Mental Accounting in College: Students and 'Free Money'

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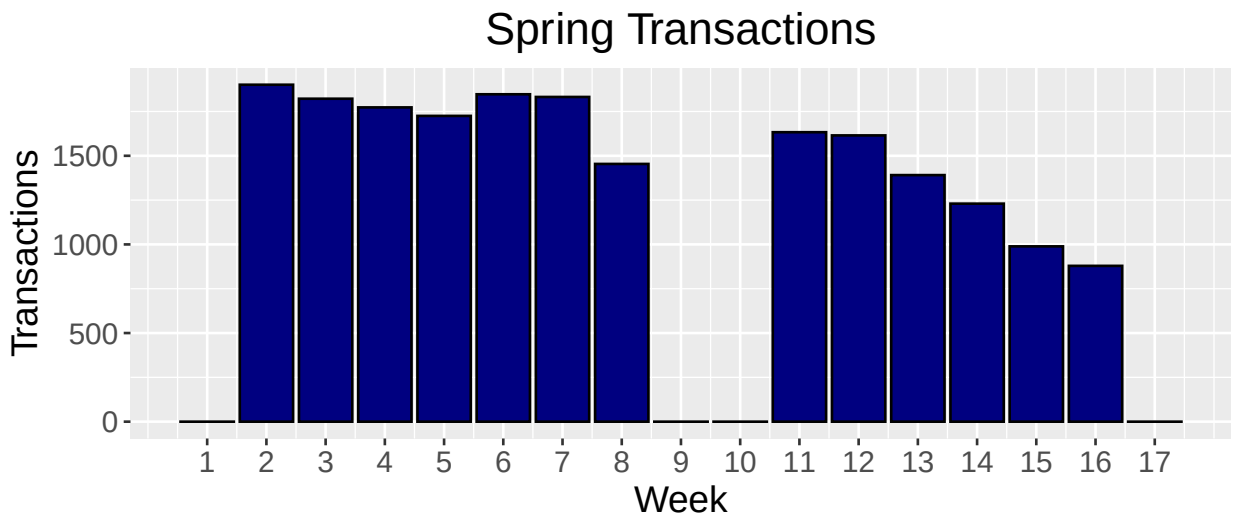
April 2, 2020

Spring Semester Dates Campus Open: 1/20/19, Start: 1/22/19, End: 5/8/19, Campus Closed: 5/20/19

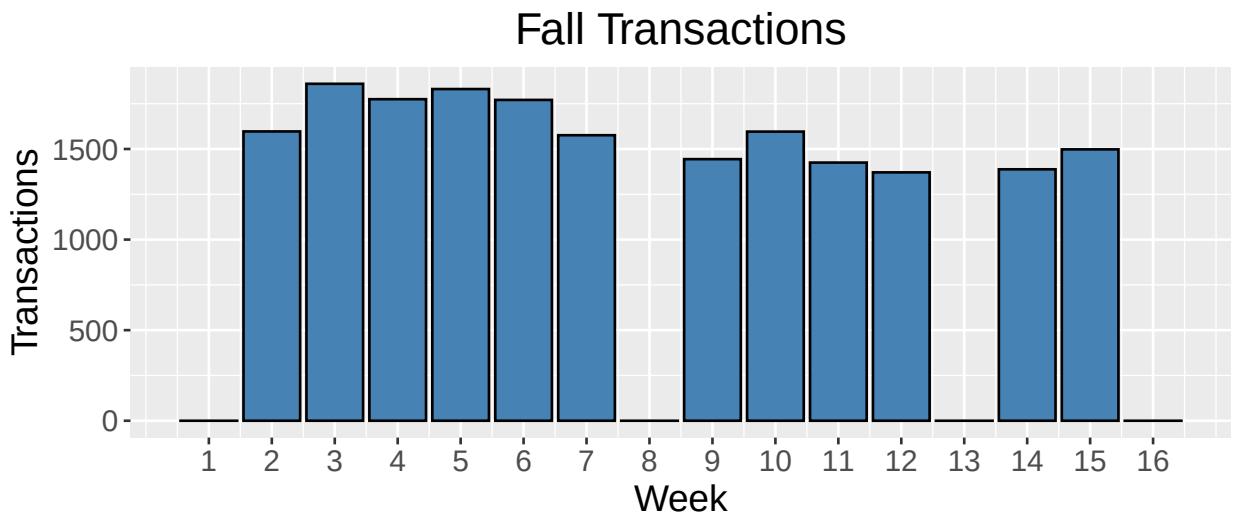
Fall Semester Dates Campus Open: 8/31/19 Start: 9/3/19, End: 12/11/19, Campus Closed: 12/21/19

```
flex_data <- read_csv("flex_data.csv")
flex_data <- flex_data %>% mutate(Time = mdy_hm(Time)) %>% mutate(Week = epiweek(Time)) %>% rename(Amou
flex_data <- flex_data %>% filter(Time >= '2019-01-20' & Time <= '2019-12-19') %>%  filter(AmountSpent
```

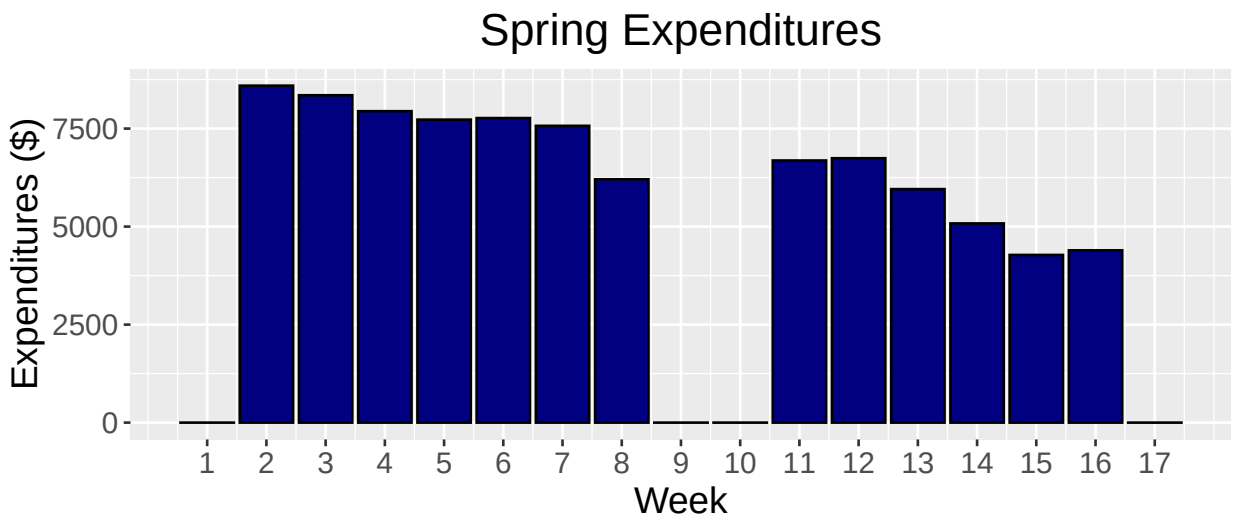
```
#Graph adjustments
theme_update(text = element_text(size=15))
theme_update(plot.title = element_text(hjust = 0.5))

#Transactions by week
springtrans <- flex_data %>% filter(Time <= '2019-5-19') %>% mutate(Week = Week-3) %>% filter(Week!=1 &
falltrans <- flex_data %>% filter(Time >= '2019-9-1') %>% mutate (Week = Week-35) %>% filter(Week!=1 & W

springtransactions <- springtrans %>% group_by(Week) %>% summarize(Transactions = n()) %>% rbind(c(1,0)
falltransactions <- falltrans %>% group_by(Week) %>% summarize(Transactions = n()) %>% rbind(c(1, 0), c

ggplot(springtransactions) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", colo
```



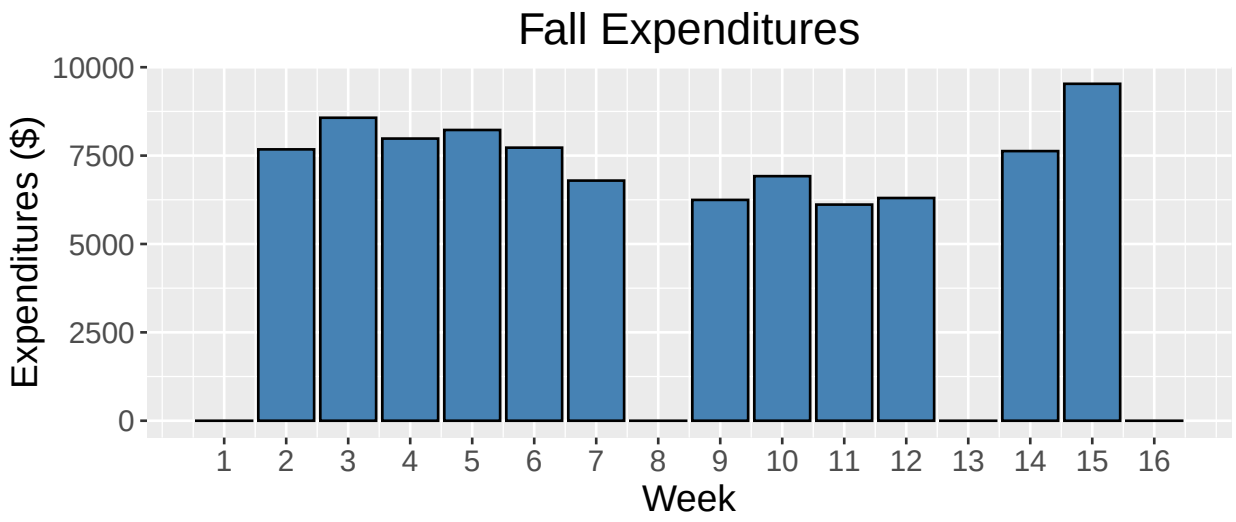

```
ggplot(falltransactions) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue", c
```



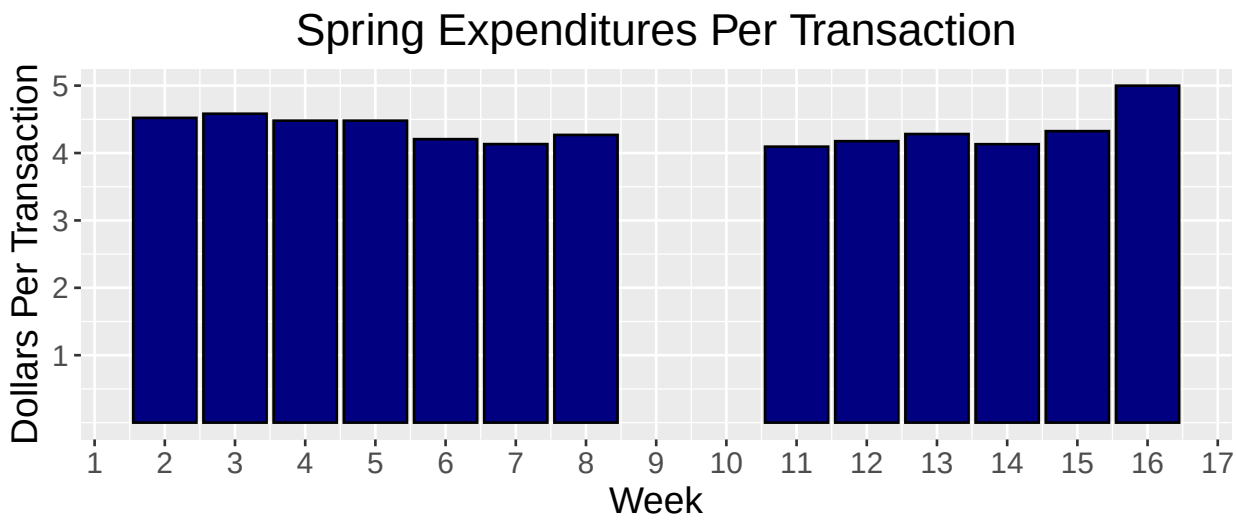

```
theme_update(text = element_text(size=15))
theme_update(plot.title = element_text(hjust = 0.5))

#Purchases by week
springpurchases <- springtrans %>% group_by(Week) %>% summarize(TotalPurch = sum(AmountSpent)) %>% rbin
fallpurchases <- falltrans %>% group_by(Week) %>% summarize(TotalPurch = sum(AmountSpent)) %>% rbind(c(

ggplot(springpurchases) + geom_bar(aes(x=Week, y=TotalPurch), stat='identity', fill = "navy", color = "
```



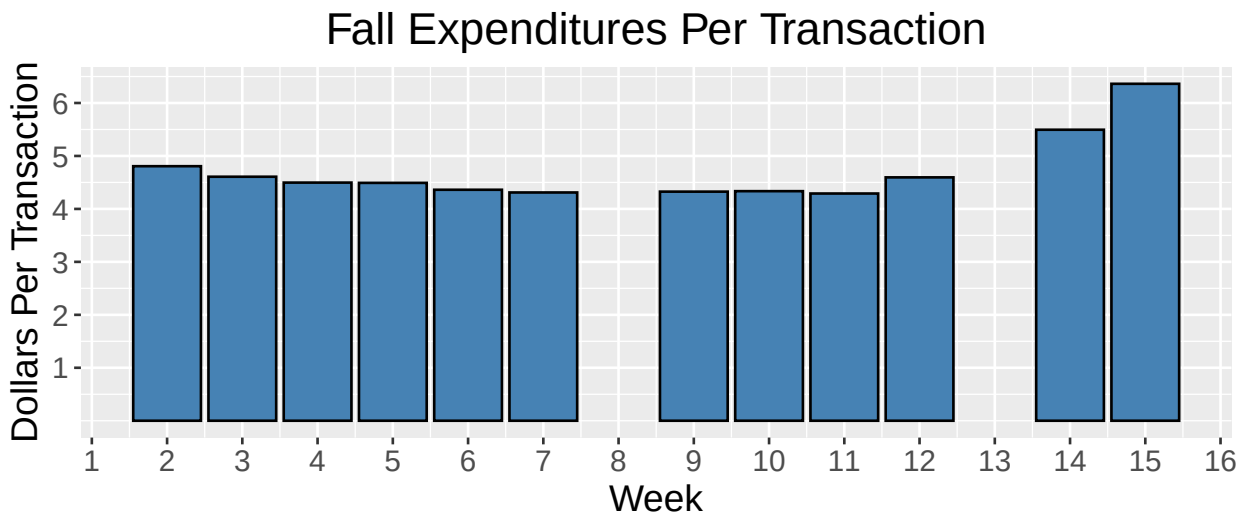

```
ggplot(fallpurchases) + geom_bar(aes(x=Week, y=TotalPurch), stat='identity', fill = "steelblue", color =
```



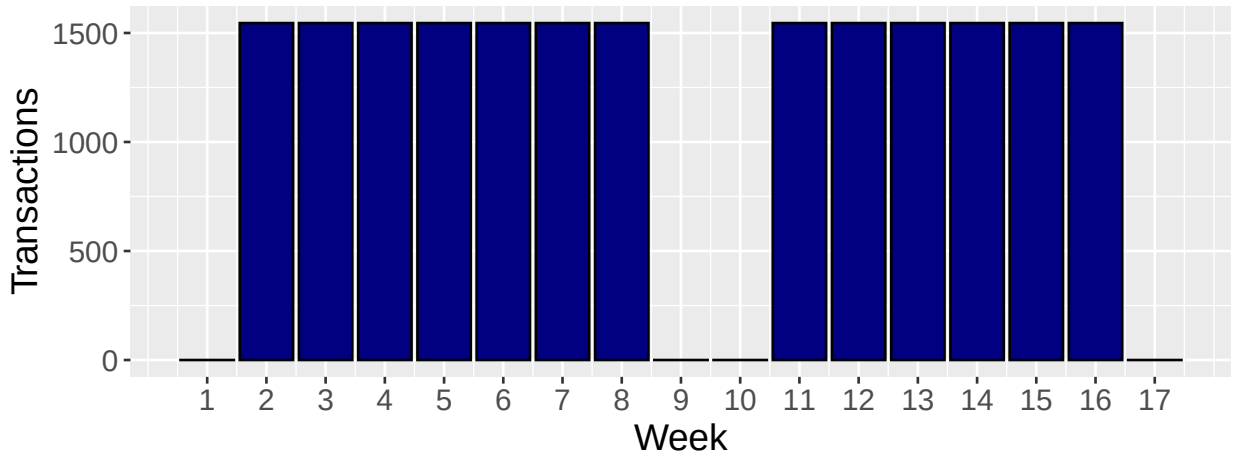

```
theme_update(text = element_text(size=15))
theme_update(plot.title = element_text(hjust = 0.5))

#Amount Spent Per Transaction
springppt <- springtrans %>% group_by(Week) %>% summarize(TotalTrans = n(), TotalPurch = sum(AmountSpen
fallppt <- falltrans %>% group_by(Week) %>% summarize(TotalTrans = n(), TotalPurch = sum(AmountSpent)) %

ggplot(springppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "navy", color = "black") + ggti
```



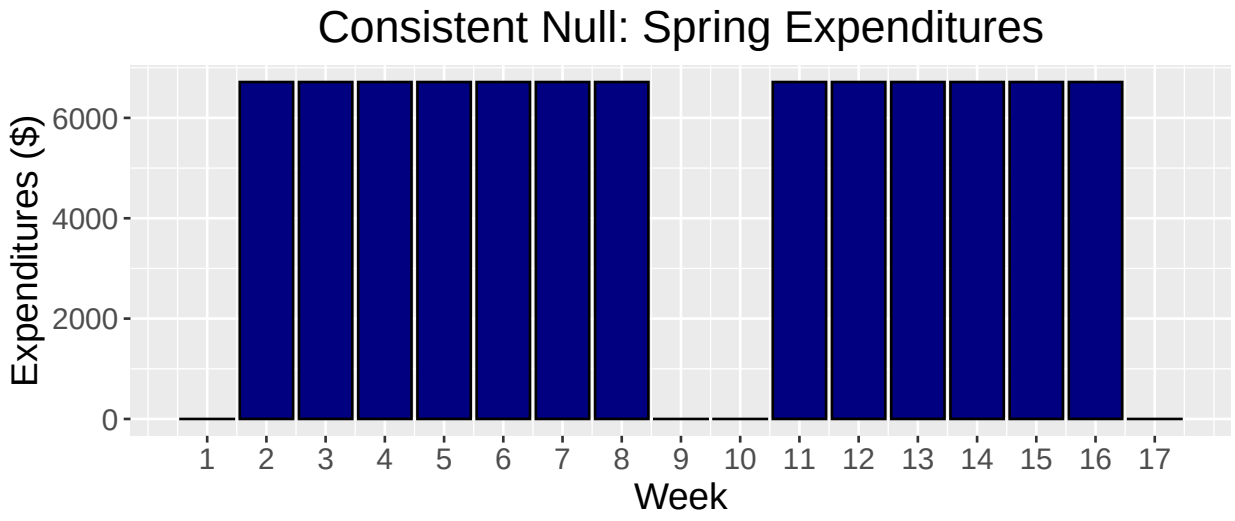

```
ggplot(fallppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "steelblue", color = "black") + g
```



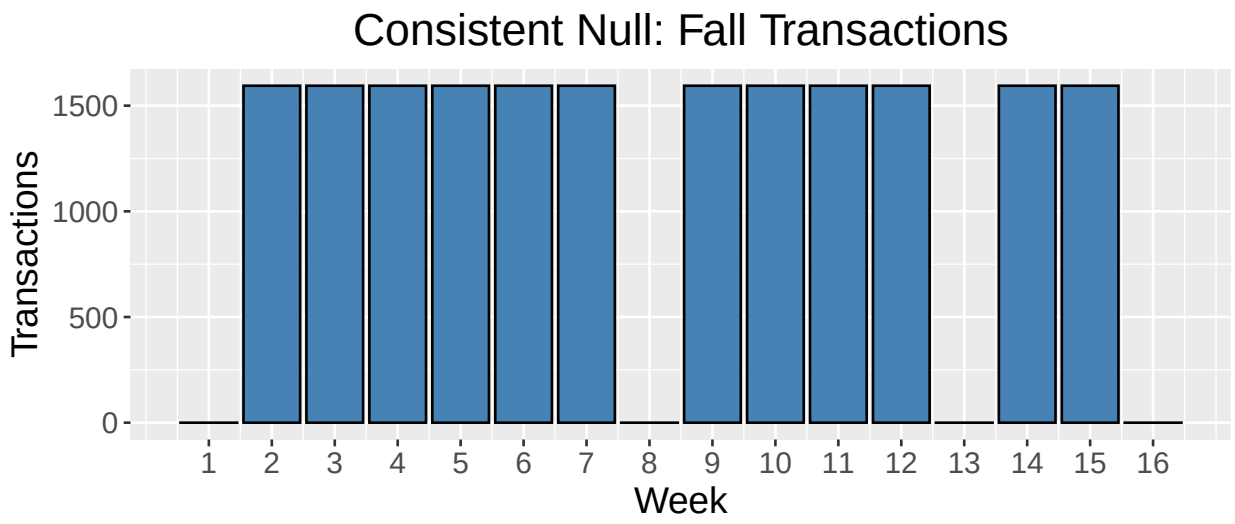

```
theme_update(text = element_text(size=15))
theme_update(plot.title = element_text(hjust = 0.5))

#Creation of consistent null dataframes
sprnullconsistent <- data.frame("Week"=1:17, "Transactions"= c(0,sum(springppt$TotalTrans)/13,sum(sprin

sprnullconsistentprob <- data.frame("Week"=1:17, "Probability"=c(0,1/13,1/13,1/13,1/13,1/13,1/13,1/13,0

fallnullconsistent <- data.frame("Week"=1:16, "Transactions"= c(0,sum(fallppt$TotalTrans)/12,sum(fallpp

fallnullconsistentprob <- data.frame("Week"=1:16, "Probability"=c(0,1/12,1/12,1/12,1/12,1/12,1/12,0,1/1

ggplot(sprnullconsistent) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", color
```




```
ggplot(sprnullconsistent) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "navy", color =
```




```
ggplot(fallnullconsistent) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue",
```




```
ggplot(fallnullconsistent) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "steelblue", co
```

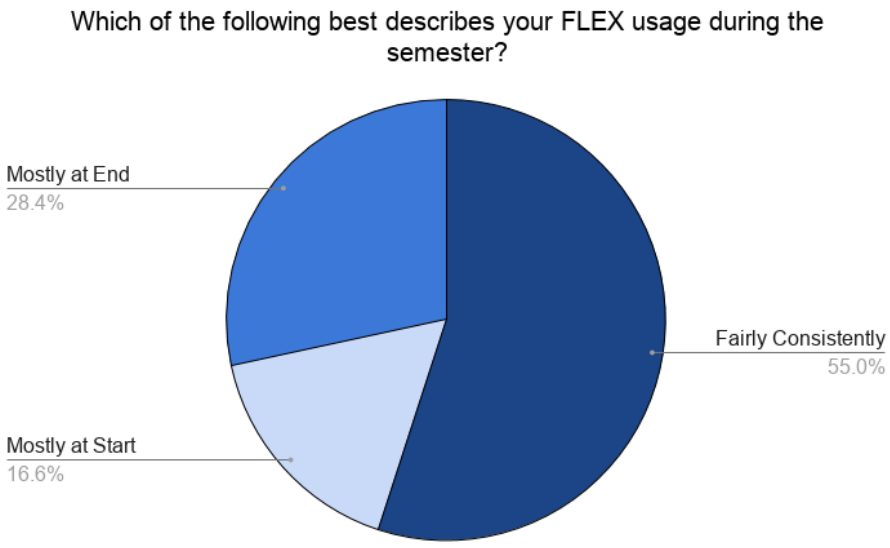
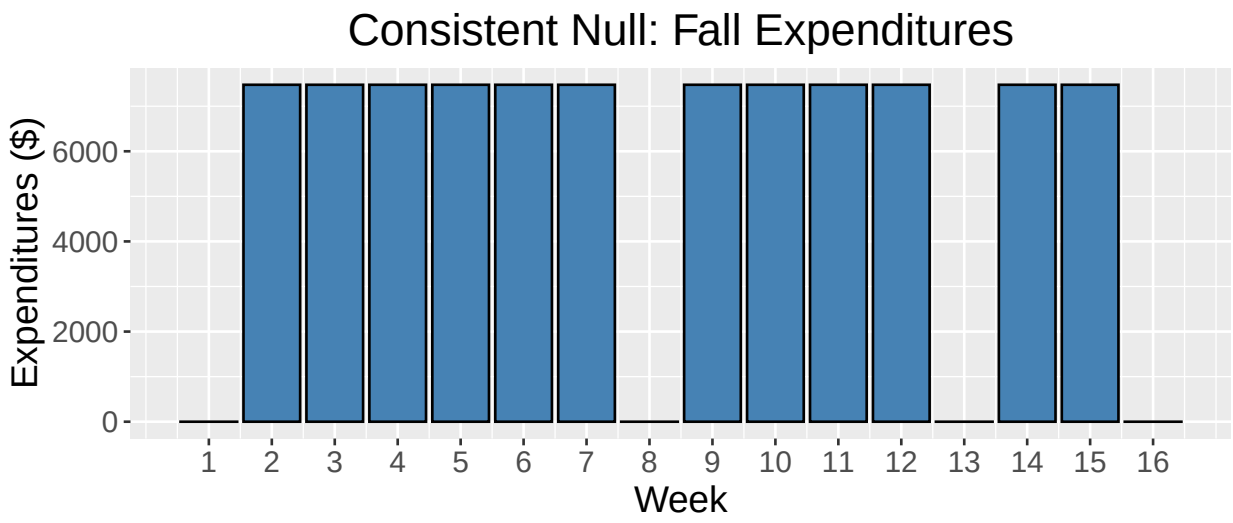
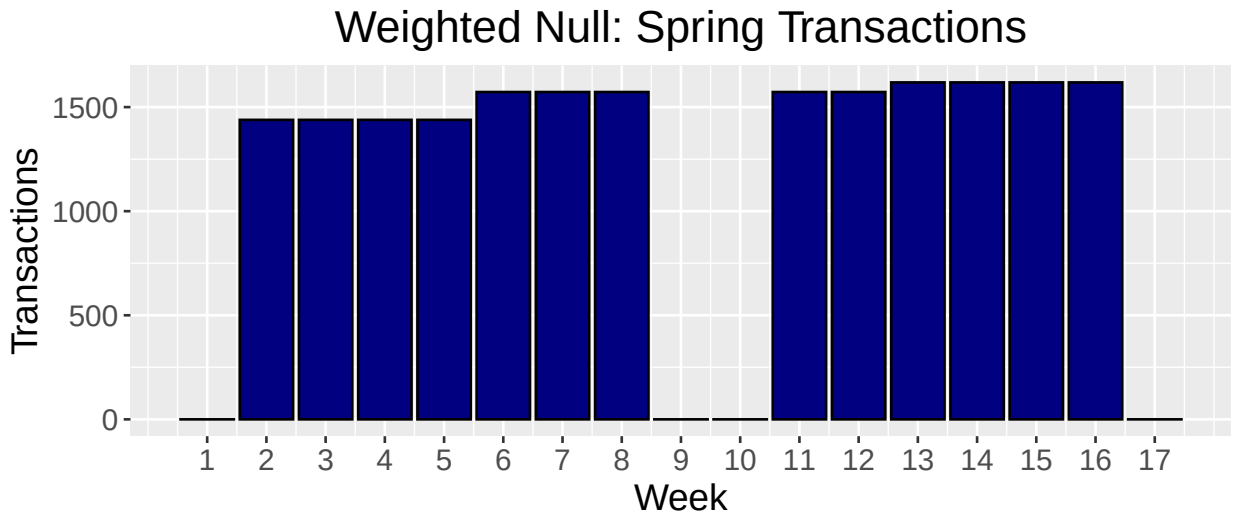


Figure 1: "Figure XXX: Student Responses to FLEX Usage"

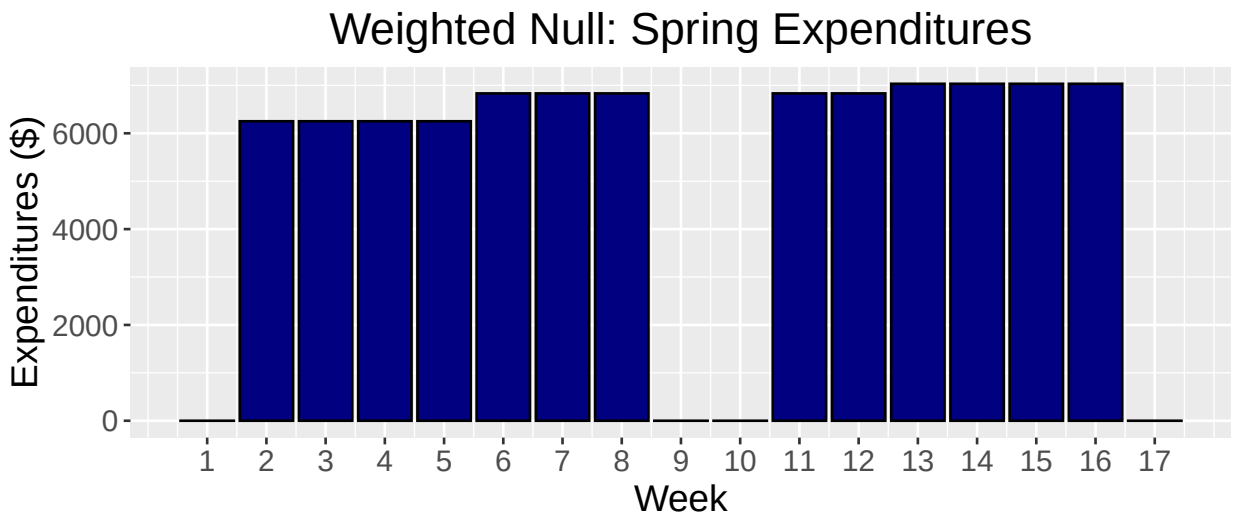



```
#285/518=55.02% of students believe they spend consistently (1/3 beginning, 1/3 middle, 1/3 end)
#86/518=16.60% of students believe they spend most in beginning (1/2 beginning, 1/3 middle, 1/6 end)
#147/518=28.38% of students believe they spend most at end (1/6 beginning, 1/3 middle, 1/2 end)

#Tested - Sums of spring/fall weighted expectation nulls add up to sum of purchases/transactions from s
#Note - each period represents total spending expected during that period, then divided by number of we

theme_update(text = element_text(size=15))
theme_update(plot.title = element_text(hjust = 0.5))

p1springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/2) + .2838
p2springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/3) + .2838
p3springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/6) + .2838
```

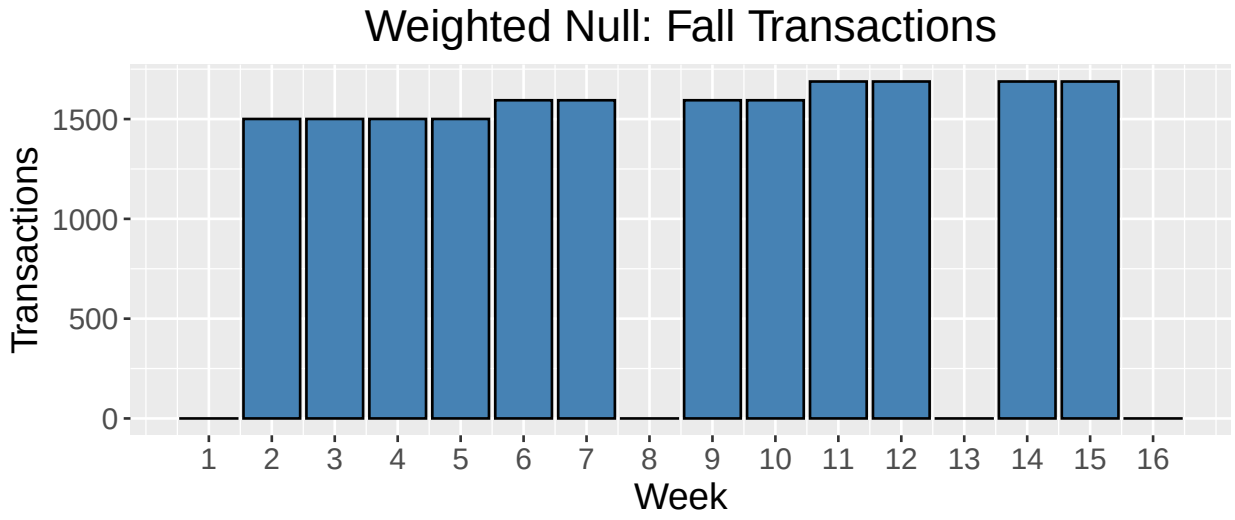
```
p1springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/2) + .2838
p2springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/3) + .2838
p3springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/6) + .2838

p1springprob <- (.5502*(1/3) + .1660*(1/2) + .2838*(1/6))*.913
p2springprob <- (.5502*(1/3) + .1660*(1/3) + .2838*(1/3))*1.174
p3springprob <- (.5502*(1/3) + .1660*(1/6) + .2838*(1/2))*.913

sprnullweighted <- data.frame("Week"=1:17, "Transactions"= c(0,p1springtrans/4,p1springtrans/4,p1spring

sprnullweightedprob <- data.frame("Week"=1:17, "Probability"= c(0,p1springprob/4,p1springprob/4,p1sprin

p1falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/2) + .2838*sum(fa
p2falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/3) + .2838*sum(fa
p3falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/6) + .2838*sum(fa

p1fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/2) + .2838*sum(fa
p2fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/3) + .2838*sum(fa
p3fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/6) + .2838*sum(fa

p1fallprob <- .5502*(1/3) + .1660*(1/2) + .2838*(1/6)
p2fallprob <- .5502*(1/3) + .1660*(1/3) + .2838*(1/3)
p3fallprob <- .5502*(1/3) + .1660*(1/6) + .2838*(1/2)

fallnullweighted <- data.frame("Week"=1:16, "Transactions"= c(0,p1falltrans/4,p1falltrans/4,p1falltrans,

fallnullweightedprob <- data.frame("Week"=1:16, "Probability"= c(0,p1fallprob/4,p1fallprob/4,p1fallprob,

ggplot(sprnullweighted) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", color =
```



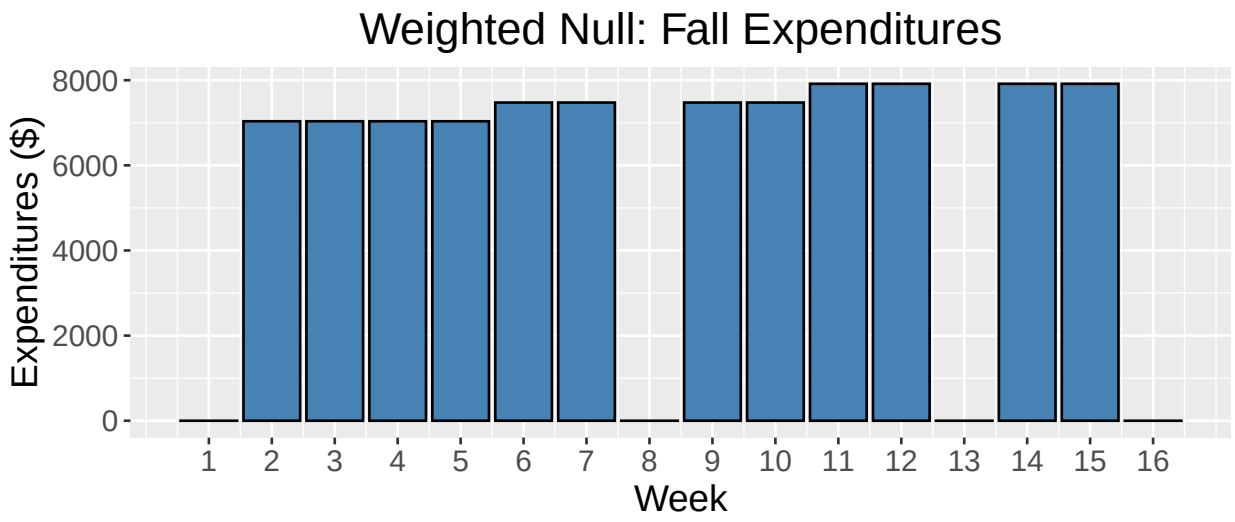

```
ggplot(sprnullweighted) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "navy", color = "bl
```




```
ggplot(fallnullweighted) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue", co
```




```
ggplot(fallnullweighted) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "steelblue", colo
```



Chi Squared Models

```
#Removing unwanted weeks from dataframes
sprnullconsistent <- sprnullconsistent %>% filter(Transactions != 0)
fallnullconsistent <- fallnullconsistent %>% filter(Transactions != 0)
sprnullweighted <- sprnullweighted %>% filter(Transactions != 0)
fallnullweighted <- fallnullweighted %>% filter(Transactions != 0)

sprnullconsistentprob <- sprnullconsistentprob %>% filter(Probability != 0)
fallnullconsistentprob <- fallnullconsistentprob %>% filter(Probability != 0)
sprnullweightedprob <- sprnullweightedprob %>% filter(Probability != 0)
fallnullweightedprob <- fallnullweightedprob %>% filter(Probability != 0)

springtransactions <- springtransactions %>% filter(Transactions != 0)
falltransactions <- falltransactions %>% filter(Transactions != 0)
springpurchases <- springpurchases %>% filter(TotalPurch != 0)
fallpurchases <- fallpurchases %>% filter(TotalPurch != 0)
```

```
#Two Nulls Against Each Other
chisq.test(sprnullweighted$Transactions, p = sprnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  sprnullweighted$Transactions
## X-squared = 45.792, df = 12, p-value = 7.535e-06
```

```
chisq.test(sprnullweighted$Purchases, p = sprnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  sprnullweighted$Purchases
## X-squared = 198.98, df = 12, p-value < 2.2e-16
```

```r
chisq.test(fallnullweighted$Transactions, p = fallnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  fallnullweighted$Transactions
## X-squared = 44.249, df = 11, p-value = 6.574e-06
```

```r
chisq.test(fallnullweighted$Purchases, p = fallnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  fallnullweighted$Purchases
## X-squared = 207.48, df = 11, p-value < 2.2e-16
```

```r
#Spring Transactions Chi Squared

chisq.test(springtransactions$Transactions, p = sprnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  springtransactions$Transactions
## X-squared = 878.69, df = 12, p-value < 2.2e-16
```

```r
chisq.test(springtransactions$Transactions, p = sprnullweightedprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  springtransactions$Transactions
## X-squared = 1197, df = 12, p-value < 2.2e-16
```

```r
#Spring Purchases Chi Squared
chisq.test(springpurchases$TotalPurch, p = sprnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  springpurchases$TotalPurch
## X-squared = 3785.5, df = 12, p-value < 2.2e-16
```

```r
chisq.test(springpurchases$TotalPurch, p = sprnullweightedprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  springpurchases$TotalPurch
## X-squared = 5438.5, df = 12, p-value < 2.2e-16
```

```r
#Fall Transactions Chi Squared
chisq.test(falltransactions$Transactions, p = fallnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  falltransactions$Transactions
## X-squared = 215.63, df = 11, p-value < 2.2e-16
```

```r
chisq.test(falltransactions$Transactions, p = fallnullweightedprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  falltransactions$Transactions
## X-squared = 424.92, df = 11, p-value < 2.2e-16
```

```r
#Fall Purchases Chi Squared
chisq.test(fallpurchases$TotalPurch, p = fallnullconsistentprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  fallpurchases$TotalPurch
## X-squared = 1590.2, df = 11, p-value < 2.2e-16
```

```r
chisq.test(fallpurchases$TotalPurch, p = fallnullweightedprob$Probability)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  fallpurchases$TotalPurch
## X-squared = 2115.8, df = 11, p-value < 2.2e-16
```

```r
#Testing the Fall and the Spring semesters against one another
springtransactions <- springtransactions %>% filter(Week != 16)
springpurchases <- springpurchases %>% filter(Week != 16)
#chisq.test(falltransactions$Transactions, p = springtransactions$ProbWeight, rescale.p = TRUE)
#chisq.test(fallpurchases$TotalPurch, p = springpurchases$ProbWeight, rescale.p = TRUE)
#chisq.test(springtransactions$Transactions, p = falltransactions$ProbWeight, rescale.p = TRUE)
#chisq.test(springpurchases$TotalPurch, p = fallpurchases$ProbWeight, rescale.p = TRUE)
```