VLE engagement and learning outcome

This analysis explores the relations between students' engagement with the virtual learning environment (VLE), students' demographic characteristics and learning outcome.

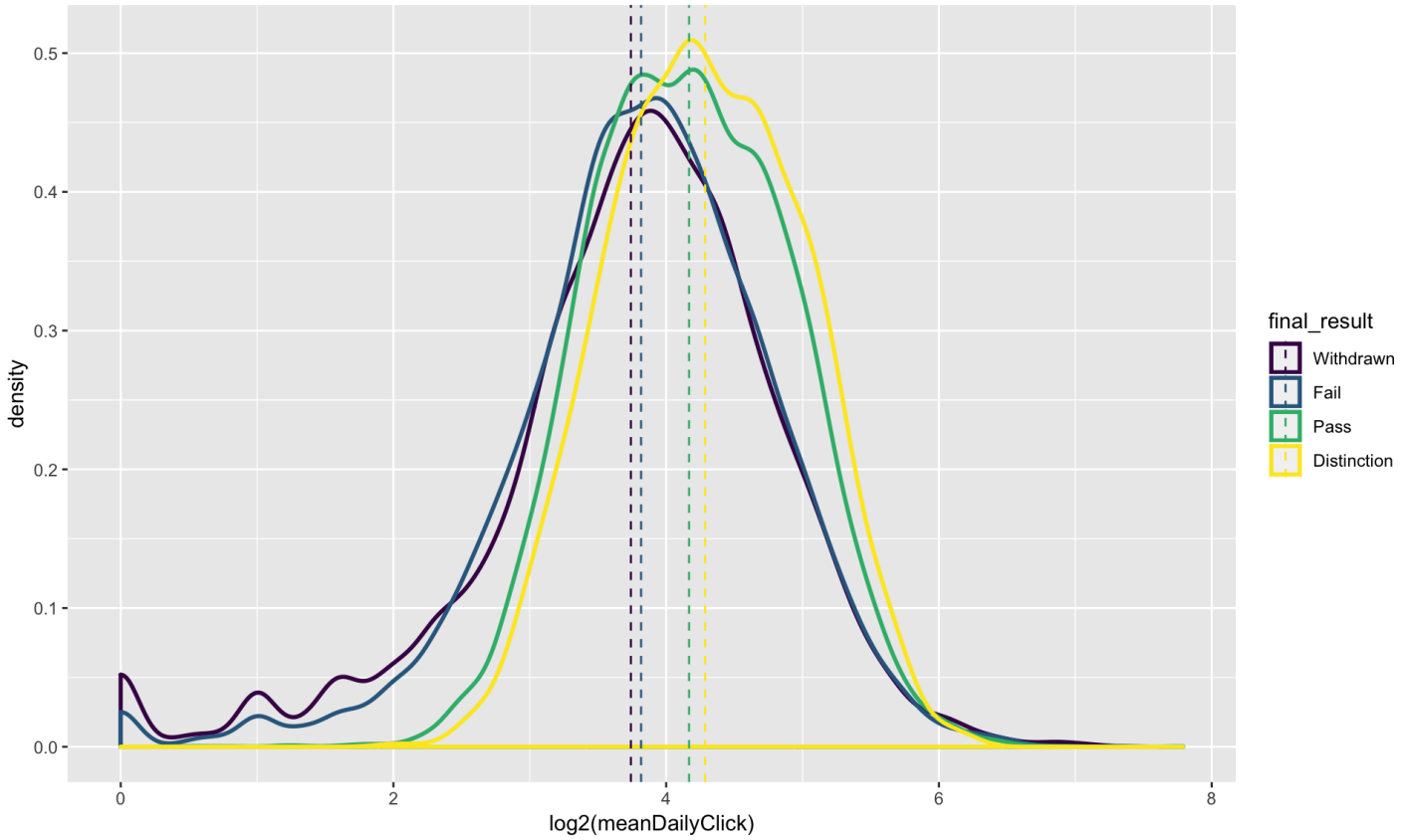
Data processing

```
library(dplyr)
library(oulad)
library(ggplot2)
data(course)
data(assessment)
data(student)
data(vle)
data(student_assessment)
data(student_vle)
data(student_registration)
student_vle_unique<- student_vle %>% group_by(code_module,code_presentation,id_student,i
d_site,date) %>% summarise(sum_click=sum(sum_click))
rm(student_vle)
#Get student-level info across multiple datasets
tmaRatio<- assessment %>% filter(assessment_type!="Exam") %>% group_by(code_module,code_
presentation) %>% summarise(tma=mean(assessment_type=="TMA"))

moduleStudentClick<-student_vle_unique %>% group_by(code_module,code_presentation,id_stu
dent) %>% summarise(meanDailyClick=sum(sum_click)/n_distinct(date))
mergedData<- merge(student,tmaRatio,by=c("code_module","code_presentation"))
mergedData<- merge(mergedData,moduleStudentClick,by=c("code_module","code_presentation",
"id_student"))

mergedData$code_module_category<-"Social sciences"
mergedData$code_module_category[mergedData$code_module %in% c("CCC","DDD","EEE","FFF")]<
-"STEM"
#re-code final result and education level as ordered factor variables
uniq_levels<-unique(mergedData$highest_education)
mergedData$highest_education<-factor(mergedData$highest_education,levels=uniq_levels[c(5
,2,3,1,4)],ordered=T)
mergedData$final_result<-factor(mergedData$final_result,levels=c("Withdrawn","Fail","Pas
s","Distinction"),ordered = T)
```

Mean daily click vs. final result

Students that pass the class or get distinction have higher mean daily click on the VLE compared to students that fail or withdraw.

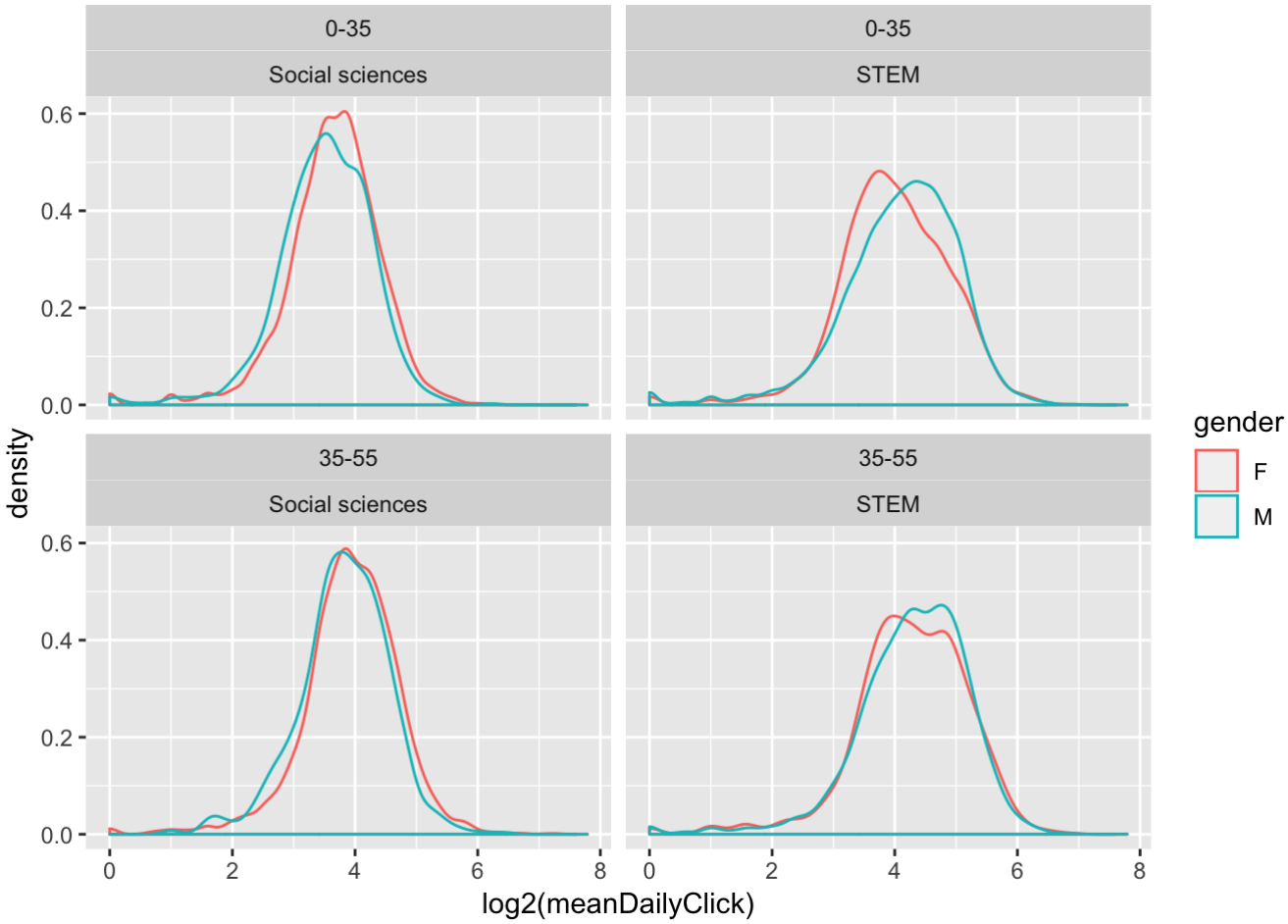
```
library(dplyr)
library(ggplot2)
mu<- mergedData %>% group_by(final_result) %>% summarise(meanClick=mean(log2(meanDailyCl
ick)))
ggplot(data=mergedData,aes(x=log2(meanDailyClick))) + geom_density(aes(color=final_resul
t),alpha=0.3,size=1) + geom_vline(data=mu, aes(xintercept=meanClick, color=final_resul
t),linetype="dashed")
```



Mean daily click and final result

For STEM classes, young (<35) female students have lower mean daily clicks than young male students. The difference is not present in social sciences, and is much smaller between older female vs. male students in STEM classes.

```
ggplot(data=mergedData[mergedData$age_band!="55<=",],aes(x=log2(meanDailyClick))) + geom
_density(aes(color=gender)) + facet_wrap(age_band~code_module_category)
```



Number of days student interact with the VLE and final result

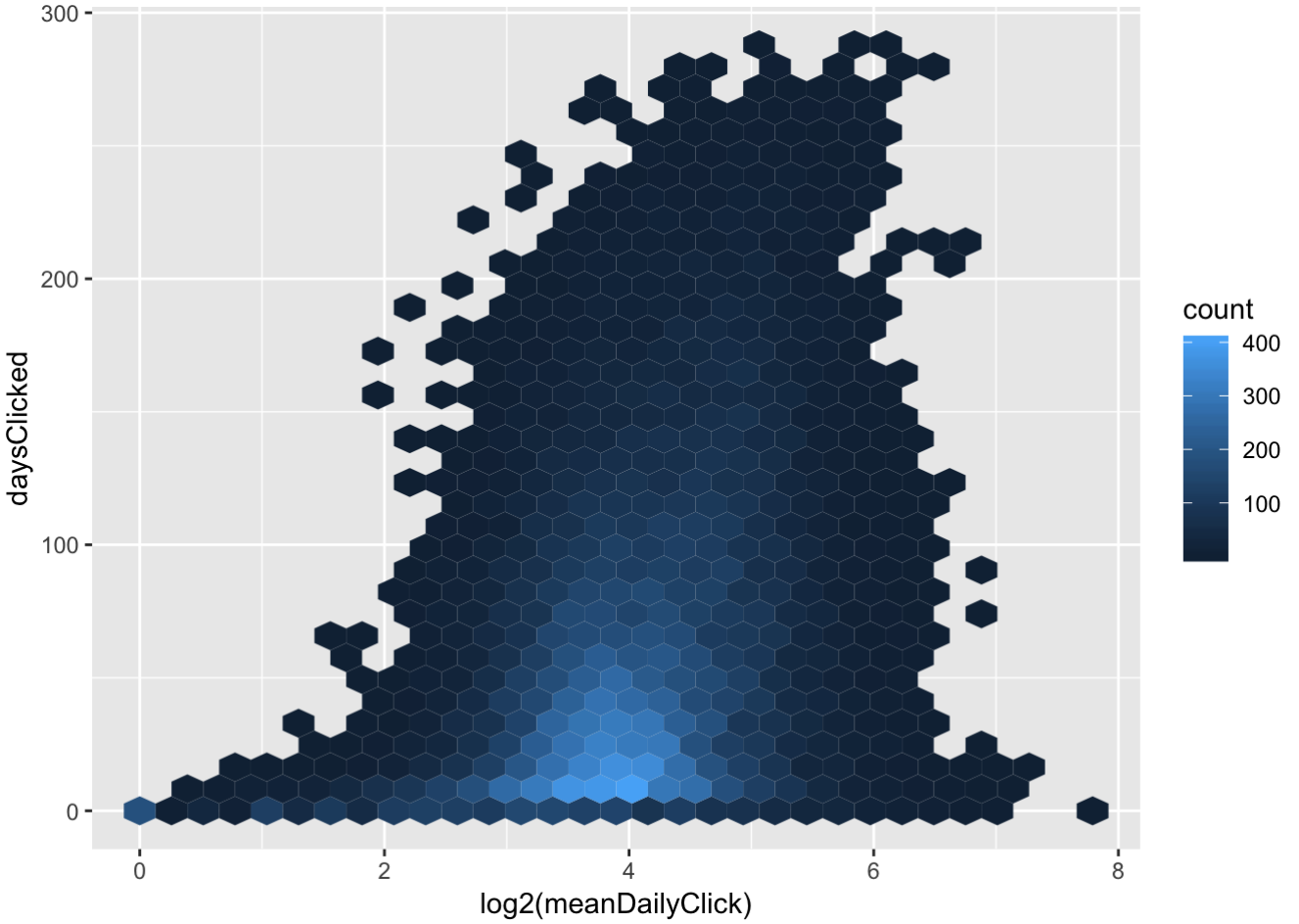
For each student in each module presentation, calculate how many days it clicked the online learning material.

```
moduleStudentDailyClick<-student_vle_unique %>% group_by(code_module,code_presentation,id_student,date) %>% summarise(totalClick=sum(sum_click)) %>% summarise(daysClicked=n_distinct(date))
mergedData<-merge(mergedData,moduleStudentDailyClick,by=c("code_module","code_presentation","id_student"))
```

Number of days students interact with the VLE is independent of mean daily clicks - no strong correlation between the two variables.

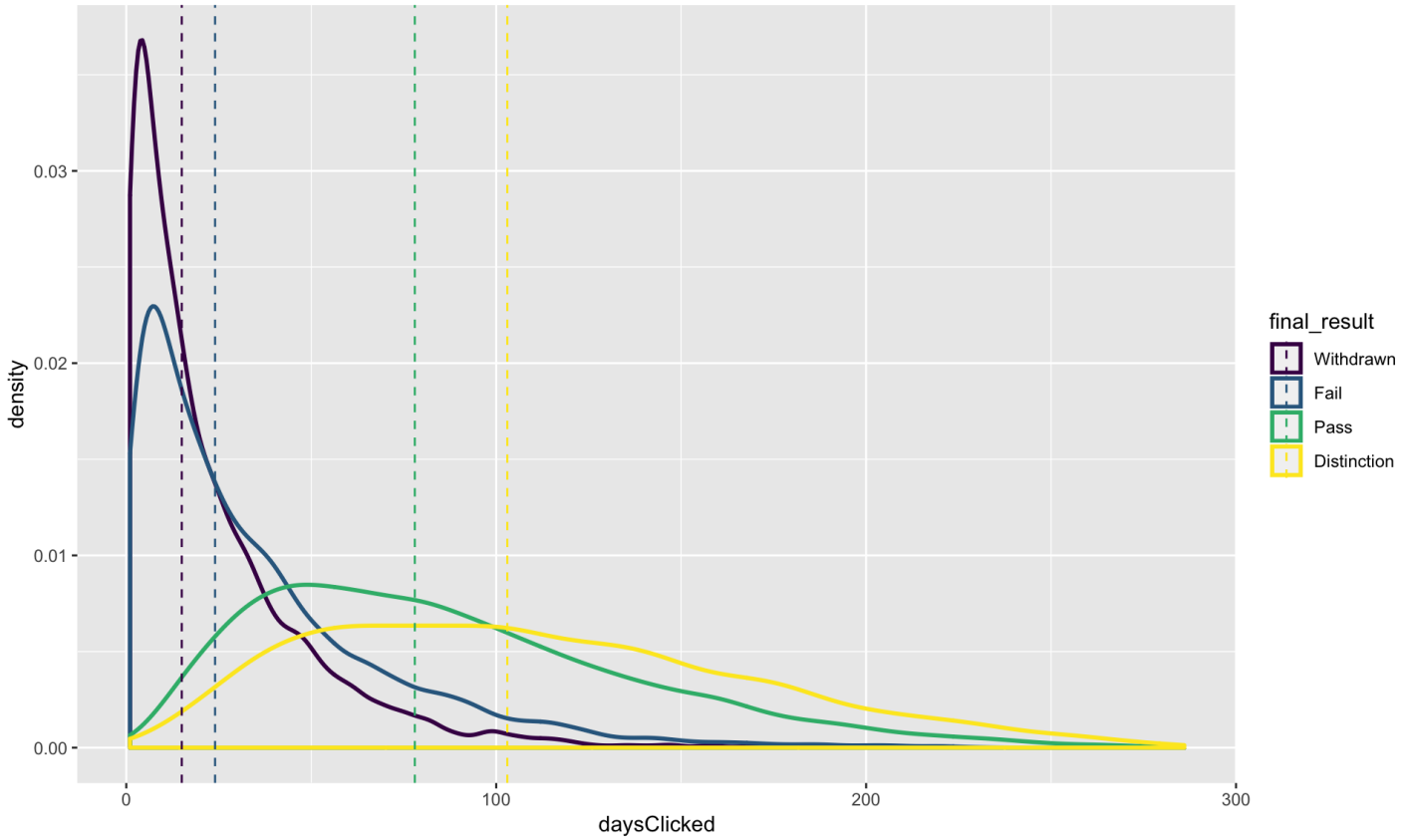
```
ggplot(data=mergedData,aes(x=log2(meanDailyClick),y=daysClicked)) + geom_hex()
```

```
## Warning: package 'hexbin' was built under R version 3.4.3
```



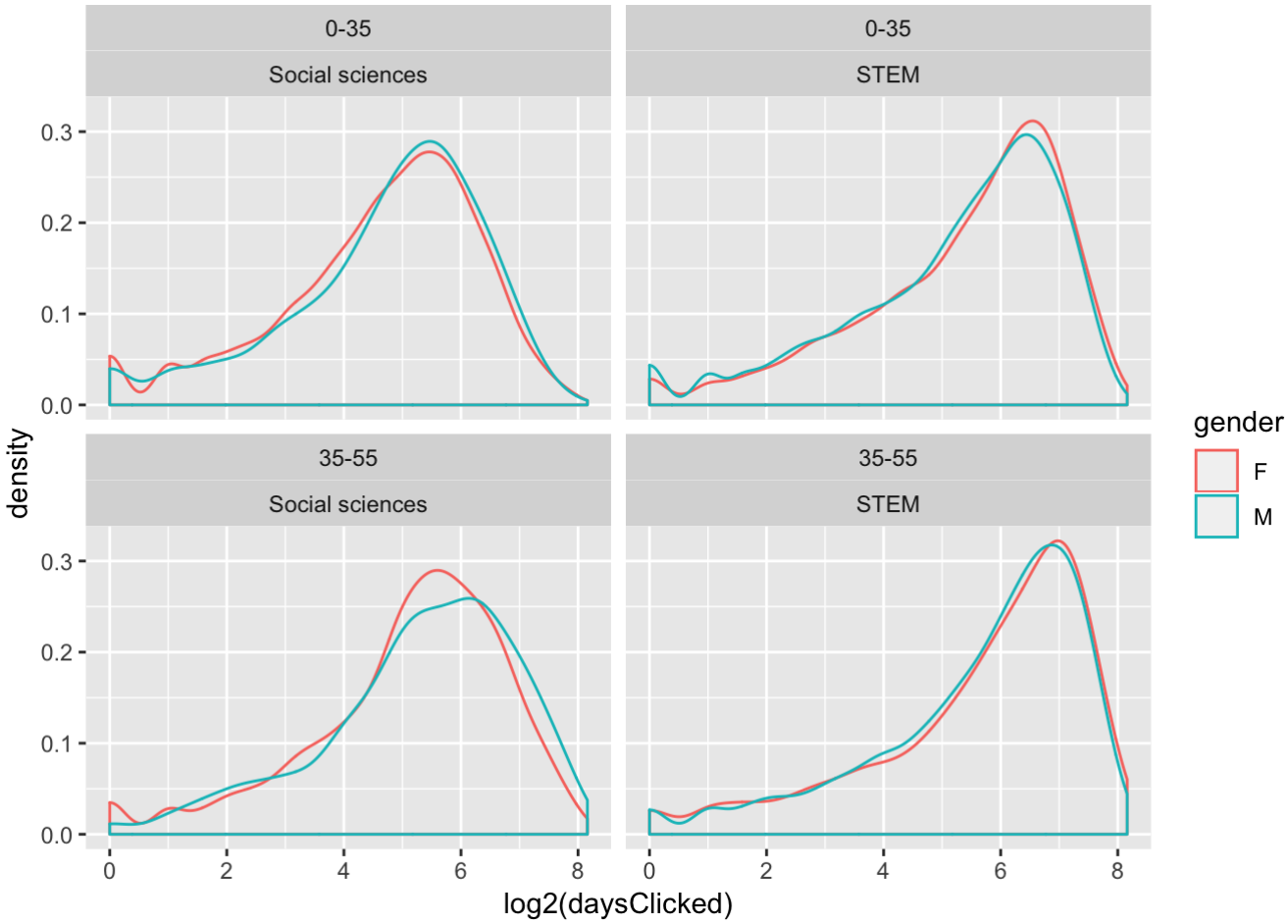
Students that pass or get distinction engage with the VLE much more frequently throughout the class comapred to students that fail or withdraw. Dashed lines show the mean number of days clicked by each group.

```
mu<- mergedData %>% group_by(final_result) %>% summarise(meanDaysClick=median(daysClicke
d))
ggplot(data=mergedData,aes(x=daysClicked)) + geom_density(aes(color=final_result),alpha=
0.3,size=1) + geom_vline(data=mu, aes(xintercept=meanDaysClick, color=final_result),line
type="dashed")
```



Female and male students across age groups engage with the VLE at similar frequency throughout both social science and STEM classes. This result is different from mean daily clicks, where young (<35) female have lower mean daily clicks in STEM classes.

```
ggplot(data=mergedData[mergedData$age_band!="55<=",],aes(x=log2(daysClicked))) + geom_de
nsity(aes(color=gender)) + facet_wrap(age_band~code_module_category)
```


0-35
Social sciences
0-35
STEM
35-55
Social sciences
35-55
STEM
density
0.0
0.1
0.2
0.3
0
2
4
6
8
log2(daysClicked)
gender
F
M