



# Paper Towel Consumption

**Behavior research**



**24 kg**

paper towels per person each year in N.A.

**4.4 kg**

... globally

**14000000000 kg**

of paper towels used in North America each year





# **Main causes for high paper towel usage**

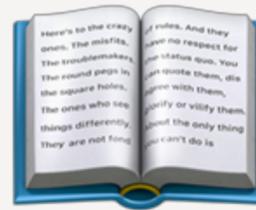
Paper towels are very convenient and very good at drying hands and surfaces

People don't know how to effectively dry their hands

People are unaware of the alternatives

# HOW MIGHT WE

reduce the amount of paper towels used in public restrooms?



# Secondary Research

**544,000**

trees could be saved each year if each US household used just **ONE** less roll of paper towels.

**17** trees and **20,000** gallons of water are polluted to make just **ONE** TON of paper towels.

# **Contrasting the Theory of Planned Behavior With the Value–Belief–Norm Model in Explaining Conservation Behavior**

In this paper, we contrast the value–belief–norm (VBN) model and the theory of planned behavior (TPB) for the first time regarding their ability to explain conservation behavior. The participants represent a convenience sample of 468 university students.



**Hypothesis**

# Hypothesis

People don't know how to properly use paper towels. We will significantly reduce the amount of towels used if we inform them about the techniques that make it possible to dry their hands with just one towel,



# Testing Methodology

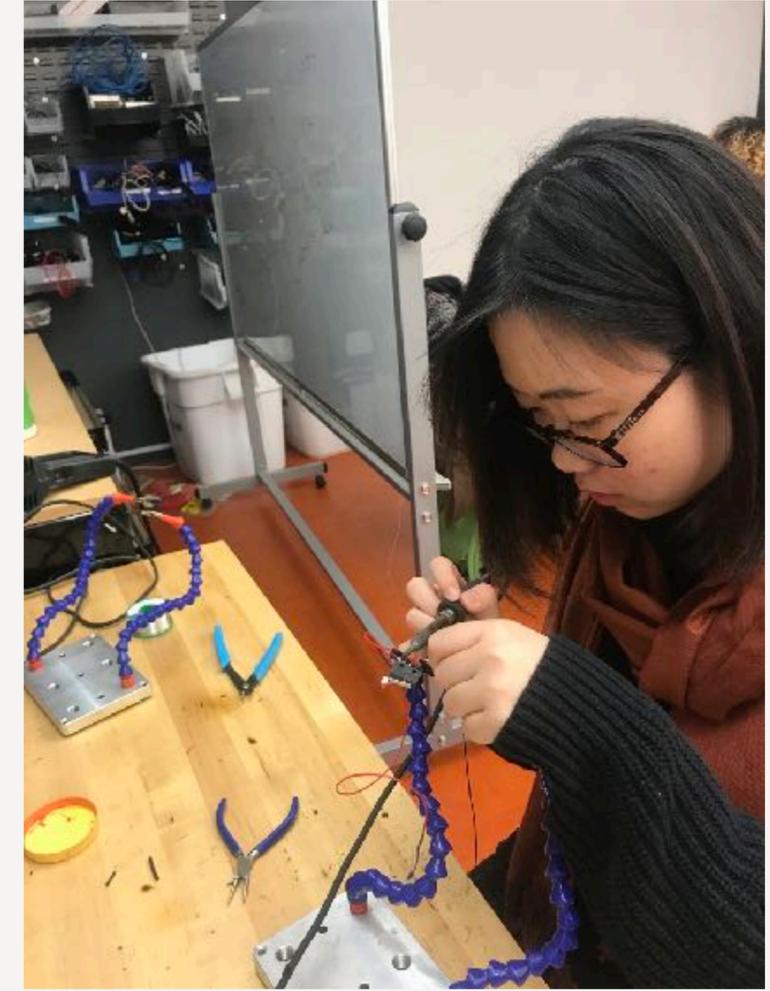
# Target Users

College students at



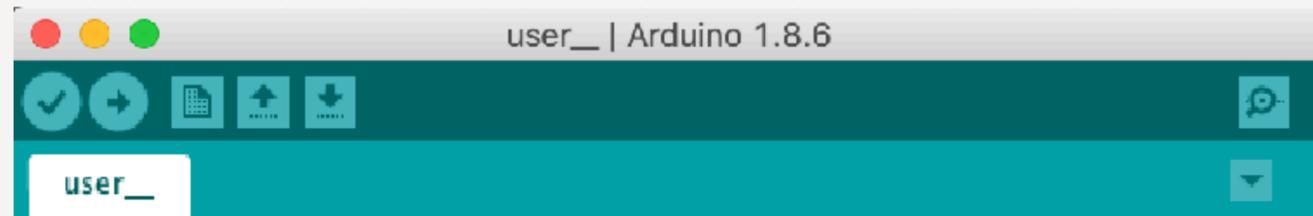
# Testing Methodology

Hardware: Arduino Uno, Read Switch



# Testing Methodology

Software: Arduino



```
void counting() {  
  unsigned long currentMillis = millis();  
  unsigned long runMillis = millis();  
  unsigned long allSeconds = millis() / 1000;  
  int runHours = allSeconds / 3600;  
  int secsRemaining = allSeconds % 3600;  
  int runMinutes = secsRemaining / 60;  
  int runSeconds = secsRemaining % 60;
```

```
  char buf[21];  
  sprintf(buf, "Runtime%02d:%02d:%02d", runHours, runMinutes, runSeconds);
```

```
  if (digitalRead(8) ) {  
    t = t + 1;
```

```
    if (currentMillis - previousMillis >= interval) {  
      previousMillis = currentMillis;  
      p = 0;  
      user += 1;  
      myFile = SD.open("paper.txt", FILE_WRITE);  
      if (myFile) {  
        myFile.print("User");  
        myFile.print(user);  
        myFile.print(", ");  
        myFile.close();  
        Serial.print("User");  
        Serial.print(user);
```



```
paper used 1.00, Runtime00:28:59, Total: 49.00  
User19.00  
paper used 1.00, Runtime00:41:00, Total: 50.00  
User20.00  
paper used 1.00, Runtime00:44:02, Total: 51.00  
paper used 2.00, Runtime00:44:04, Total: 52.00  
User21.00
```

```
paper used 1.00, Runtime00:45:35, Total: 53.00  
User22.00  
paper used 1.00, Runtime00:46:15, Total: 54.00  
User23.00  
paper used 1.00, Runtime00:59:52, Total: 55.00  
paper used 2.00, Runtime00:59:53, Total: 56.00  
paper used 3.00, Runtime00:59:54, Total: 57.00  
User24.00
```

```
paper used 1.00, Runtime01:01:24, Total: 58.00  
User25.00
```

```
paper used 1.00, Runtime01:06:03, Total: 59.00  
paper used 2.00, Runtime01:06:04, Total: 60.00  
User26.00
```

```
paper used 1.00, Runtime01:07:55, Total: 61.00  
paper used 2.00, Runtime01:07:58, Total: 62.00  
User27.00
```

```
paper used 1.00, Runtime01:13:48, Total: 63.00  
paper used 2.00, Runtime01:13:48, Total: 64.00  
User28.00
```

```
paper used 1.00, Runtime01:16:22, Total: 65.00  
paper used 2.00, Runtime01:16:23, Total: 66.00  
User29.00
```

```
paper used 1.00, Runtime01:41:07, Total: 67.00  
User30.00  
paper used 1.00, Runtime01:47:56, Total: 68.00  
User31.00
```

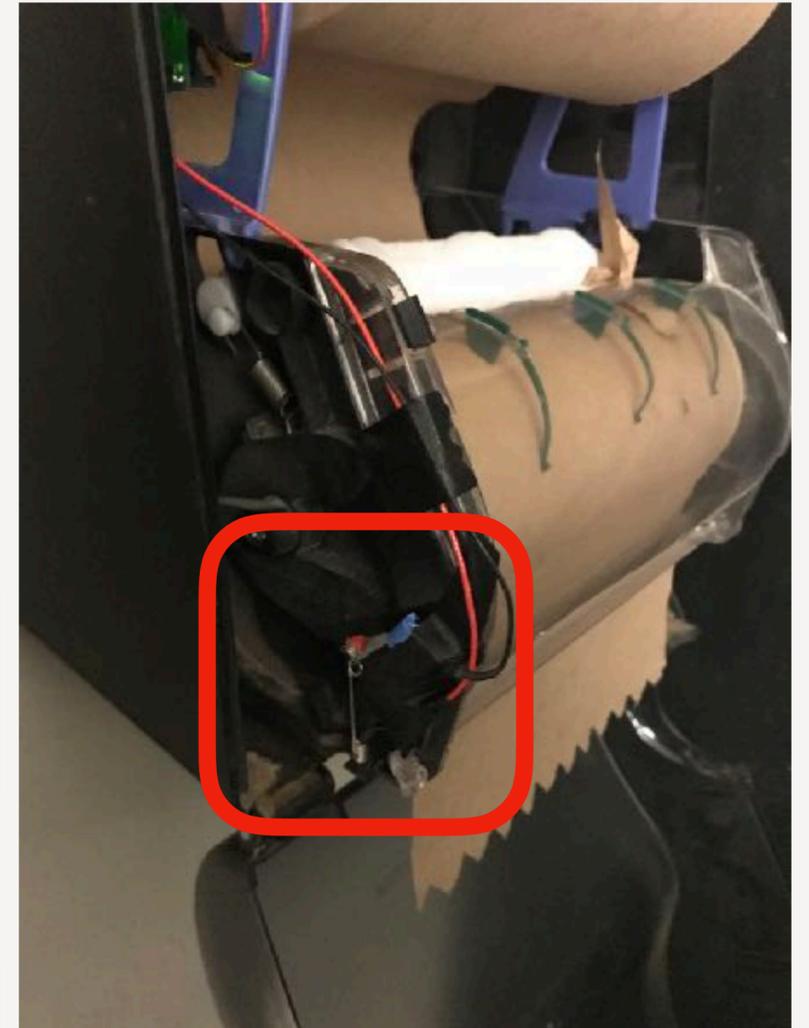
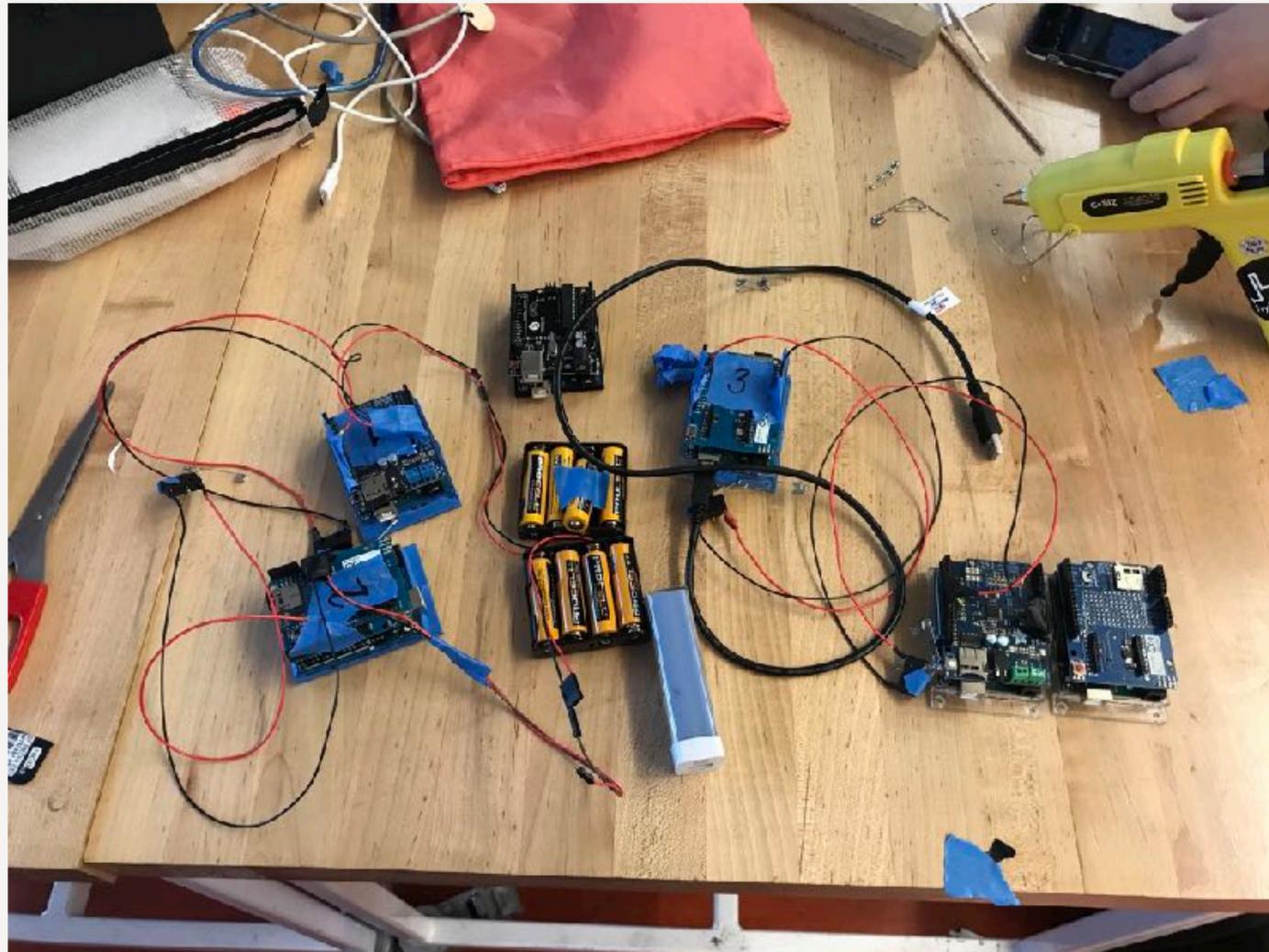
```
paper used 1.00, Runtime01:52:49, Total: 69.00  
paper used 2.00, Runtime01:52:51, Total: 70.00  
paper used 3.00, Runtime01:52:51, Total: 71.00
```

```
paper used 4.00, Runtime01:52:52, Total: 72.00  
paper used 5.00, Runtime01:52:52, Total: 73.00  
paper used 6.00, Runtime01:52:53, Total: 74.00  
User32.00
```

```
paper used 1.00, Runtime01:54:07, Total: 75.00  
User33.00
```

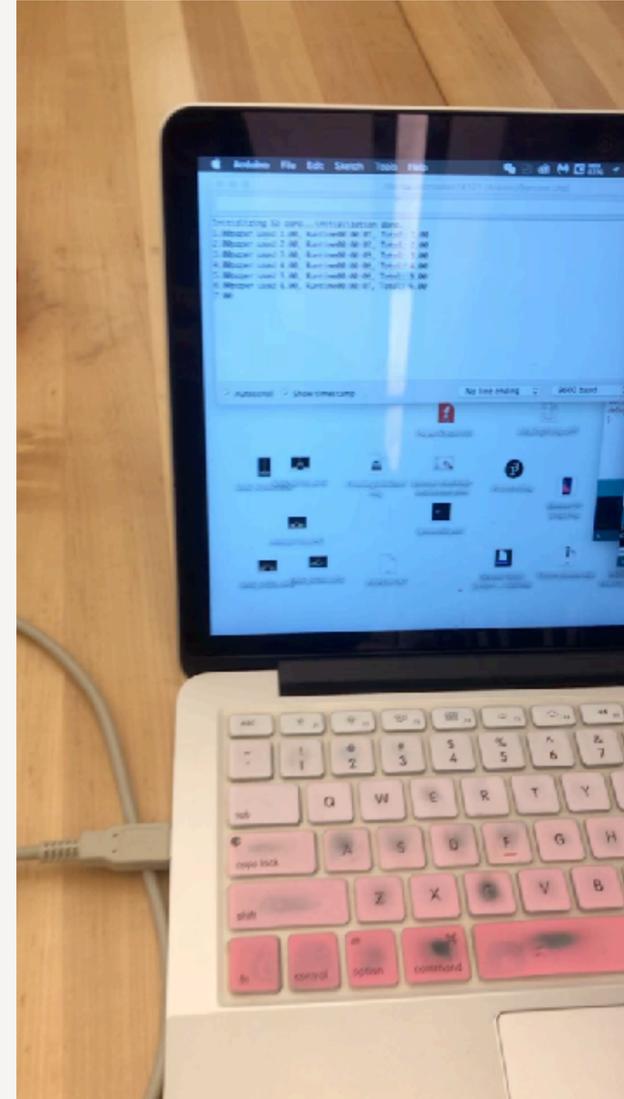
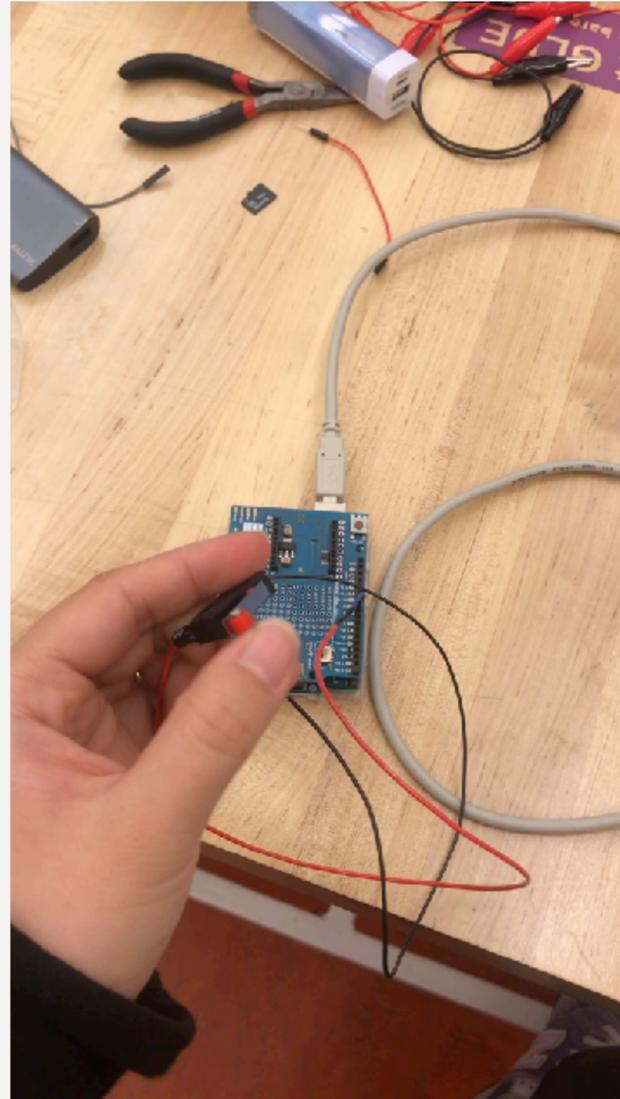
# Testing Methodology

## Installation



# Testing Methodology

How does it work?



Every press of the switch counts "1"

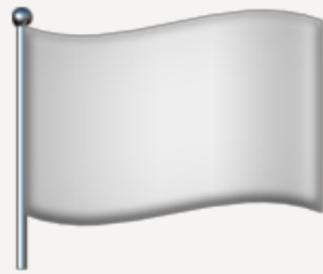
**The info can we gather:**

The number of users

The number of paper towel used per person

Total usage of the paper towel

Time



# **Test Execution**



**It took us several days to  
ask for permission**

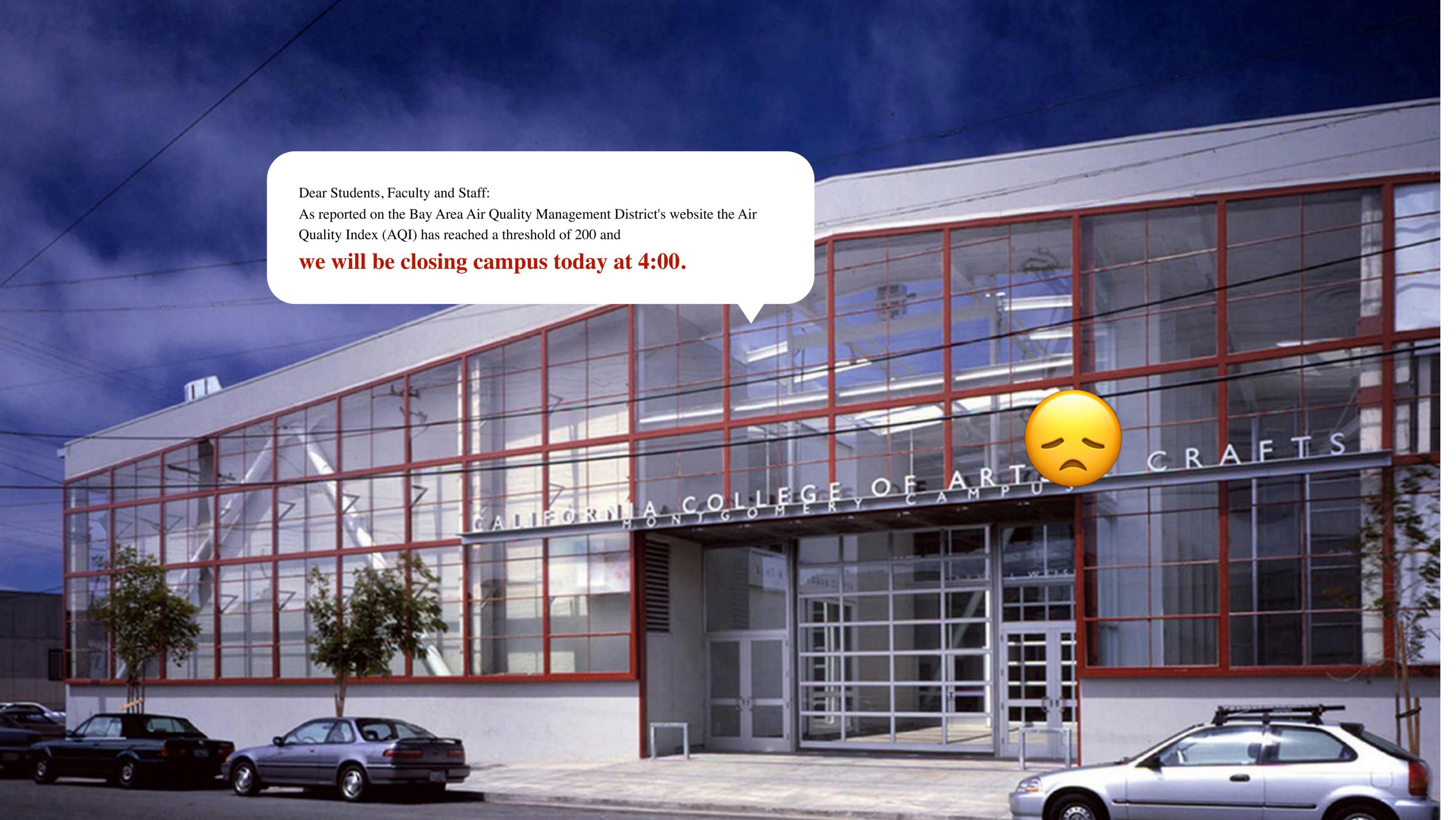




Dear Students, Faculty and Staff:

As reported on the Bay Area Air Quality Management District's website the Air Quality Index (AQI) has reached a threshold of 200 and

**we will be closing campus today at 4:00.**



**In the next few days, A lot of  
professors canceled their classes**





Thanksgiving break: 4 days



Mon	Tue	Wed	Thu	Fri	Sat	Sun
5	6	7	8	9	10	11
	• Project kickoff 17:00		Getting Permission			
12	13	14	15	16	17	18
Getting Permission		Towel Tests				
			Camp Fire			
19	20	21	22	23	24	25
Towel Tests						
Many classes cancelled			Thanksgiving			
26	27	28	29	30	1. Dez.	2
Towel Tests						
	• Nudge installed 16:00					

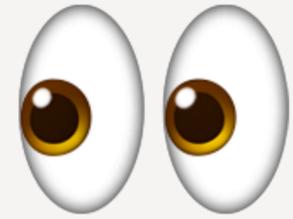
**Something wrong with our data?!**

**Oh we forgot to change the battery!**

**Where did the SD card go??**

**The switch is not working!!!**





**Observation**

# Participants

466

**Total**

# Participants

**466**

**Total**

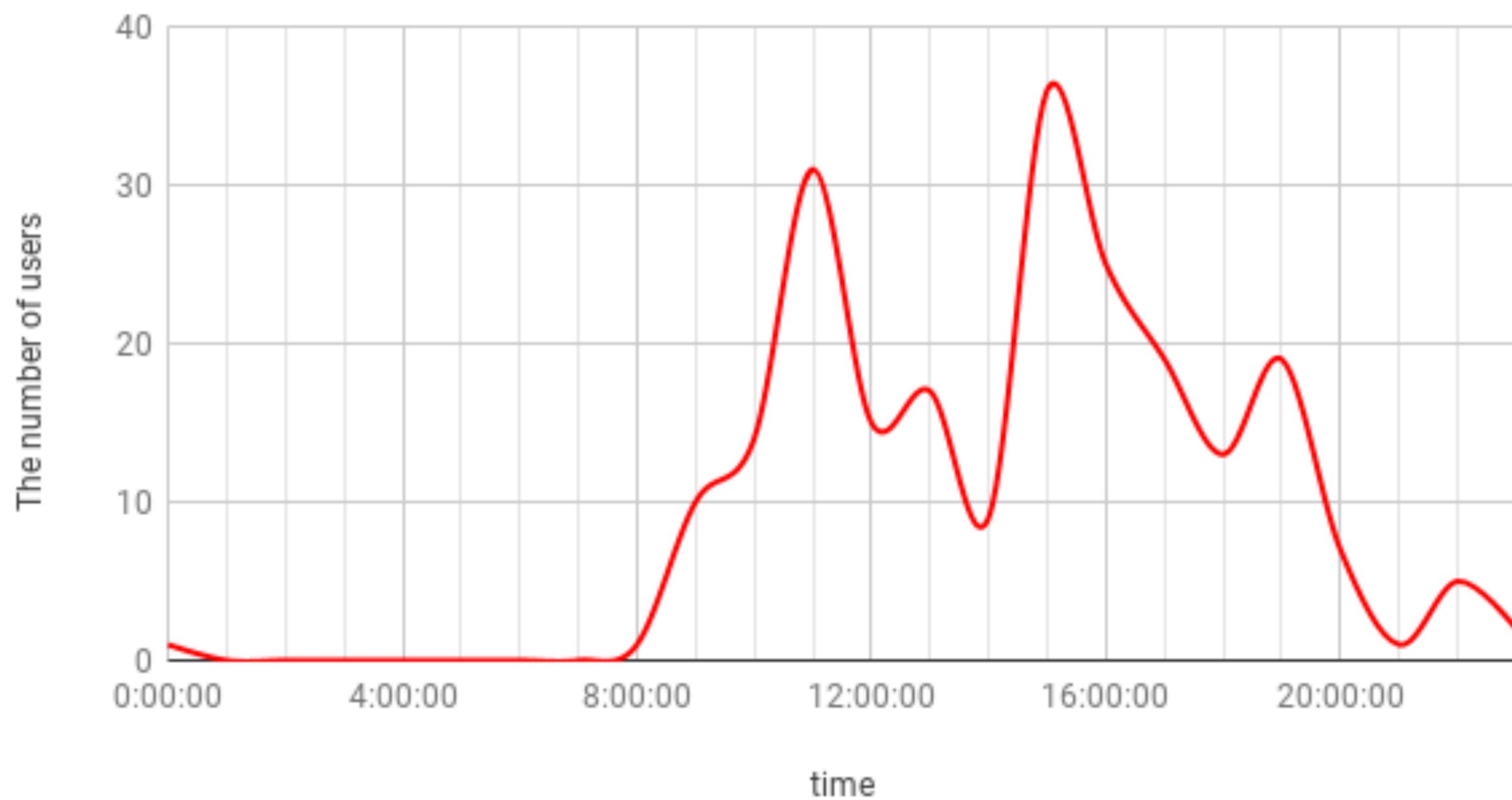
**Female Restroom**

**271**

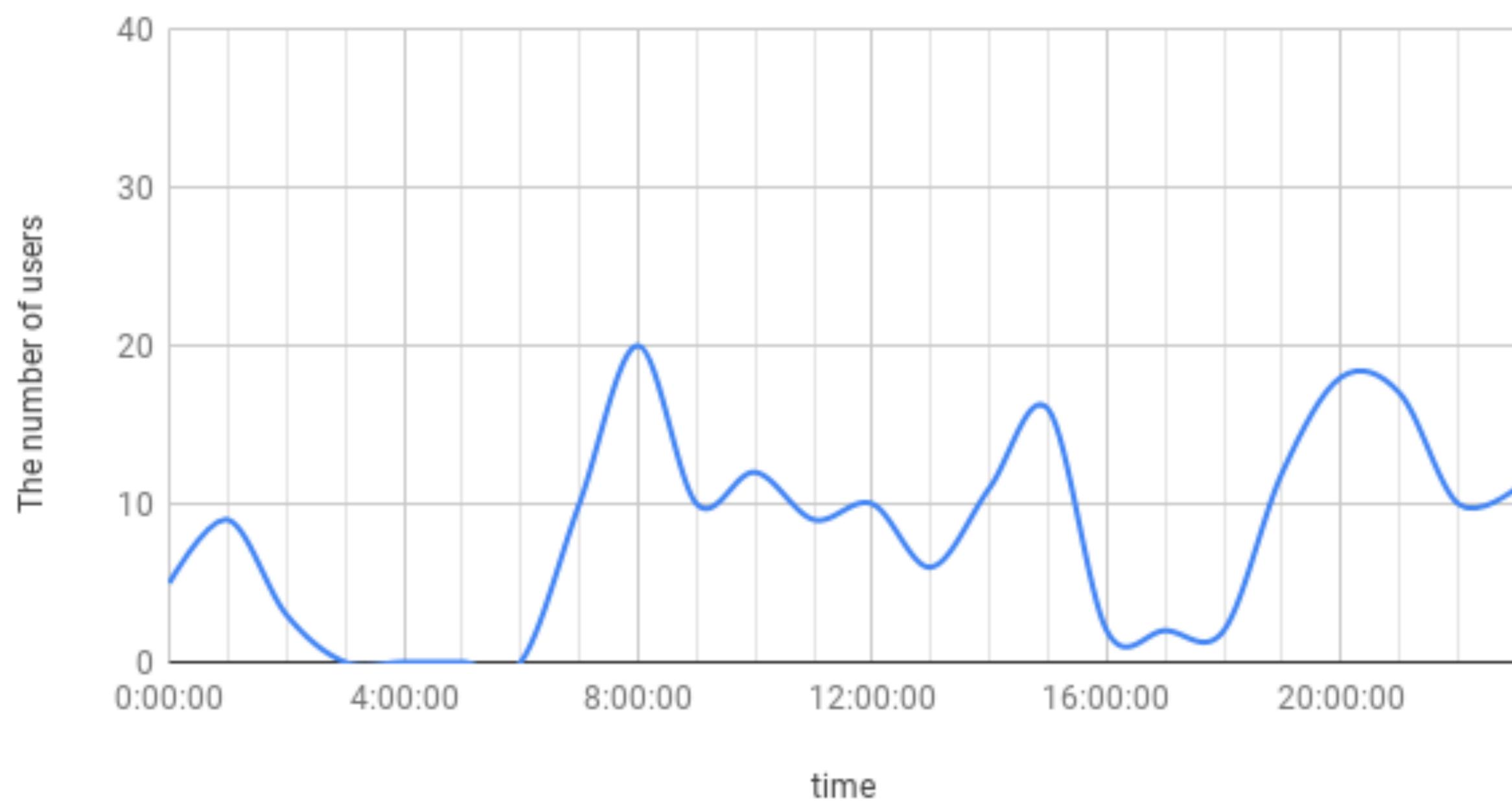
**Male Restroom**

**195**

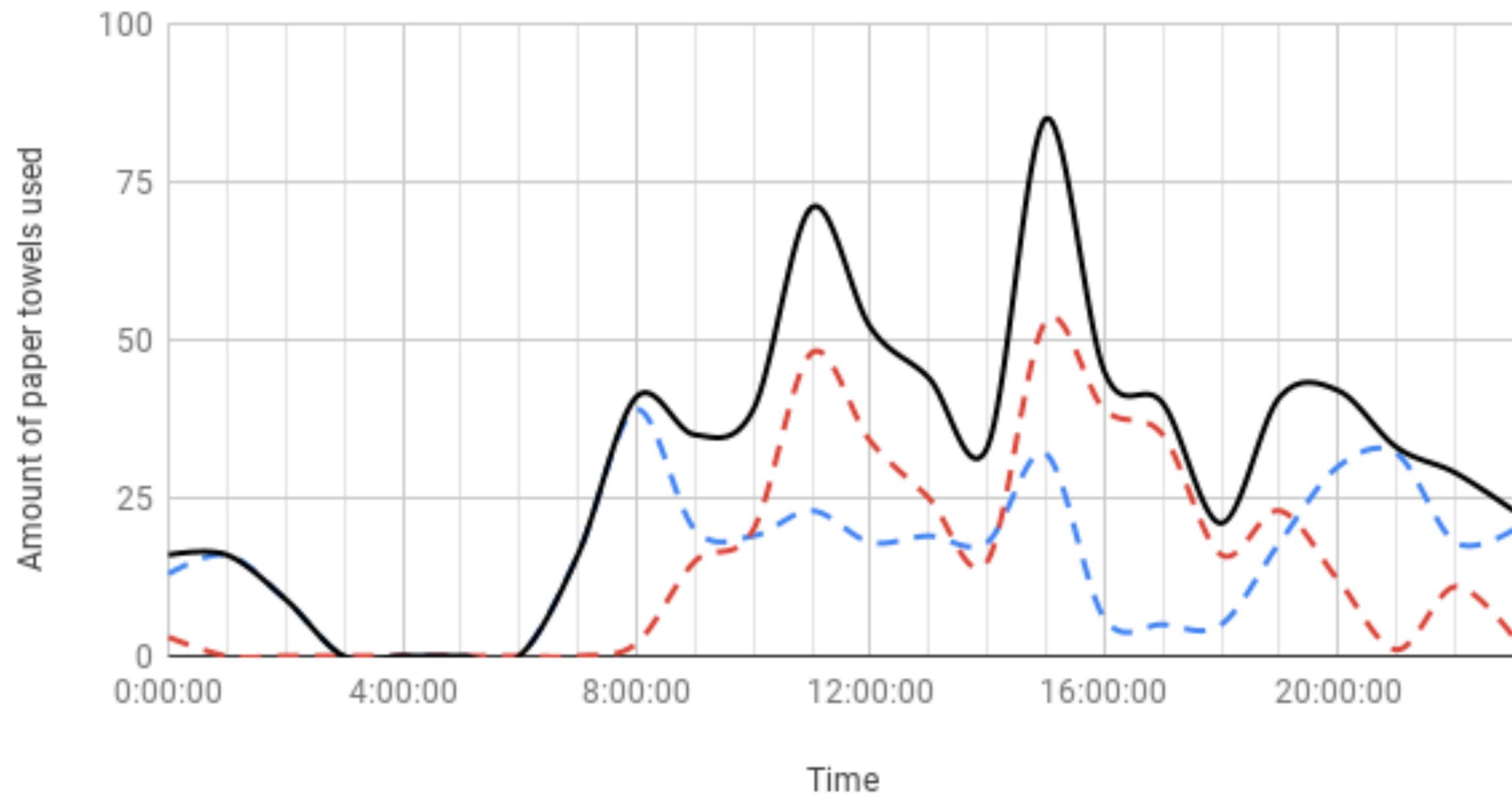
## The Number of Users (The Female Restroom)



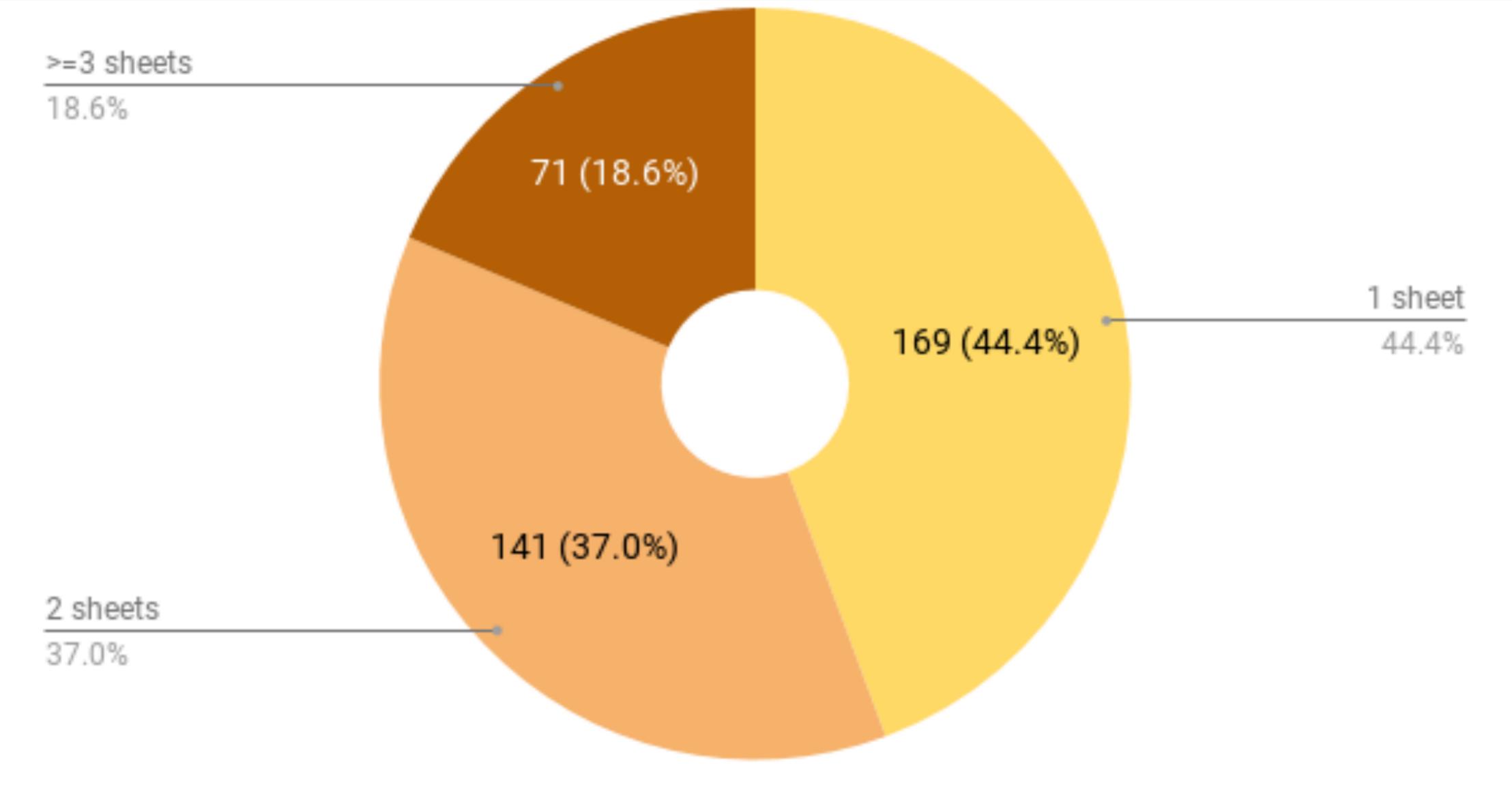
## The Number of Users (The Male Restroom)



## Absolute Usage (Combined)



**A different perspective**



**55.6% of people use more than one paper towel after using the restroom.**

# Participants

**Female Restroom**

**271**

**>**

**Male Restroom**

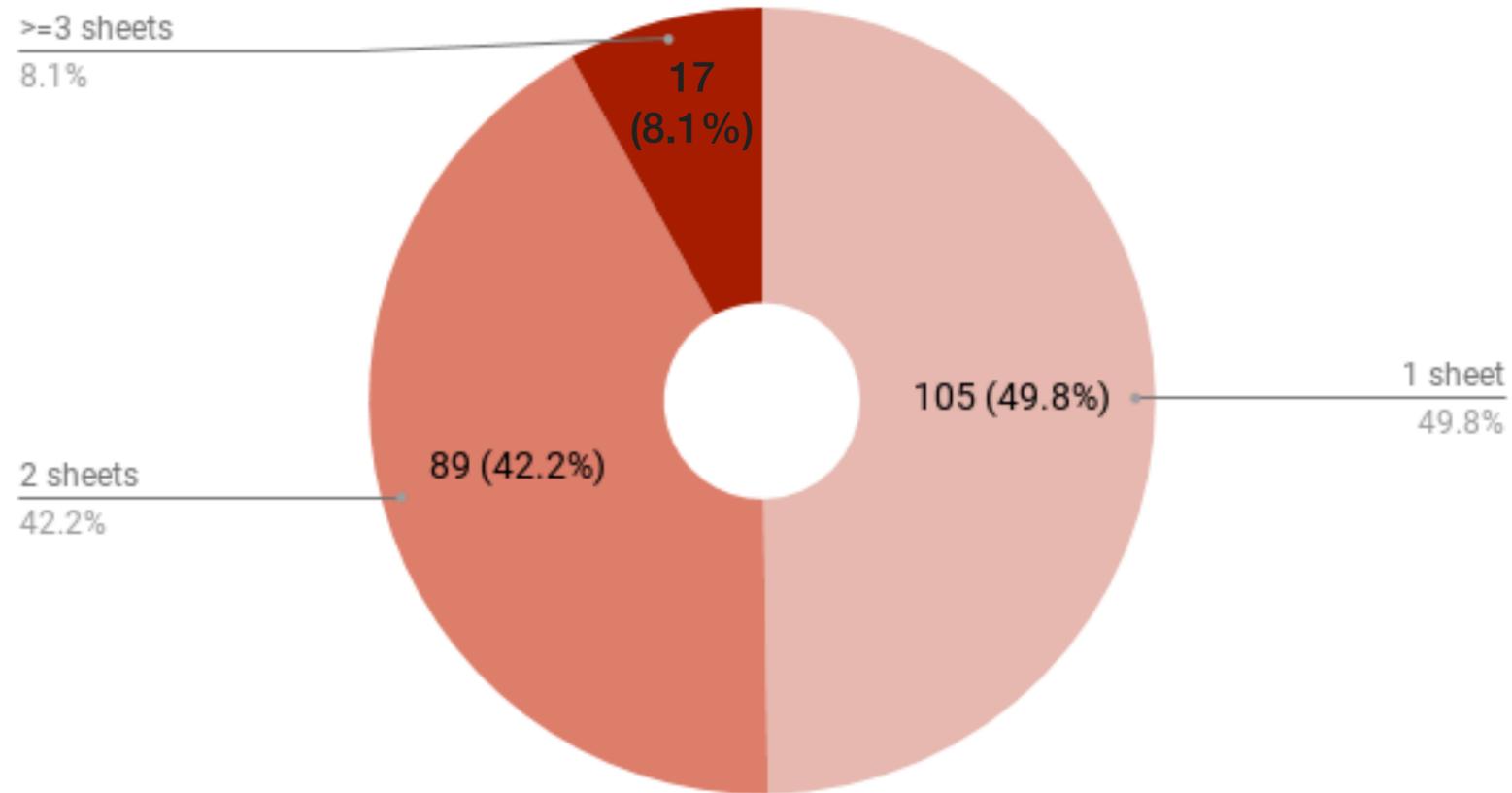
**195**

**355**

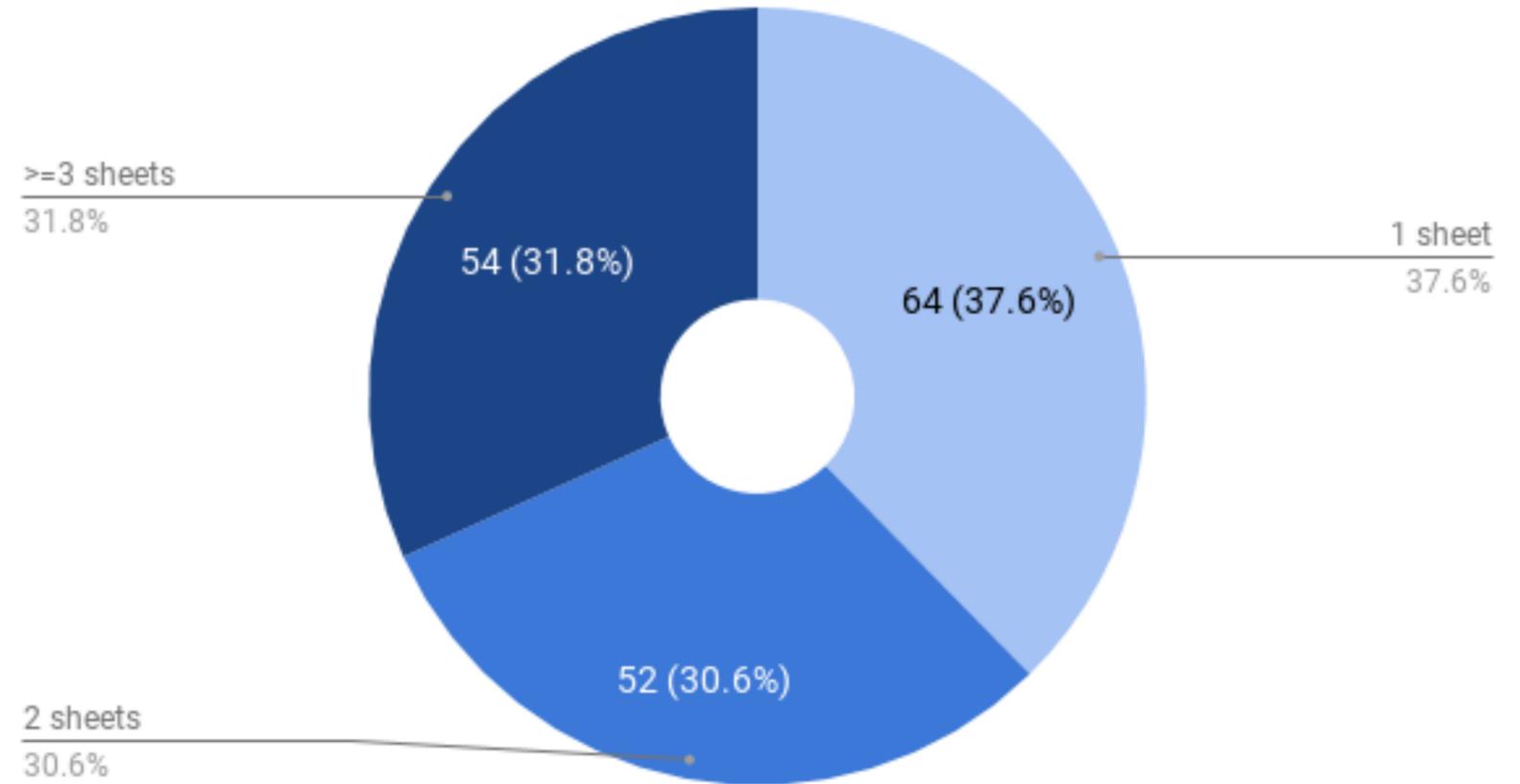
**<**

**376**

Individual Usage in the Female Restroom ( Before Nudge )



Individual Usage in the Male Restroom ( Before Nudge )



**Males tend to use more paper towels than females do.**



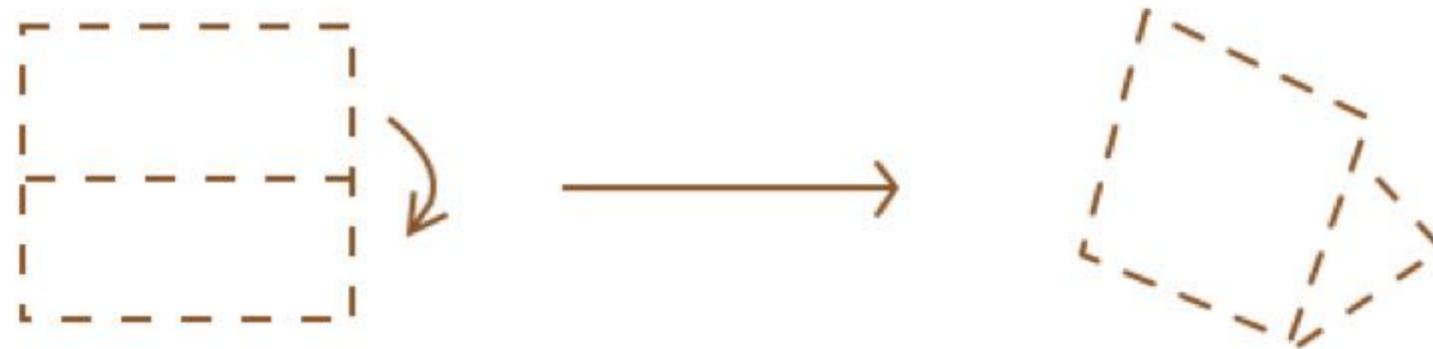
# Setting up the nudge

# How to use fewer paper towels

Method 1. Shake your hands before using the paper towel !



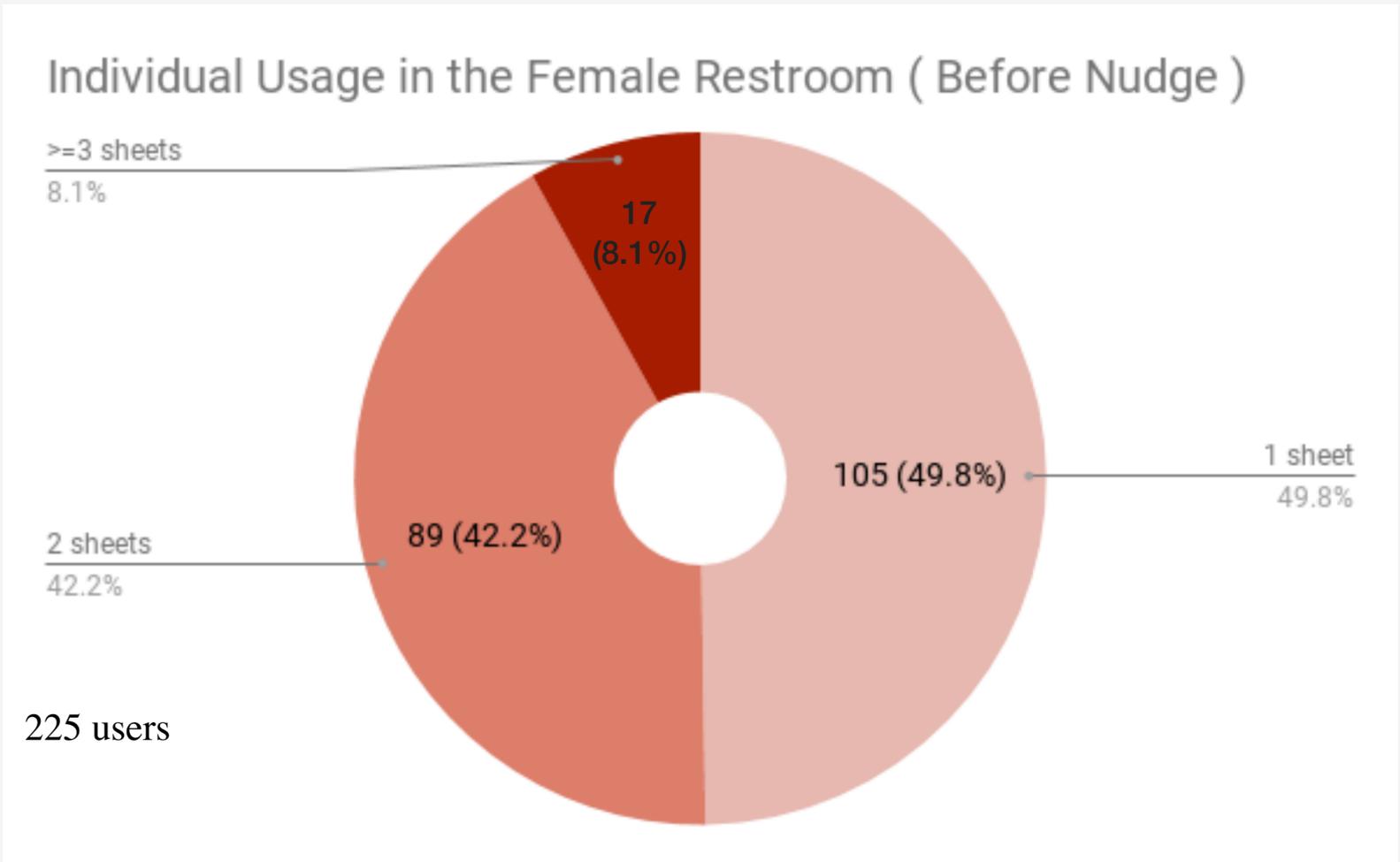
Method 2. Use fewer paper towels by folding them in half.



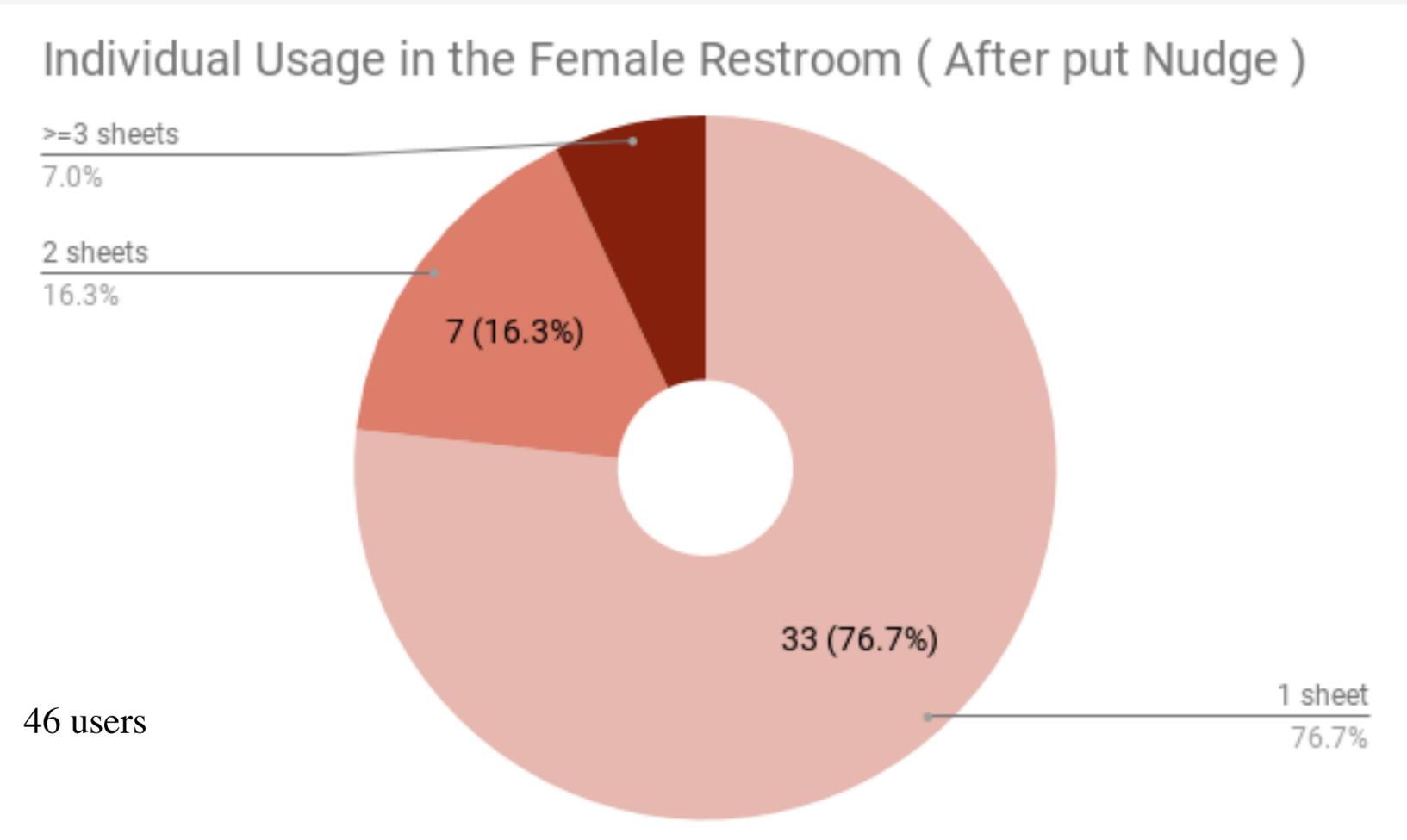


**After we placed our nudge**

Before the nudge

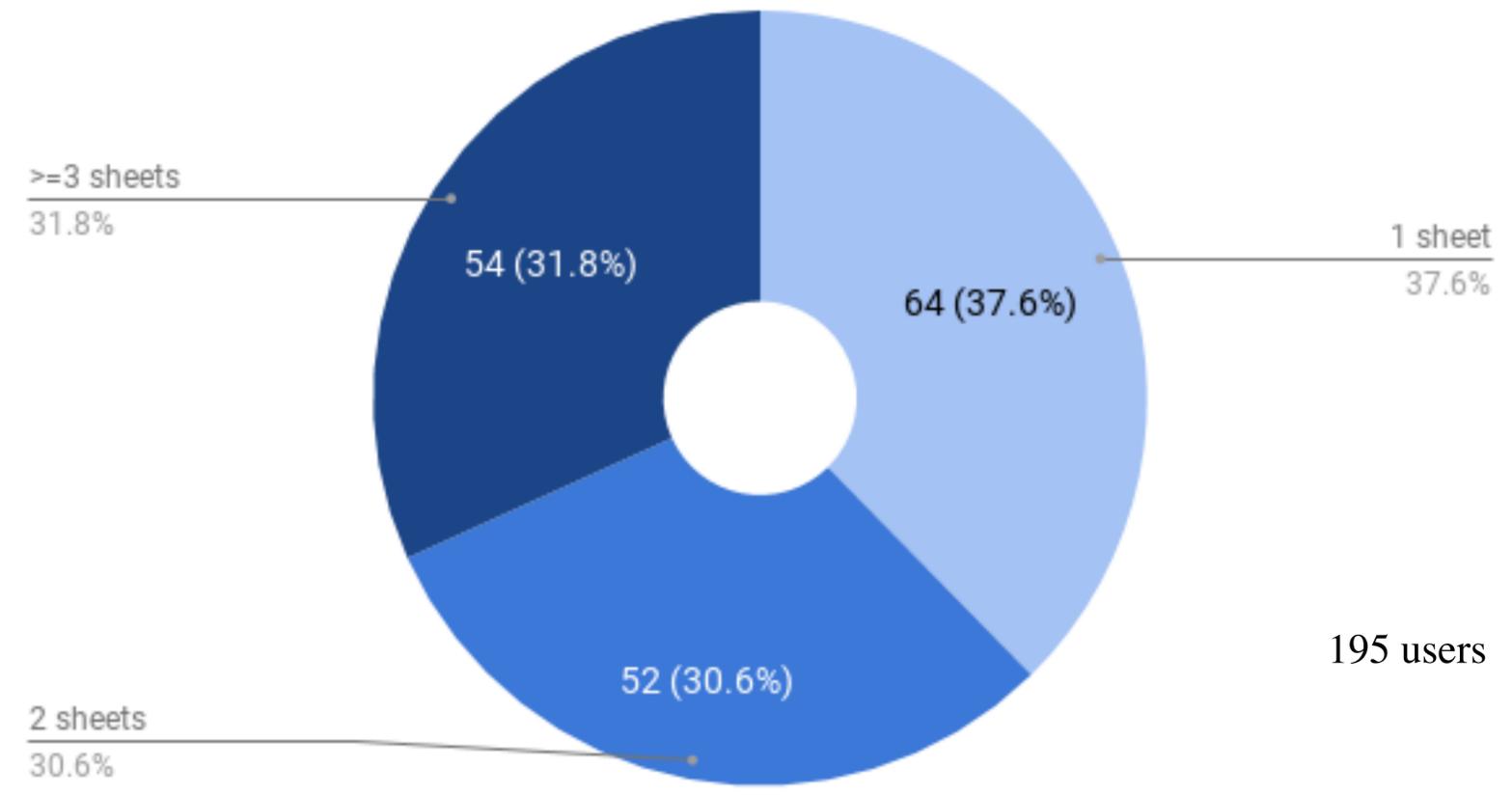


With the nudge



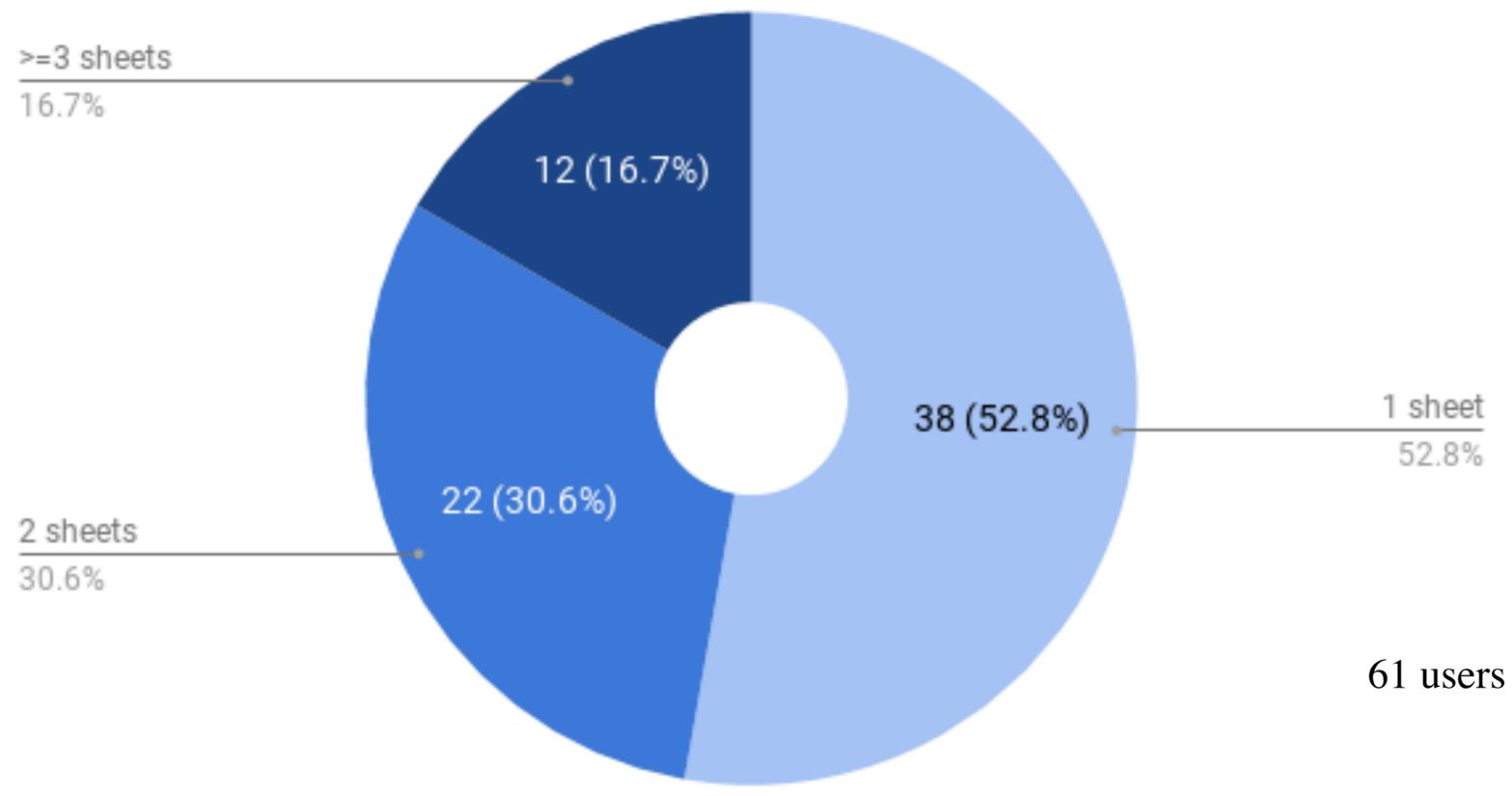
Before the nudge

Individual Usage in the Male Restroom ( Before Nudge )

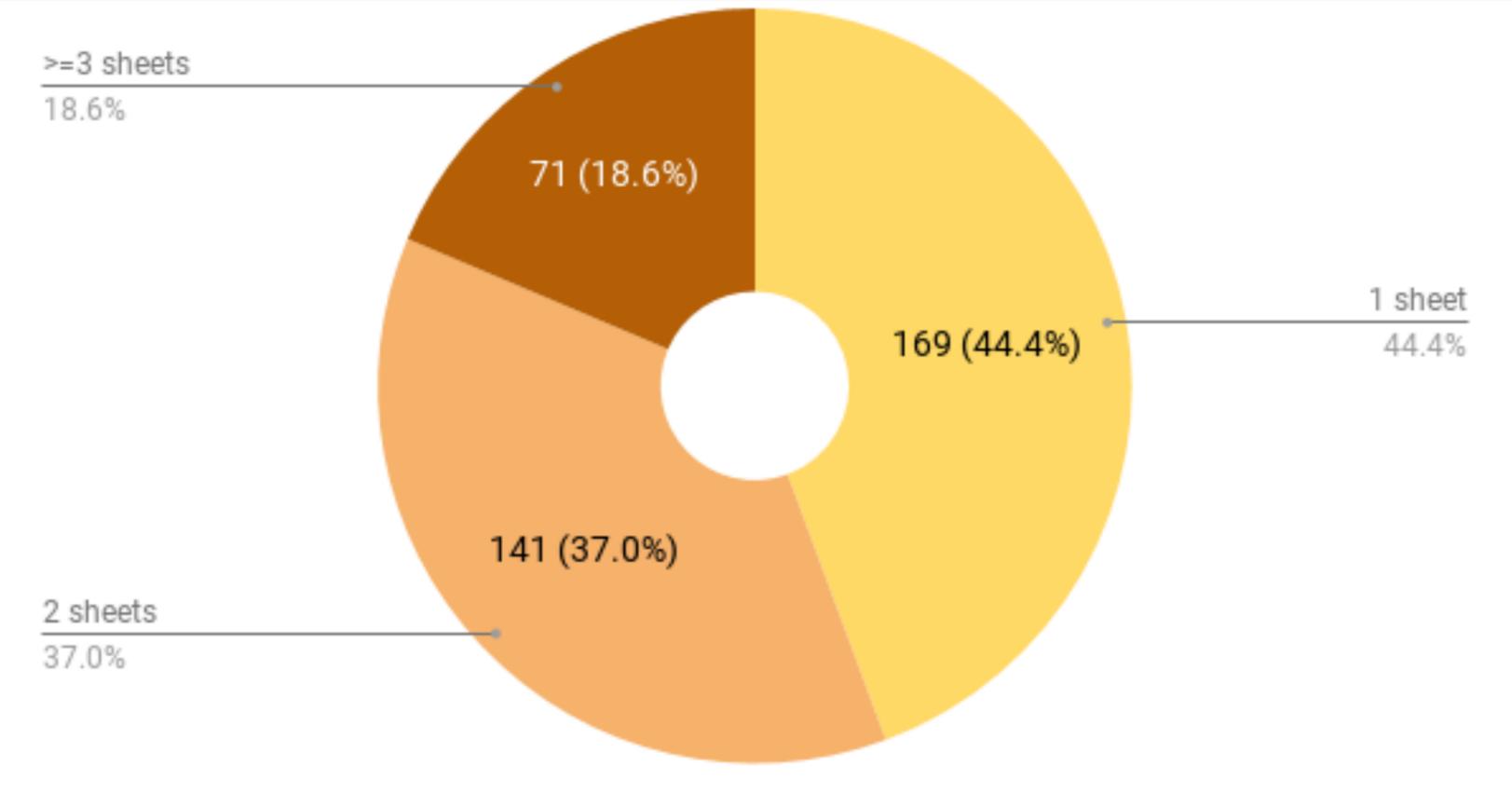


With the nudge

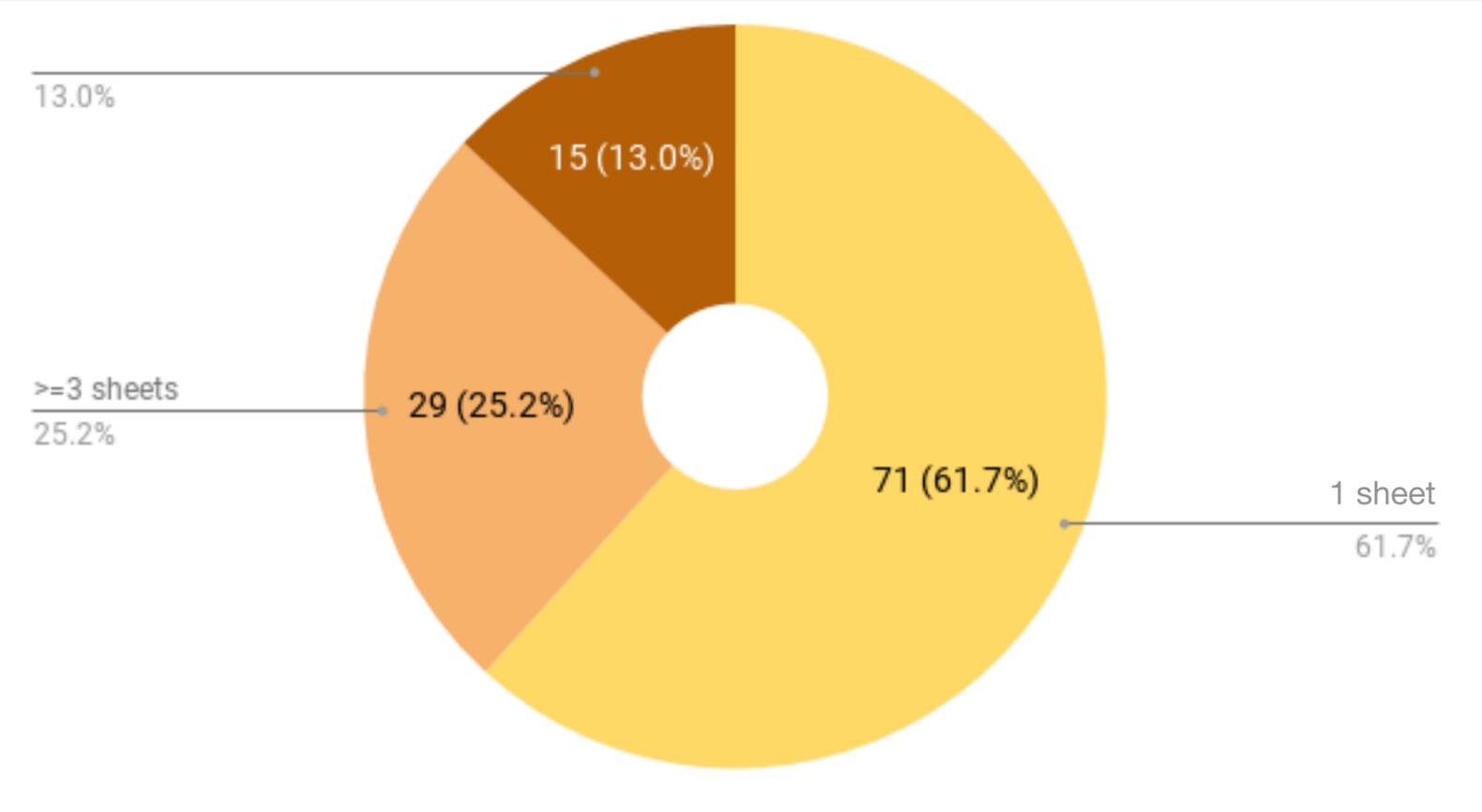
Individual Usage in the Male Restroom ( After Nudge )

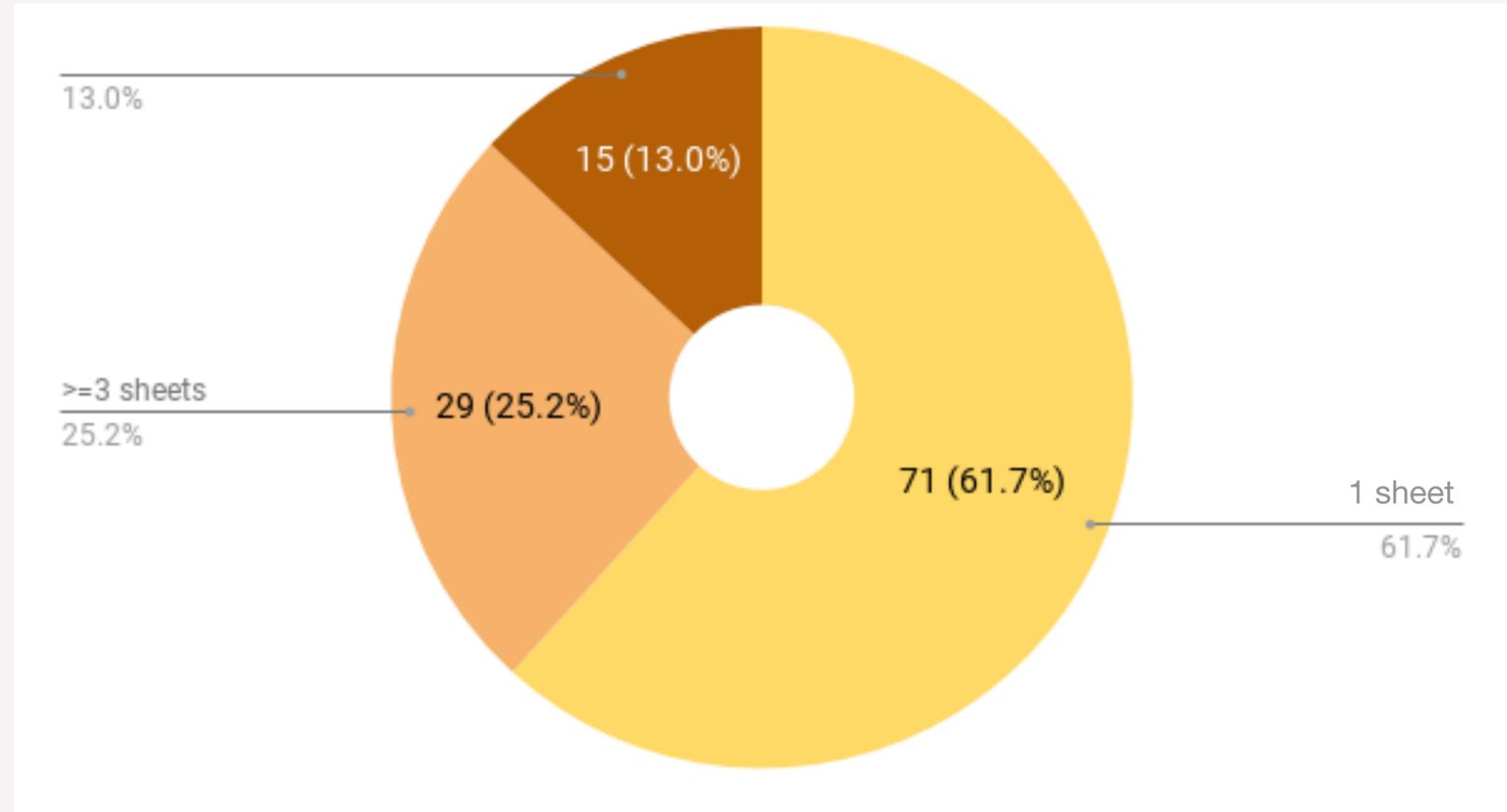
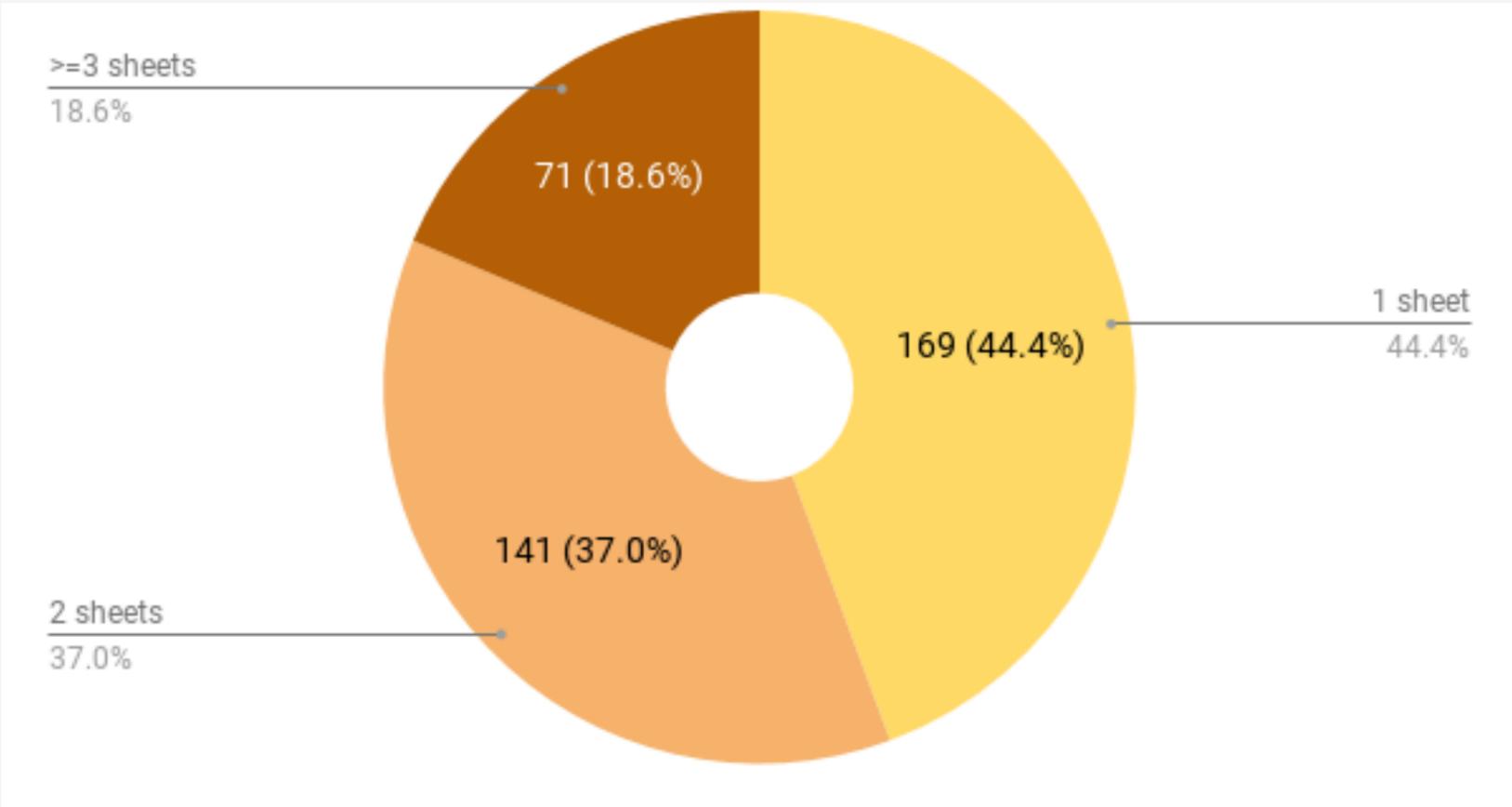


Before the nudge



With the nudge





**40% more**

people are using just 1 towel

**30% less**

people are using 3+ towel

**Our nudge works!**

# Conclusion:

Through our simple, informational nudge we could drastically decrease the amount of paper towels used in public bathrooms. This will have a major impact. Not just financially but also on the environment.

# What we learned

# What we learned

You will need 2x - 3x the amount of everything...time...  
materials...patience...

Implementation is as important as theory and planning...

Check your timeframe / calendar...

Agree on how to structure your findings early.

“Always hit reset after reinserting the SD card!” - Jiaying Yang, 2018

## Next steps...

We believe that if this test was implemented on a larger scale with more time, we would be able to prove more conclusively that there is a clear correlation between **the introduction of our informing nudge** and **eliciting a change in planned behavior.**

**Thank you!**