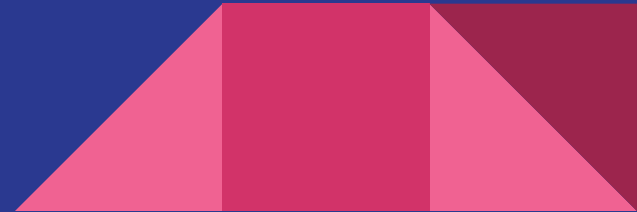# Great Zzzz's - Is my sleep influenced by what I do two hours before I go to bed?
An insight on sleep using wearable technology

Experiment by Sleep Cycle and Dream Chaser

Testable Question

Is my sleep influenced by what I do two hours before going to bed?
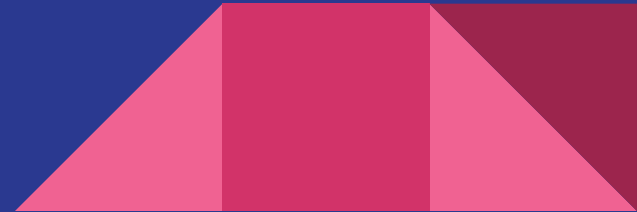
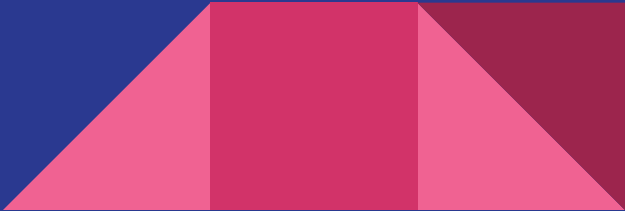# Prediction

Sleep Cycles:

When you do a lot of circular activities, you will be very tired and fall asleep quickly. For Example: I once went on a picnic and I played a lot and after that, I was very tired.

Dream Chaser's:

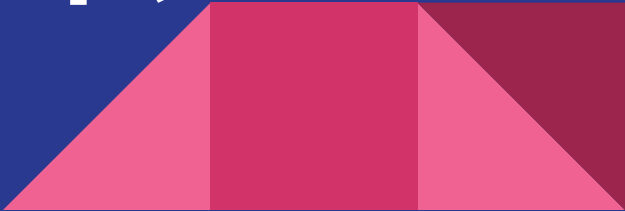An activity that is more interesting to me will keep my brain wired and therefore the sleep will be less deep.

Procedure

❏ Selected the independent variables: what activity to perform each evening, two hours before going to bed (different activity each evening)

❏ Identified the constant conditions

❏ Determined how to monitor the sleep (we used the SleepWatch app. See appendix 2 and 3 for details)

❏ Collected and analyzed the data

Background

We decided on this experiment after we brainstorm several ideas. We wanted something interesting, useful and fun. We also wanted something unique. For the most part, sleep is still a mystery: Why do we need to sleep? Why do we dream? What happens when we sleep? How can we get the best night Zzzzzs? Can we convince our parents that playing video games before going to bed improves our sleep? (wishful thinking :))

Background (cont.)

We learned about sleep, sleep cycles and what they are by reading several online resources (see Appendix 1) and then we looked at various apps that can be used to track sleep stages based on heart rate.
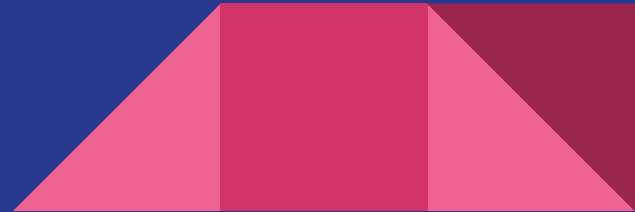
Trials

We decided to monitor our sleep for at least five nights (during the week, so there is less variability in what we do during the day). It took more than five trials since sometimes the app did not record the overnight data.
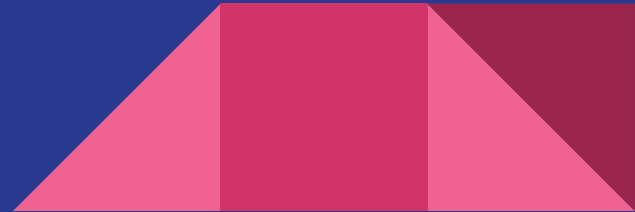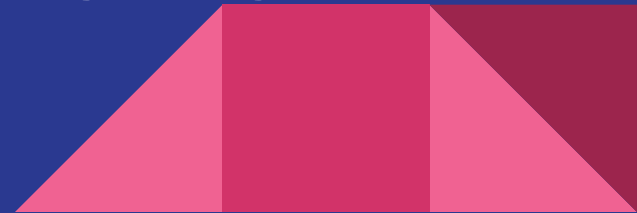
Independent variables

The activities conducted two hours before sleep

Sleep Cycle:
➢ Movie
➢ Reading
➢ Math
➢ Walking
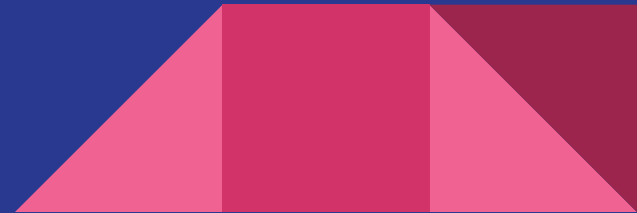➢ Sports
➢ Exercise

Dream chaser:
➢ Math
➢ Movie
➢ Reading
➢ Video games
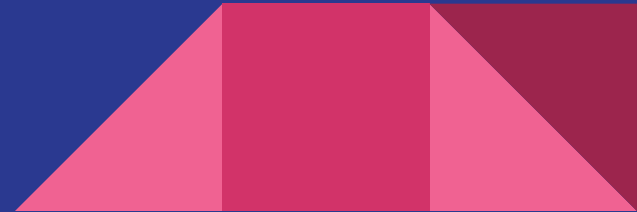➢ Running & Yoga

Dependent variables

Sleep outcomes as measured by the app

➢ Restful vs light sleep
➢ Sleep patterns
➢ Average sleeping heart rate
➢ Average sleeping heart rate variability
➢ Sleep disruptions

Constant conditions

➢ Tested during weeknights only
➢ Time to go to sleep and to wake up
➢ Sleep conditions: place, room temp, light
➢ Food type and timing (tried to keep a similar diet for the days when tested. Had last meal two hours before going to bed)
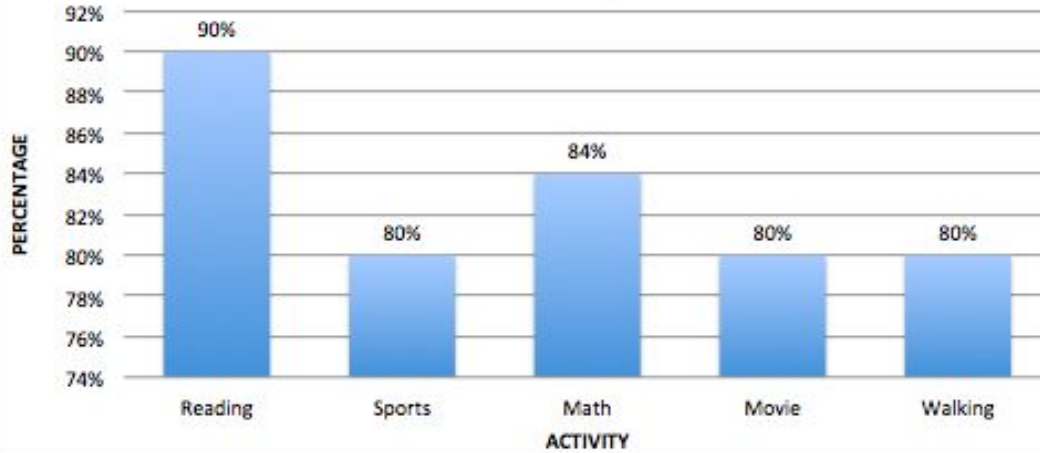
Sleep Cycles Data

# of nights & activities	Night 1	Night 2	Night 3	Night 4	Night 5
	Reading	Sports	Math*	Movie	Walking*
Restful sleep (%)	90%	80%	84%	80%	80%
Light sleep instances (#)	7	11	10	16	14
Average sleeping heart rate (bpm)	71 bpm	71 bpm	67 bpm	64 bpm	63 bpm
Average sleeping heart rate variability (ms)	NA'	56 ms	66 ms	55 ms	63 ms
Sleep disruption instances (#)	0	0	0	0	1

*Those are all examples of what I <u>might</u> have done.   ' It did not record that part.
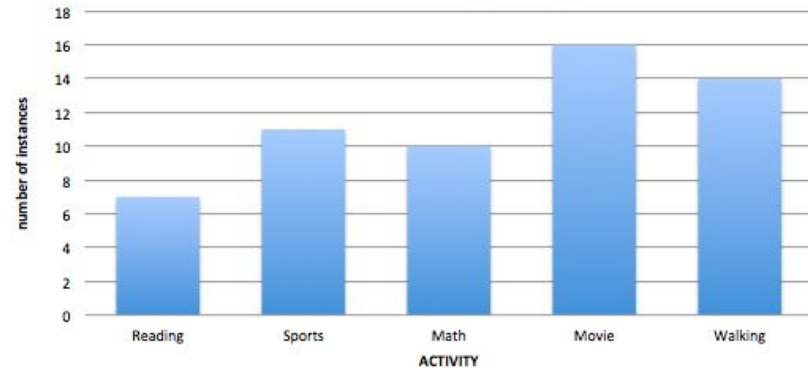
Data for Sleep Cycle

Restful sleep

Activities and Restful sleep

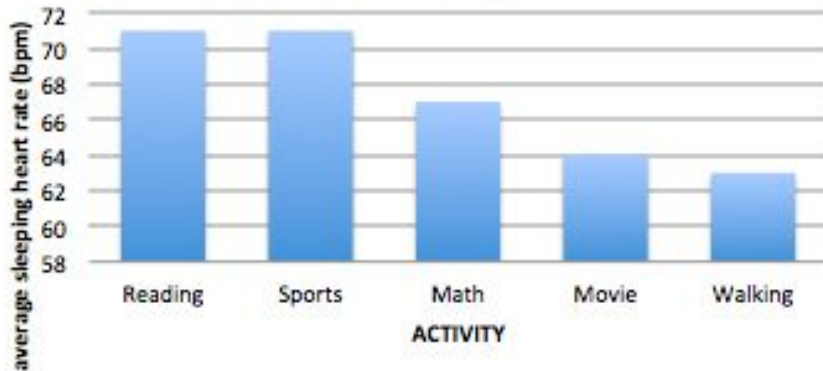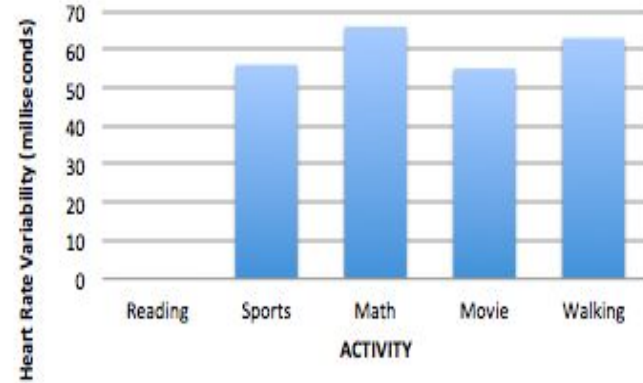## Activities and Light sleep instances

Instances of light sleep

Data for Sleep Cycle (continued)
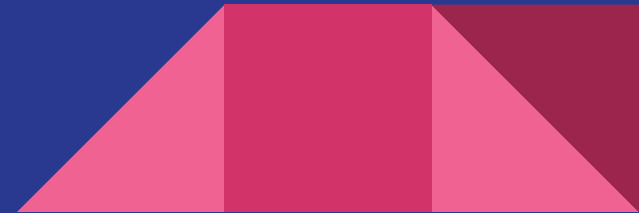
Activities and Average Sleeping Heart rate

Activities and Heart rate variability

Sleep Cycles Conclusions

* I think walking would be a good way to fall asleep because as I said in my prediction, being active before falling asleep makes you tired and as a result, you get a good sleep.

* Movies help me sleep too, but it depends on what movie I'm watching. Like, before I went to sleep one night, I watched a Harry Potter movie. It has some scary parts, but not the kind of scary you would see in horror movies.

* In another way, I agree with Dream Chaser - math before sleeping is good. When you fall asleep, you will probably feel comfortable about the topic and sleep feeling good ,which results into good sleep.
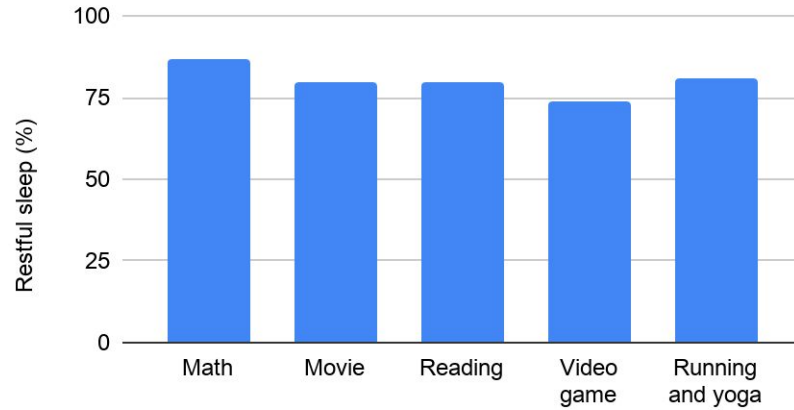
Data for Dream chaser

|	Night 1	Night 2	Night 3	Night 4	Night 5
	Math	Movie	Reading	Video game	Running and yoga
Restful sleep (%)	87	80	80	74	81
Light sleep instances (#)	12	14	16	15	18
Average sleeping heart rate (bpm)	76	80	78	78	74
Average sleeping heart rate variability (ms)	37	51	82	33*	70
Sleep disruption instances (#)	0	0	0	0	0

*the app did not record the heart rate until 2am

Data for Dream chaser

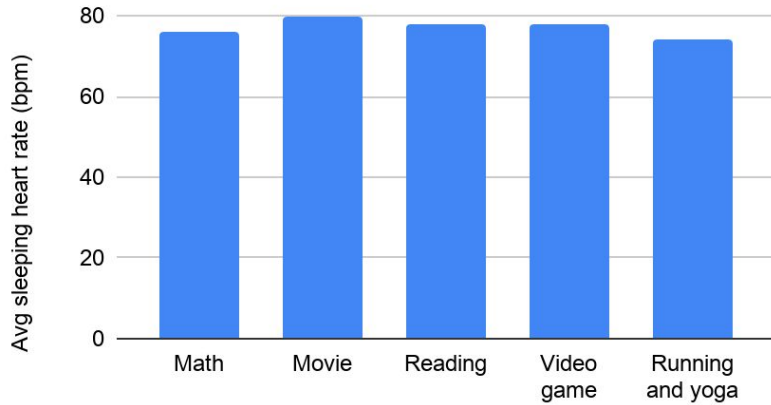Activities and Restful sleep

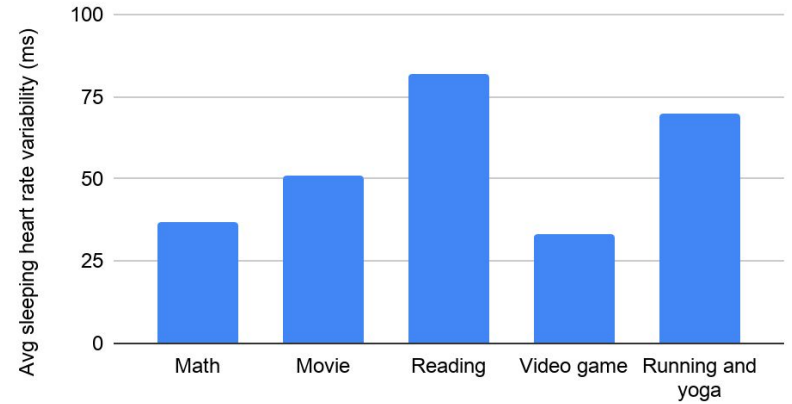
Activities and Light sleep instances
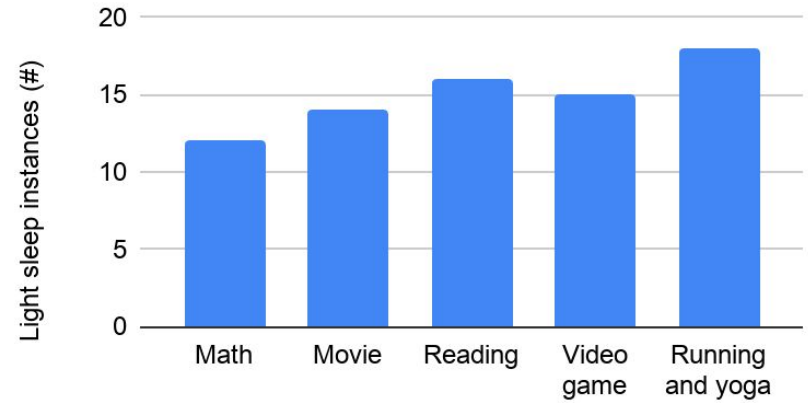
Data for Dream chaser


Activities and average sleeping heart rate

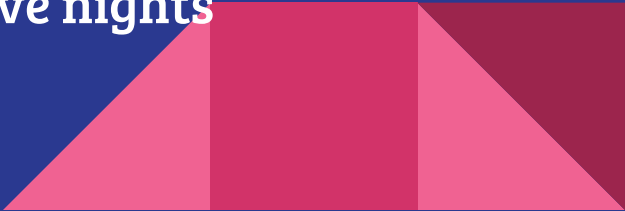Activities and Avg sleeping heart rate variability

Due to partial data recorded during the 4h night (video game), I will not use these outcomes for my conclusions

Dream chaser's conclusions

❏ Based on the % of restful sleep, doing math before going to bed has resulted in a better sleep. And playing video games before going to bed resulted in the least restful night.

❏ That confirmed my hypothesis that doing an activity that is more interesting to me will keep my brain wired and therefore the sleep will be less deep.

❏ Reading and watching a comedy movie had similar effects in restfulness.
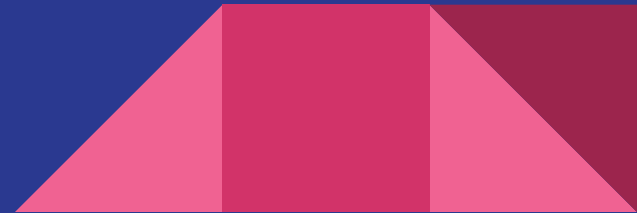
Dream chaser's conclusions (cont.)

- ❏ Based on the number of instances of light sleep during the night, doing math before going to bed was also the winner!
- ❏ Interestingly, running (aerobic activity) and yoga produced the highest number of light sleep instances.
- ❏ Watching a comedy movie, playing video games and reading were in the middle
- ❏ I do not know enough (yet) about heart rate levels to draw conclusions
- ❏ There were no sleep disruptions in any of the five nights

Dream chaser's reflections

❏   It would be interesting to look at the total time of light sleep during each night (not only the number of instances) and maybe even at when they occur during the night.
❏   Also, I would like to see if the results would be the same if I were to test each activity for few times and then average the results by activity
❏   I would pair yoga with another relaxing activity, not with running
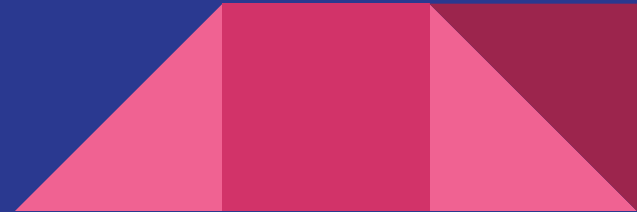
Appendix 1 - Bibliography

- Brain basics (National Institute of Neurological disorders and stroke - NINDS)
- Stages of sleep (University of Michigan)
- Sleep.org
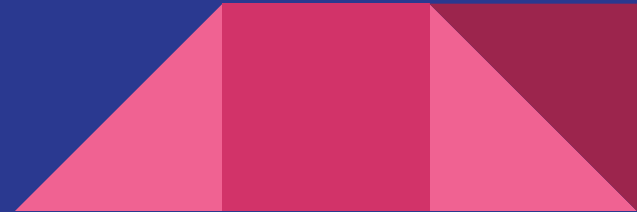
Appendix 2 - using the SleepWatch app

We downloaded the <u>Sleepwatch</u> app onto the Apple watch and wore the watch at night. In the morning we were checking to see if our sleep data was recorded. There were couple of instances where it did not record or it recorded only few hours. We used a phone that was connected to the watch to find out our data.

We found the FAQs on the SleepWatch.zendesk.com useful in figuring out how to use the app with the Apple watch.

Appendix 3 - screenshot from the app

This is an example of one of the nights we tested.