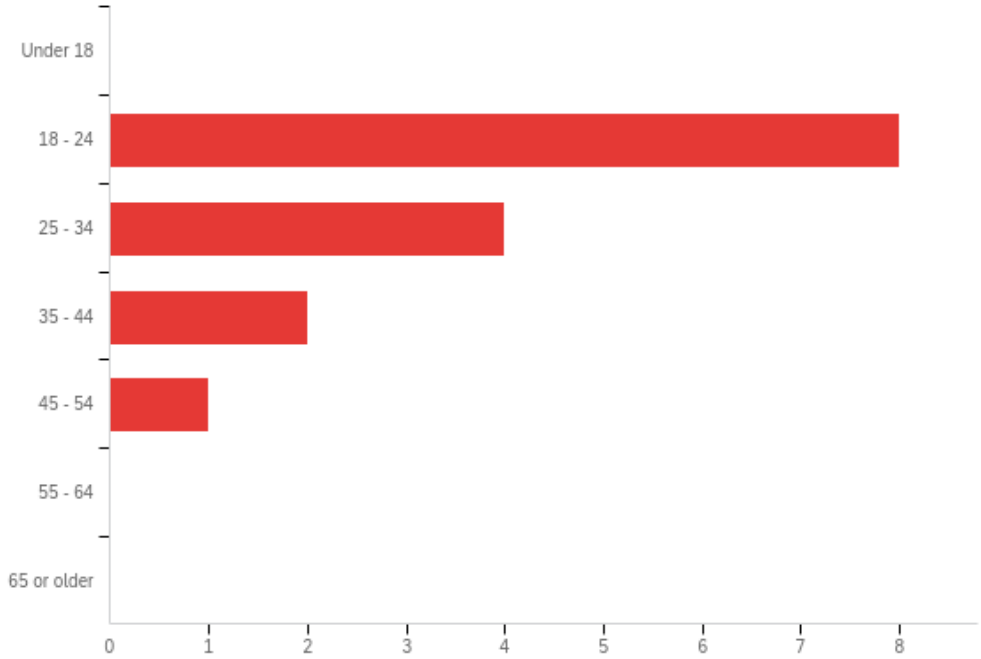

Figure 1b

#	Answer	%	Count
1	Under 18	0.00%	0
2	18 - 24	53.33%	8
3	25 - 34	26.67%	4
4	35 - 44	13.33%	2
5	45 - 54	6.67%	1
6	55 - 64	0.00%	0
7	65 - 74	0.00%	0
8	75 - 84	0.00%	0
9	85 or older	0.00%	0
	Total	100%	15

Stretch-a-little - take a break from your computer

Q2 - Please select your gender

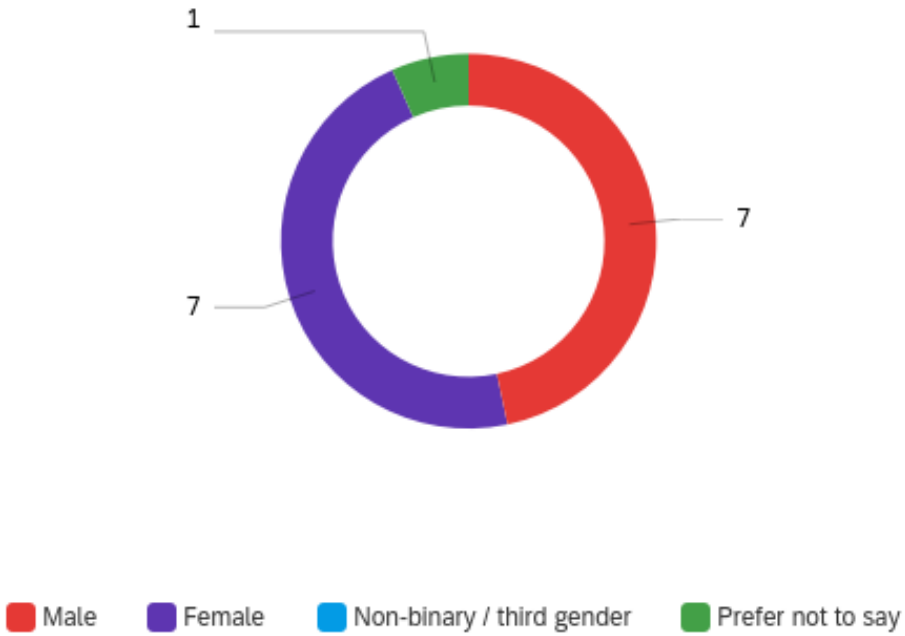

Figure 2b

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Please select your gender	1.00	4.00	1.67	0.79	0.62	15

#	Answer	%	Count
1	Male	46.67%	7
2	Female	46.67%	7
3	Non-binary / third gender	0.00%	0
4	Prefer not to say	6.67%	1
	Total	100%	15

Stretch-a-little - take a break from your computer

Q3 - Did you use the customization features available in the application?

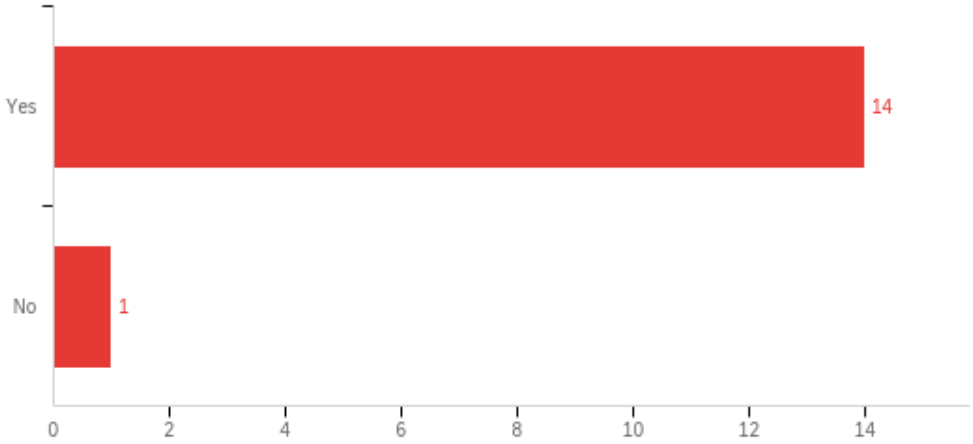

Figure 3b

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Did you use the customization features available in the application?	1.00	2.00	1.07	0.25	0.06	15

#	Answer	%	Count
1	Yes	93.33%	14
2	No	6.67%	1
	Total	100%	15

Stretch-a-little - take a break from your computer

Q4 - Did the customizations help you maintain control over the application, such as receiving notifications in your preferred frequency and manner?

Did the customizations help you maintain control over the application, such as receiving notifications in your preferred frequency and manner?
Yes. They were good
Yes, it was for my liking
Absolutely, it was very easy to setup and understand
Didn't use them, as the default settings were my preference
Yes the customization helped me alot
Without a doubt, the customizations have been a key element in keeping me in control of the application, offering a personalized notification experience.
The app helped me set up notifications in a way that aligns with my priorities and work habits.
Yes, the custom notification settings have been a significant factor in allowing me to receive updates in a manner that suits my daily workday routine.
The flexibility provided by customizations has been crucial in maintaining control over notifications, ensuring they don't disrupt my focus.
The custom notification features have been a lifesaver, enabling me to set up alerts in a manner that aligns seamlessly with my daily routine.
Customizations have played a key role in helping me maintain control, ensuring notifications are delivered in a way that maximizes my productivity.
The ability to customize notifications has significantly enhanced my experience, allowing me to stay informed on my terms.
Yes, the tailored settings have been a game-changer, providing me with the flexibility to control how and when I receive notifications.
The customizations have allowed me to manage notifications effectively, receiving them in a manner that suits my workflow.
Customized settings have given me full control over notifications, ensuring they align with my preferences perfectly.

Stretch-a-little - take a break from your computer

Q5 - How satisfied are you with the customization options provided by the application?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied - 5: Fully Satisfied	3.00	5.00	4.60	0.71	0.51	15

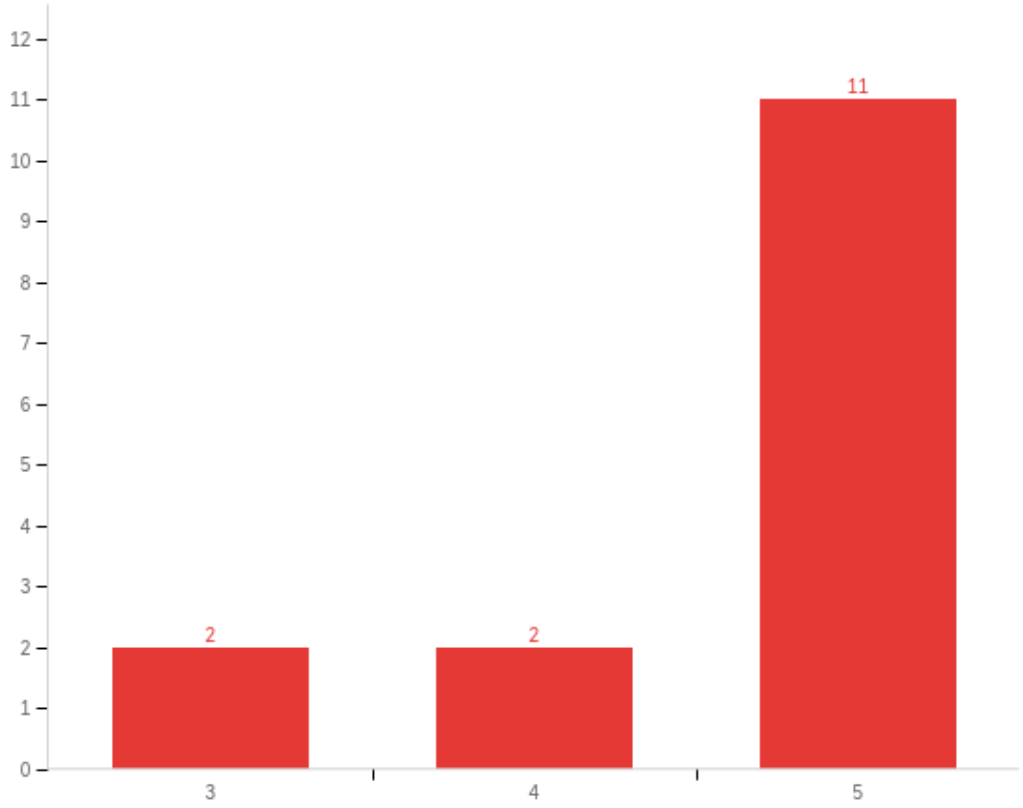

Figure 4b

#	Answer	%	Count
3	3	13.33%	2
4	4	13.33%	2
5	5	73.33%	11
	Total	100%	15

Stretch-a-little - take a break from your computer

Q6 - How often did you comply with the breaks prompted by the application?

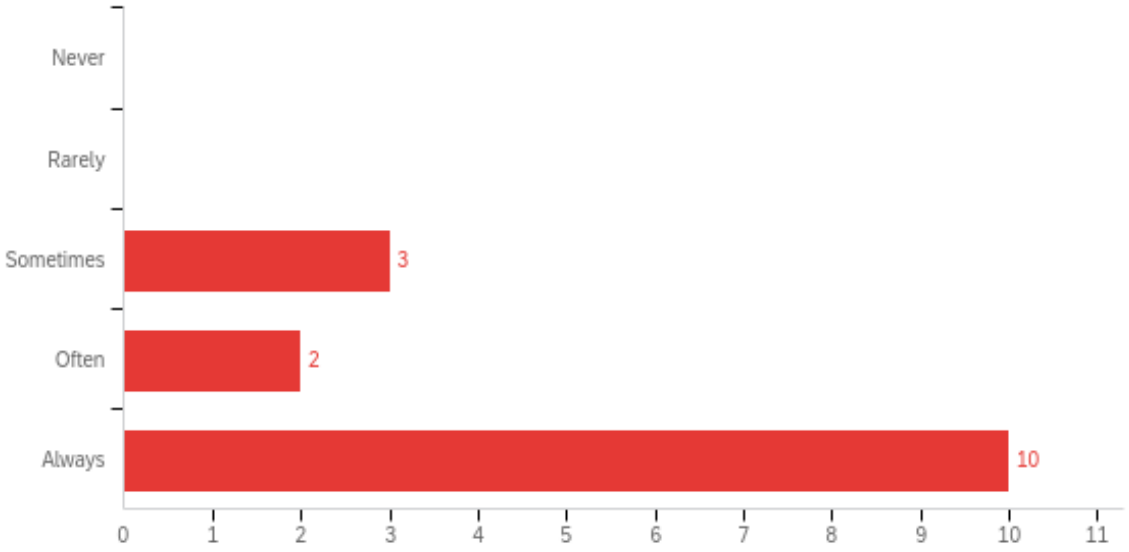

Figure 5b

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How often did you comply with the breaks prompted by the application?	7.00	9.00	8.47	0.81	0.65	15

#	Answer	%	Count
5	Never	0.00%	0
6	Rarely	0.00%	0
7	Sometimes	20.00%	3
8	Often	13.33%	2
9	Always	66.67%	10
	Total	100%	15

Stretch-a-little - take a break from your computer

Q7 - How frequently did you complete the stretching session as prompted by the application?

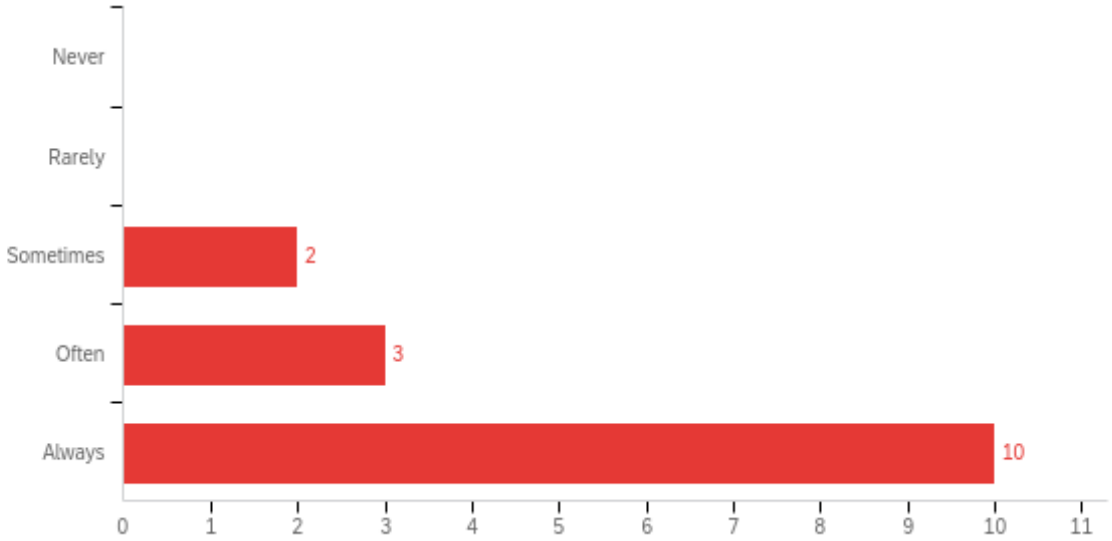

Figure 6b

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How frequently did you complete the stretching session as prompted by the application?	7.00	9.00	8.53	0.72	0.52	15

#	Answer	%	Count
5	Never	0.00%	0
6	Rarely	0.00%	0
7	Sometimes	13.33%	2
8	Often	20.00%	3
9	Always	66.67%	10
	Total	100%	15

Q8 - If you have skipped the stretching session, what factors influence the decision?

If you have skipped the stretching session, what factors influence the decision?
None
Felt stretching was not needed at that time
Had a few in person meetings and was not able to
My workload fluctuates and would prefer to continue with my work without being interrupted
I have performed stretches multiple times.
I performed stretches when i am on my break
I've performed every stretch session.
I have performed stretches.
No i performed stretches while i am on my break
Not a single stretching session has been skipped by me.
I haven't missed any stretching sessions.
Every stretching session has been attended by me without fail.
No stretching sessions have been skipped by me.
I have not missed any stretching sessions.
No I haven't skipped any stretching session

Stretch-a-little - take a break from your computer

Q9 - How satisfied are you with the stretches provided by the application?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied - 5: Fully Satisfied (5)	3.00	5.00	4.53	0.72	0.52	15

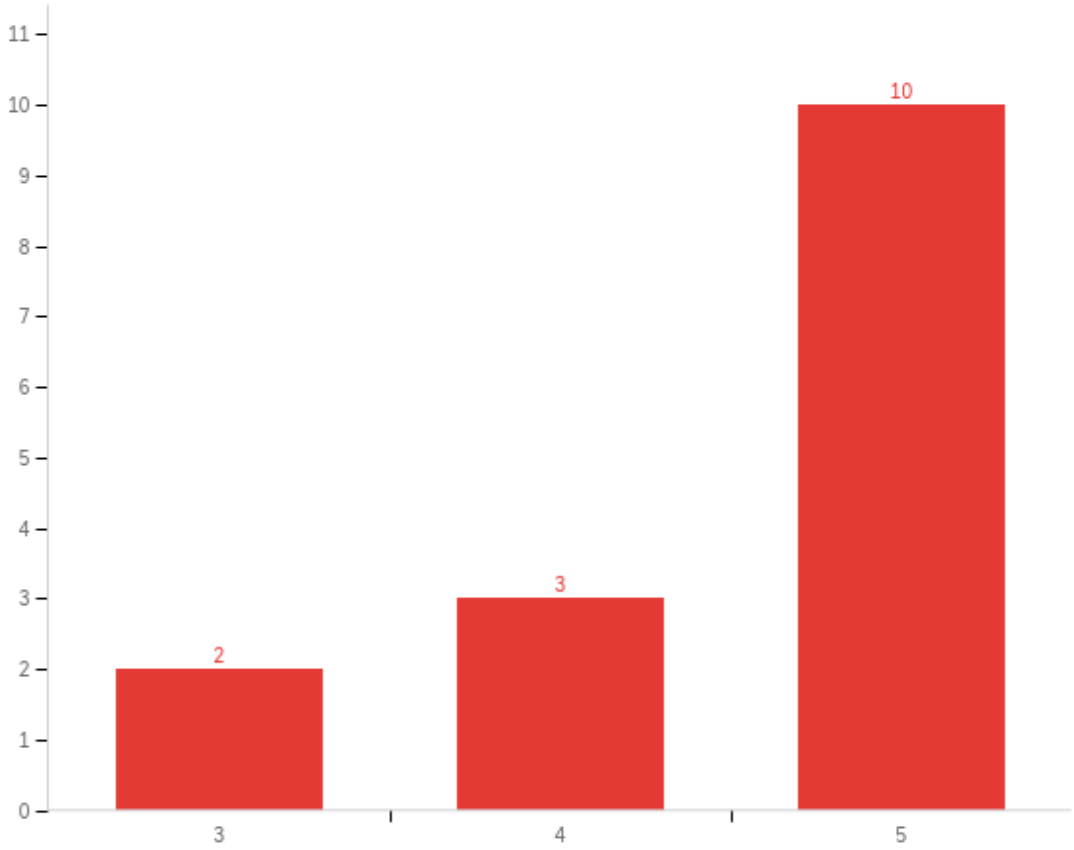

Figure 7b

#	Answer	%	Count
3	3	13.33%	2
4	4	20.00%	3
5	5	66.67%	10
	Total	100%	15

Q10 - Any comments on the effectiveness of the stretches suggested by the application?

Any comments on the effectiveness of the stretches suggested by the application?
They were good, but would've preferred different/new stretches each time
They were good and effective
They were good and effective for me
They were good, but would've preferred variety
Stretches are very effective and they are useful.
Stretches are user-friendly.
The stretches suggested by the app are practical.
Stretches are really helpful
They are very useful and very easy to perform
They are very useful
After using the app I've incorporated the stretches into my workout routine
The app's stretches are not just helpful but also easy to incorporate into my daily routine.
I'm impressed with how well the stretches in the app have alleviated muscle tension.
The stretches suggested by the app are genuinely helpful for increasing flexibility.
I've used the application, and I found the stretches to be really useful for improving flexibility and relieving muscle tension.

Stretch-a-little - take a break from your computer

Q11 - How often do you read the stretch-related articles provided by the application?

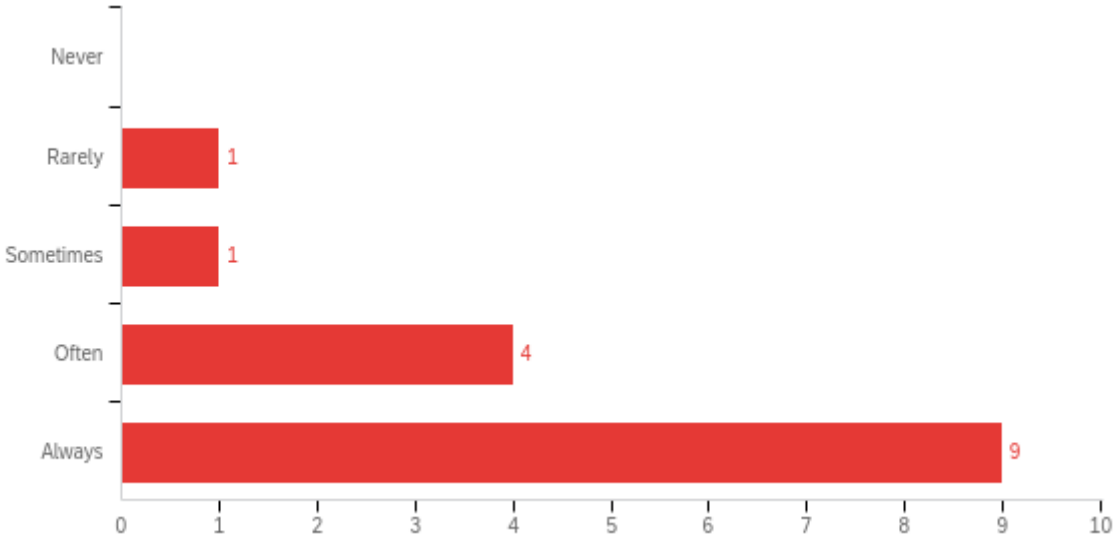

Figure 8b

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How often do you read the stretch-related articles provided by the application?	6.00	9.00	8.40	0.88	0.77	15

#	Answer	%	Count
5	Never	0.00%	0
6	Rarely	6.67%	1
7	Sometimes	6.67%	1
8	Often	26.67%	4
9	Always	60.00%	9
	Total	100%	15

Q12 - Did you find the articles useful?

Did you find the articles useful?
Yes
Yes, they were insightful
Yes, but I was already aware of the benefits of stretching
Yes, helped me gain more insights
The articles provided valuable context.
The articles were informative
The articles were a beneficial addition to the stretching sessions.
The articles gave me a deeper understanding of the stretches.
Articles made the stretching more informative.
Yes, the articles offered valuable tips and reasons for each stretch.
Without a doubt, the articles enriched my experience with detailed insights.
Definitely, reading articles enhanced my understanding of each stretch.
Yes, the articles provided helpful information for effective stretching.
Absolutely, the articles added valuable insights to each stretch.
Yes, I found the articles very useful. Reading them alongside each stretch provided detailed information about the advantages and reasons for performing each stretch, enhancing my overall experience with the application.

Stretch-a-little - take a break from your computer

Q13 - Rate the fatigue or discomfort you faced during your work hours when using the application

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: No fatigue or discomfort - 5: Higher level of fatigue or discomfort	0.00	3.00	1.60	0.95	0.91	15

#	Answer	%	Count
0	0	13.33%	2
1	1	33.33%	5
2	2	33.33%	5
3	3	20.00%	3
	Total	100%	15

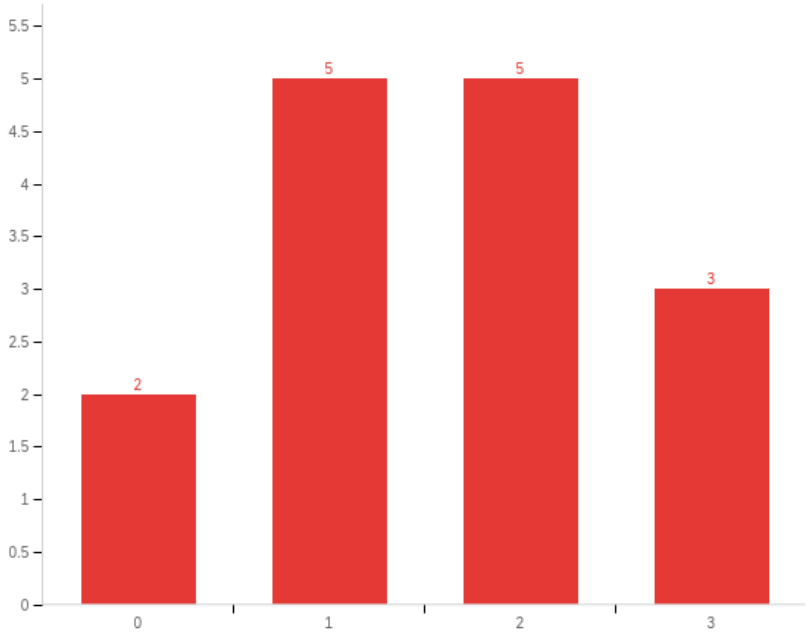

Figure 9b

Stretch-a-little - take a break from your computer

Q14 – Any complaints you may have when using the application?

Any complaints you may have when using the application?
No, it was good
No, the application was pretty straightforward to use
It was good, but felt the individual work day setting was redundant for me, as my work schedule is usually fixed
Would’ve preferred different stretches. If not, it was good
I navigated through the app without any problems; it was a hassle-free experience.
I had a smooth experience using the application, with no challenges or difficulties.
Everything worked seamlessly for me; no complaints about the application.
I didn’t run into any difficulties while using the app.
I have no complaints as my experience with the application was flawless.
Navigating through the app was easy, and I didn’t face challenges.
Everything went smoothly for me, and I didn’t face any difficulties while using the app.
No complaints from me—I had a smooth and trouble-free experience using the application.
I found everything to be smooth, and navigating through the app was effortless.
My experience with the application has been seamless, and I haven’t encountered any issues while using it.
I have used the application and found everything smooth. I did not face any difficulty while navigating through the app.

Q15 – Any comments on the overall application interface?

Any comments on the overall application interface?
Easy to use and understand. Liked the blue color!
Easy to use interface and didn’t consume a lot of time to understand it
The interface was good, intuitive and the notifications were not intrusive. I really liked the voice prompts
The interface was very easy to use with good customization features
The interface makes it easy for me to navigate and make quick adjustments to my settings.
Setting custom preferences for breaks has made a positive impact on my daily work routine.
The app’s flexibility allows me to choose stretches that align with my specific needs.
I found the app to be user-friendly, and I didn’t experience any issues during my use.
Customization options, from notification preferences to individual workdays, make the app helpful.
The flexibility to set notification frequencies, including voice prompts, is a great feature. A suggestion would be to include the feature to increase the font size which could further help the users with limited accessibility
I appreciate the educational aspect of the app, with informative articles accompanying each stretch.
The application’s design allows for a seamless integration of short breaks into my workday
Custom settings for break duration and specific stretches provide a personalized experience.
I love how Stretch-a-Little lets me set individual workdays and choose my preferred notification style.
The interface is user-friendly, and the customizable options make it easy to tailor breaks to my preferences.

Stretch-a-little - take a break from your computer

Q16 – How satisfied are you with the overall user interface and ease of use of the application?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	0: Not Satisfied – 5: Fully Satisfied (5)	3.00	5.00	4.13	0.72	0.52	15

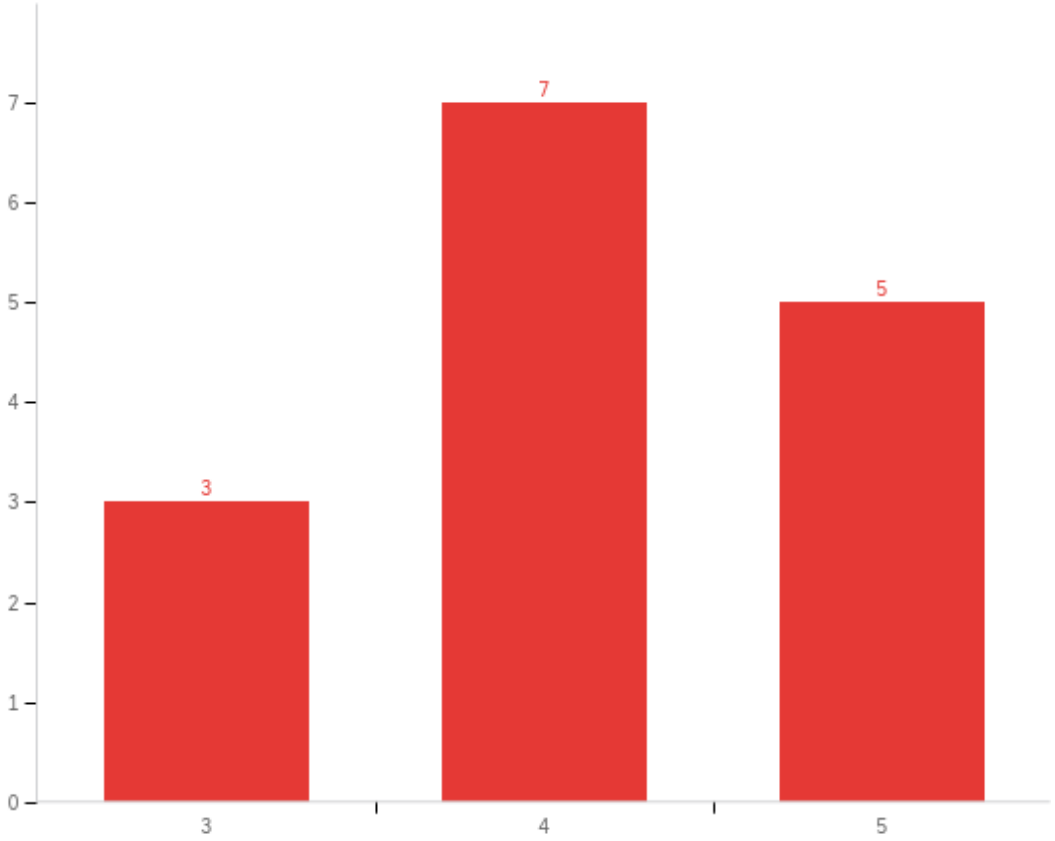

Figure 10b

#	Answer	%	Count
3	3	20.00%	3
4	4	46.67%	7
5	5	33.33%	5
	Total	100%	15