MVA Group Final

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```
library(readr)
```

```
## Warning: package 'readr' was built under R version 4.2.3
```

```
library(MVA)
```

```
## Loading required package: HSAUR2
```

```
## Loading required package: tools
```

```
library(HSAUR2)
library(SciViews)
```

```
## Warning: package 'SciViews' was built under R version 4.2.3
```

```
library(scatterplot3d)
library(car)
```

```
## Loading required package: carData
```

```
library(lattice)
library(GGally)
```

```
## Warning: package 'GGally' was built under R version 4.2.3
```

```
## Loading required package: ggplot2
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

```
library(ggplot2)
library(ggridges)
```

```
## Warning: package 'ggridges' was built under R version 4.2.3
```

```
library(ggthemes)
```

```
## Warning: package 'ggthemes' was built under R version 4.2.3
```

```
library(cowplot)
```

```
##
## Attaching package: 'cowplot'
```

```
## The following object is masked from 'package:ggthemes':
##
##     theme_map
```

```
library(gapminder)
```

```
## Warning: package 'gapminder' was built under R version 4.2.3
```

```
library(gganimate)
```

```
## Warning: package 'gganimate' was built under R version 4.2.3
```

```
## No renderer backend detected. gganimate will default to writing frames to separate files
## Consider installing:
## - the `gifski` package for gif output
## - the `av` package for video output
## and restarting the R session
```

```
library(ggfortify)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:car':
##
##     recode
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(grid)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
library(RColorBrewer)
library(Hotelling)
```

```
## Loading required package: corpcor
```

```
##
## Attaching package: 'Hotelling'
```

```
## The following object is masked from 'package:dplyr':
##
##     summarise
```

```
library(stats)
library(biotools)
```

```
## Warning: package 'biotools' was built under R version 4.2.3
```

```
## Loading required package: MASS
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
## ---
## biotools version 4.2
```

```
library(factoextra)
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```
library(psych)
```

```
##
## Attaching package: 'psych'
```

```
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
## The following object is masked from 'package:car':
##
##     logit
```

```
library(corrplot)
```

```
## corrplot 0.92 loaded
```

```
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.2.3
```

```
## Warning: package 'forcats' was built under R version 4.2.3
```

```
## Warning: package 'lubridate' was built under R version 4.2.3
```

```
## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
## ✓ forcats   1.0.0     ✓ stringr   1.5.0
## ✓ lubridate 1.9.2     ✓ tibble    3.1.8
## ✓ purrr     1.0.1     ✓ tidyr     1.3.0
```

```
## ── Conflicts ──────────────────────────────────────── tidyverse_conflicts() ──
## ✖ psych::%+%()           masks ggplot2::%+%()
## ✖ psych::alpha()         masks ggplot2::alpha()
## ✖ gridExtra::combine()   masks dplyr::combine()
## ✖ dplyr::filter()        masks stats::filter()
## ✖ dplyr::lag()           masks stats::lag()
## ✖ dplyr::recode()        masks car::recode()
## ✖ MASS::select()         masks dplyr::select()
## ✖ purrr::some()          masks car::some()
## ✖ lubridate::stamp()     masks cowplot::stamp()
## ✖ Hotelling::summarise() masks dplyr::summarise()
## ℹ Use the ]8;;http://conflicted.r-lib.org/conflicted package]8;; to force all conflicts t
o become errors
```

```
library(cluster)
library(magrittr)
```

```
##
## Attaching package: 'magrittr'
##
## The following object is masked from 'package:purrr':
##
##     set_names
##
## The following object is masked from 'package:tidyr':
##
##     extract
```

```
library(NbClust)
library(MASS)
library(gvlma)
library(leaps)
library(relaimpo)
```

```
## Warning: package 'relaimpo' was built under R version 4.2.3
```

```
## Loading required package: boot
##
## Attaching package: 'boot'
##
## The following object is masked from 'package:psych':
##
##     logit
##
## The following object is masked from 'package:lattice':
##
##     melanoma
##
## The following object is masked from 'package:car':
##
##     logit
##
## Loading required package: survey
```

```
## Warning: package 'survey' was built under R version 4.2.3
```

```
## Loading required package: Matrix
##
## Attaching package: 'Matrix'
##
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
##
## Loading required package: survival
##
## Attaching package: 'survival'
##
## The following object is masked from 'package:boot':
##
##     aml
##
##
## Attaching package: 'survey'
##
## The following object is masked from 'package:graphics':
##
##     dotchart
##
## Loading required package: mitools
```

```
## Warning: package 'mitools' was built under R version 4.2.3
```

```
## This is the global version of package relaimpo.
##
## If you are a non-US user, a version with the interesting additional metric pmvd is available
##
## from Ulrike Groempings web site at prof.beuth-hochschule.de/groemping.
```

```
library(tidyverse)
```

```
Students <- read.csv("C:/Users/ta560/Downloads/Class_Survey.csv")
Students
```

```
##                    Student            Week Whatsapp..hrs. Instagram..hrs.
## 1               AJAY ADDALA  Feb 26 - Mar 4           8.90            7.10
## 2               AJAY ADDALA  Mar 5 - Mar 11          11.85           11.16
## 3               AJAY ADDALA Mar 12 - Mar 18          12.25           16.75
## 4               AJAY ADDALA Mar 19 - Mar 25          12.33           12.90
## 5               AJAY ADDALA  Mar 26 - Apr 1           8.50           11.90
## 6               AJAY ADDALA   Apr 2 - Apr 8           9.50           11.25
## 7               AJAY ADDALA  Apr 9 - Apr 15           8.25           11.75
## 8          TEJESH ALAPARTHI  Feb 26 - Mar 4           5.70           12.00
## 9          TEJESH ALAPARTHI  Mar 5 - Mar 11           4.50            7.25
## 10         TEJESH ALAPARTHI Mar 12 - Mar 18           6.80            4.50
## 11         TEJESH ALAPARTHI Mar 19 - Mar 25           5.90            3.50
## 12         TEJESH ALAPARTHI  Mar 26 - Apr 1           5.50            4.50
## 13         TEJESH ALAPARTHI   Apr 2 - Apr 8           6.20            7.00
## 14         TEJESH ALAPARTHI  Apr 9 - Apr 15           5.70            6.50
## 15             VEDA ALLOORI  Feb 26 - Mar 4          10.50           14.80
## 16             VEDA ALLOORI  Mar 5 - Mar 11           5.20            8.00
## 17             VEDA ALLOORI Mar 12 - Mar 18           3.30            4.00
## 18             VEDA ALLOORI Mar 19 - Mar 25           3.50            7.00
## 19             VEDA ALLOORI  Mar 26 - Apr 1           5.23            6.30
## 20             VEDA ALLOORI   Apr 2 - Apr 8           4.30           12.30
## 21             VEDA ALLOORI  Apr 9 - Apr 15           3.70           11.20
## 22            VIDHI AMBWANI  Feb 26 - Mar 4           8.40            5.80
## 23            VIDHI AMBWANI  Mar 5 - Mar 11           5.73           10.25
## 24            VIDHI AMBWANI Mar 12 - Mar 18           4.20            9.75
## 25            VIDHI AMBWANI Mar 19 - Mar 25           5.25            5.00
## 26            VIDHI AMBWANI  Mar 26 - Apr 1           5.00            8.50
## 27            VIDHI AMBWANI   Apr 2 - Apr 8           6.00            6.50
## 28            VIDHI AMBWANI  Apr 9 - Apr 15           7.50            8.90
## 29    POOJA BYLAPLAR JAYANNA  Feb 26 - Mar 4           7.50            4.90
## 30    POOJA BYLAPLAR JAYANNA  Mar 5 - Mar 11           8.90            7.80
## 31    POOJA BYLAPLAR JAYANNA Mar 12 - Mar 18           3.90           15.10
## 32    POOJA BYLAPLAR JAYANNA Mar 19 - Mar 25           4.60            8.60
## 33    POOJA BYLAPLAR JAYANNA  Mar 26 - Apr 1           6.70           11.10
## 34    POOJA BYLAPLAR JAYANNA   Apr 2 - Apr 8           7.70           10.20
## 35    POOJA BYLAPLAR JAYANNA  Apr 9 - Apr 15           8.40           12.70
## 36             ANUSHKA CHAUBE  Feb 26 - Mar 4           8.38           12.36
## 37             ANUSHKA CHAUBE  Mar 5 - Mar 11           5.42           16.25
## 38             ANUSHKA CHAUBE Mar 12 - Mar 18           5.52           22.29
## 39             ANUSHKA CHAUBE Mar 19 - Mar 25           5.25           12.59
## 40             ANUSHKA CHAUBE  Mar 26 - Apr 1           6.53           13.34
## 41             ANUSHKA CHAUBE   Apr 2 - Apr 8           4.52           14.90
## 42             ANUSHKA CHAUBE  Apr 9 - Apr 15           8.30           15.38
## 43           MUSKAN CHOWATIA  Feb 26 - Mar 4           8.00            7.00
## 44           MUSKAN CHOWATIA  Mar 5 - Mar 11           9.00            8.00
## 45           MUSKAN CHOWATIA Mar 12 - Mar 18           7.00            7.00
## 46           MUSKAN CHOWATIA Mar 19 - Mar 25           8.20            7.00
## 47           MUSKAN CHOWATIA  Mar 26 - Apr 1           8.50            8.00
## 48           MUSKAN CHOWATIA   Apr 2 - Apr 8           9.00            8.00
## 49           MUSKAN CHOWATIA  Apr 9 - Apr 15          10.00            9.00
## 50     TANAY RAJESH DANGAICH  Feb 26 - Mar 4          20.00            4.34
## 51     TANAY RAJESH DANGAICH  Mar 5 - Mar 11          12.00            3.10
```

```
## 52     TANAY RAJESH DANGAICH Mar 12 - Mar 18          21.00            4.50
## 53     TANAY RAJESH DANGAICH Mar 19 - Mar 25          20.93            4.75
## 54     TANAY RAJESH DANGAICH  Mar 26 - Apr 1          13.99            2.83
## 55     TANAY RAJESH DANGAICH   Apr 2 - Apr 8          22.03            4.88
## 56     TANAY RAJESH DANGAICH  Apr 9 - Apr 15          17.17            4.73
## 57                 JIAYUE GAO  Feb 26 - Mar 4           0.00            0.13
## 58                 JIAYUE GAO  Mar 5 - Mar 11           0.00            0.10
## 59                 JIAYUE GAO Mar 12 - Mar 18           0.00            0.13
## 60                 JIAYUE GAO Mar 19 - Mar 25           0.12            0.32
## 61                 JIAYUE GAO  Mar 26 - Apr 1           0.02            0.35
## 62                 JIAYUE GAO   Apr 2 - Apr 8           0.08            0.30
## 63                 JIAYUE GAO  Apr 9 - Apr 15           0.00            0.35
## 64  RUTWIK SANJAY GUNTOORKAR  Feb 26 - Mar 4           5.01            5.24
## 65  RUTWIK SANJAY GUNTOORKAR  Mar 5 - Mar 11           3.22            6.24
## 66  RUTWIK SANJAY GUNTOORKAR Mar 12 - Mar 18           3.03           12.16
## 67  RUTWIK SANJAY GUNTOORKAR Mar 19 - Mar 25           5.46            5.17
## 68  RUTWIK SANJAY GUNTOORKAR  Mar 26 - Apr 1           4.26            5.57
## 69  RUTWIK SANJAY GUNTOORKAR   Apr 2 - Apr 8           4.32            4.05
## 70  RUTWIK SANJAY GUNTOORKAR  Apr 9 - Apr 15           6.15            4.29
## 71             TARUN KAUSHIK  Feb 26 - Mar 4          11.50            6.70
## 72             TARUN KAUSHIK  Mar 5 - Mar 11          11.20            8.20
## 73             TARUN KAUSHIK Mar 12 - Mar 18          10.00            8.10
## 74             TARUN KAUSHIK Mar 19 - Mar 25           3.00            3.60
## 75             TARUN KAUSHIK  Mar 26 - Apr 1           9.00            8.00
## 76             TARUN KAUSHIK   Apr 2 - Apr 8          10.00           10.50
## 77             TARUN KAUSHIK  Apr 9 - Apr 15          12.00            9.50
## 78            BATUL KHAMBATA  Feb 26 - Mar 4           8.10           10.70
## 79            BATUL KHAMBATA  Mar 5 - Mar 11          10.30           10.50
## 80            BATUL KHAMBATA Mar 12 - Mar 18          14.50           11.50
## 81            BATUL KHAMBATA Mar 19 - Mar 25          13.40           11.30
## 82            BATUL KHAMBATA  Mar 26 - Apr 1          13.80           10.60
## 83            BATUL KHAMBATA   Apr 2 - Apr 8          12.70           10.40
## 84            BATUL KHAMBATA  Apr 9 - Apr 15          10.30            8.40
## 85   PRINCE RAMESHBHAI KHENI  Feb 26 - Mar 4          11.07            2.50
## 86   PRINCE RAMESHBHAI KHENI  Mar 5 - Mar 11           8.37            3.05
## 87   PRINCE RAMESHBHAI KHENI Mar 12 - Mar 18           8.13            2.43
## 88   PRINCE RAMESHBHAI KHENI Mar 19 - Mar 25           8.45            3.10
## 89   PRINCE RAMESHBHAI KHENI  Mar 26 - Apr 1           9.52            2.54
## 90   PRINCE RAMESHBHAI KHENI   Apr 2 - Apr 8           6.26            3.14
## 91   PRINCE RAMESHBHAI KHENI  Apr 9 - Apr 15           7.17            6.41
## 92             PRIYAM KUMARI  Feb 26 - Mar 4          12.58            4.23
## 93             PRIYAM KUMARI  Mar 5 - Mar 11          16.98            7.58
## 94             PRIYAM KUMARI Mar 12 - Mar 18          15.95           14.00
## 95             PRIYAM KUMARI Mar 19 - Mar 25          14.20            8.00
## 96             PRIYAM KUMARI  Mar 26 - Apr 1          12.20            5.00
## 97             PRIYAM KUMARI   Apr 2 - Apr 8           9.10            7.00
## 98             PRIYAM KUMARI  Apr 9 - Apr 15          10.00            9.00
## 99         SARJAK ATUL MANIAR  Feb 26 - Mar 4           8.43            0.00
## 100        SARJAK ATUL MANIAR  Mar 5 - Mar 11           6.20            0.00
## 101        SARJAK ATUL MANIAR Mar 12 - Mar 18           6.28            0.00
## 102        SARJAK ATUL MANIAR Mar 19 - Mar 25           7.19            0.00
## 103        SARJAK ATUL MANIAR  Mar 26 - Apr 1          11.34            0.00
```

```
## 104       SARJAK ATUL MANIAR   Apr 2 - Apr 8           8.30            0.00
## 105       SARJAK ATUL MANIAR  Apr 9 - Apr 15           9.05            0.00
## 106         KIREETI MANTRALA  Feb 26 - Mar 4           9.34           18.50
## 107         KIREETI MANTRALA  Mar 5 - Mar 11           7.49           18.58
## 108         KIREETI MANTRALA Mar 12 - Mar 18           7.22           10.33
## 109         KIREETI MANTRALA Mar 19 - Mar 25           5.46            7.35
## 110         KIREETI MANTRALA  Mar 26 - Apr 1           5.47           16.43
## 111         KIREETI MANTRALA   Apr 2 - Apr 8           4.40           10.48
## 112         KIREETI MANTRALA  Apr 9 - Apr 15           4.34           12.43
## 113           SHREYASH MEHTA  Feb 26 - Mar 4           9.63            7.35
## 114           SHREYASH MEHTA  Mar 5 - Mar 11           8.73            7.80
## 115           SHREYASH MEHTA Mar 12 - Mar 18           5.80            4.75
## 116           SHREYASH MEHTA Mar 19 - Mar 25           4.48            6.38
## 117           SHREYASH MEHTA  Mar 26 - Apr 1           4.20            6.15
## 118           SHREYASH MEHTA   Apr 2 - Apr 8           3.87            6.13
## 119           SHREYASH MEHTA  Apr 9 - Apr 15           5.18            5.19
## 120        RUCHIT JATIN MODY  Feb 26 - Mar 4          10.00            7.50
## 121        RUCHIT JATIN MODY  Mar 5 - Mar 11          12.25            8.20
## 122        RUCHIT JATIN MODY Mar 12 - Mar 18           9.00            9.70
## 123        RUCHIT JATIN MODY Mar 19 - Mar 25           7.25           12.67
## 124        RUCHIT JATIN MODY  Mar 26 - Apr 1           8.84            4.77
## 125        RUCHIT JATIN MODY   Apr 2 - Apr 8           9.00           10.50
## 126        RUCHIT JATIN MODY  Apr 9 - Apr 15           6.43            7.16
## 127       NAGA ASRITHA NARRA  Feb 26 - Mar 4           6.00            9.00
## 128       NAGA ASRITHA NARRA  Mar 5 - Mar 11           7.00            8.00
## 129       NAGA ASRITHA NARRA Mar 12 - Mar 18           7.00            4.00
## 130       NAGA ASRITHA NARRA Mar 19 - Mar 25           8.00            5.00
## 131       NAGA ASRITHA NARRA  Mar 26 - Apr 1           5.00            7.00
## 132       NAGA ASRITHA NARRA   Apr 2 - Apr 8           7.00            5.00
## 133       NAGA ASRITHA NARRA  Apr 9 - Apr 15           9.25            9.00
## 134          SAILESH POTTURI  Feb 26 - Mar 4           5.50           10.40
## 135          SAILESH POTTURI  Mar 5 - Mar 11           3.22            6.28
## 136          SAILESH POTTURI Mar 12 - Mar 18           4.20            8.45
## 137          SAILESH POTTURI Mar 19 - Mar 25           3.40            5.25
## 138          SAILESH POTTURI  Mar 26 - Apr 1           3.32            2.28
## 139          SAILESH POTTURI   Apr 2 - Apr 8           5.30           16.70
## 140          SAILESH POTTURI  Apr 9 - Apr 15           3.59           12.28
## 141             NAMRATA RATH  Feb 26 - Mar 4          22.50           24.00
## 142             NAMRATA RATH  Mar 5 - Mar 11          19.50           18.00
## 143             NAMRATA RATH Mar 12 - Mar 18          18.50           17.50
## 144             NAMRATA RATH Mar 19 - Mar 25          20.00           18.00
## 145             NAMRATA RATH  Mar 26 - Apr 1          15.00           13.00
## 146             NAMRATA RATH   Apr 2 - Apr 8          12.00           14.50
## 147             NAMRATA RATH  Apr 9 - Apr 15          19.00           15.00
## 148          AKASH SHANMUGAM  Feb 26 - Mar 4          12.55           19.12
## 149          AKASH SHANMUGAM  Mar 5 - Mar 11          10.13           17.35
## 150          AKASH SHANMUGAM Mar 12 - Mar 18           8.12           21.53
## 151          AKASH SHANMUGAM Mar 19 - Mar 25           9.01           15.35
## 152          AKASH SHANMUGAM  Mar 26 - Apr 1           9.30           16.01
## 153          AKASH SHANMUGAM   Apr 2 - Apr 8           7.20           15.04
## 154          AKASH SHANMUGAM  Apr 9 - Apr 15           8.10           14.03
## 155     PARTHVI KALPESH SONI  Feb 26 - Mar 4          12.13            3.00
```

```
## 156     PARTHVI KALPESH SONI  Mar 5 - Mar 11          9.50           2.30
## 157     PARTHVI KALPESH SONI Mar 12 - Mar 18         10.50           0.00
## 158     PARTHVI KALPESH SONI Mar 19 - Mar 25         11.36           0.00
## 159     PARTHVI KALPESH SONI  Mar 26 - Apr 1          7.70           0.00
## 160     PARTHVI KALPESH SONI   Apr 2 - Apr 8          9.70           3.00
## 161     PARTHVI KALPESH SONI  Apr 9 - Apr 15         12.50          14.30
## 162 SHRUTI SANJIVAN SONTAKKE  Feb 26 - Mar 4          4.52          10.60
## 163 SHRUTI SANJIVAN SONTAKKE  Mar 5 - Mar 11          5.21           9.28
## 164 SHRUTI SANJIVAN SONTAKKE Mar 12 - Mar 18          2.14          10.80
## 165 SHRUTI SANJIVAN SONTAKKE Mar 19 - Mar 25          5.10          10.35
## 166 SHRUTI SANJIVAN SONTAKKE  Mar 26 - Apr 1          3.40           7.20
## 167 SHRUTI SANJIVAN SONTAKKE   Apr 2 - Apr 8          5.20          11.00
## 168 SHRUTI SANJIVAN SONTAKKE  Apr 9 - Apr 15          5.23          13.80
## 169             CHENHAO ZHOU  Feb 26 - Mar 4          0.04           7.60
## 170             CHENHAO ZHOU  Mar 5 - Mar 11          0.00           1.80
## 171             CHENHAO ZHOU Mar 12 - Mar 18          0.73           6.33
## 172             CHENHAO ZHOU Mar 19 - Mar 25          0.15           9.30
## 173             CHENHAO ZHOU  Mar 26 - Apr 1          0.03           7.20
## 174             CHENHAO ZHOU   Apr 2 - Apr 8          0.05           3.60
## 175             CHENHAO ZHOU  Apr 9 - Apr 15          0.01          10.00
##     Snapchat.hrs. Telegram..hrs. Facebook.Messenger..hrs. BeReal..hrs.
## 1            1.90           0.02                     0.00         0.00
## 2            2.45           0.06                     0.00         0.00
## 3            3.25           0.01                     0.00         0.00
## 4            3.12           0.06                     0.00         0.00
## 5            1.90           0.05                     0.00         0.00
## 6            1.20           0.16                     0.00         0.00
## 7            1.67           0.00                     0.00         0.00
## 8            2.00           0.25                     0.00         0.35
## 9            1.40           0.35                     0.00         0.21
## 10           2.10           0.33                     0.00         0.65
## 11           3.25           0.72                     0.00         0.42
## 12           1.35           0.82                     0.00         0.15
## 13           2.50           0.96                     0.00         0.14
## 14           2.10           0.59                     0.00         0.32
## 15          12.10           0.00                     0.00         0.00
## 16           4.00           0.00                     0.00         0.00
## 17           4.30           0.00                     0.00         5.40
## 18          10.00           0.00                     0.00         8.60
## 19           7.12           0.00                     0.00         1.57
## 20           5.20           0.00                     0.00         0.50
## 21           4.30           0.00                     0.00         0.20
## 22           0.28           0.00                     0.00         0.00
## 23           1.20           0.00                     0.00         0.00
## 24           1.15           0.00                     0.00         0.00
## 25           1.15           0.00                     0.00         0.00
## 26           1.00           0.00                     0.00         0.00
## 27           1.20           0.00                     0.00         0.00
## 28           0.80           0.00                     0.00         0.00
## 29           9.50           0.06                     0.00         0.00
## 30           8.60           0.06                     0.00         0.00
## 31           2.70           0.00                     0.00         0.00
```

```
## 32          0.00          0.00                  0.00          0.00
## 33          0.00          0.00                  0.00          0.00
## 34          0.00          0.00                  0.00          0.00
## 35          0.00          0.00                  0.00          0.00
## 36          1.40          0.00                  0.20          0.00
## 37          1.50          0.00                  0.10          0.00
## 38          1.46          0.00                  0.14          0.00
## 39          1.59          0.00                  0.11          0.00
## 40          1.32          0.00                  0.20          0.00
## 41          1.01          0.00                  0.10          0.00
## 42          1.32          0.00                  0.00          0.00
## 43          1.00          0.50                  0.00          0.00
## 44          0.50          0.00                  0.00          0.00
## 45          0.50          0.50                  0.00          0.00
## 46          0.50          0.00                  0.00          0.00
## 47          1.00          0.00                  0.00          0.00
## 48          0.30          0.00                  0.00          0.00
## 49          1.00          0.50                  0.00          0.00
## 50          0.04          0.00                  0.00          0.00
## 51          0.00          0.00                  0.00          0.00
## 52          0.14          0.00                  1.15          0.00
## 53          0.04          0.00                  0.00          0.00
## 54          0.00          0.00                  0.55          0.00
## 55          0.14          0.00                  1.15          0.00
## 56          0.35          0.00                  0.04          0.00
## 57          0.00          0.00                  0.00          0.00
## 58          0.00          0.00                  0.00          0.00
## 59          0.00          0.00                  0.00          0.00
## 60          0.00          0.00                  0.00          0.00
## 61          0.00          0.00                  0.00          0.00
## 62          0.00          0.00                  0.00          0.00
## 63          0.00          0.00                  0.00          0.00
## 64          2.04          0.00                  0.27          0.00
## 65          2.31          0.00                  0.00          0.00
## 66          2.26          0.00                  0.00          0.00
## 67          2.10          0.00                  0.00          0.00
## 68          1.55          0.00                  0.00          0.00
## 69          2.48          0.00                  0.00          0.00
## 70          1.48          0.00                  0.00          0.00
## 71          0.01          0.01                  0.50          0.00
## 72          0.01          0.01                  0.10          0.00
## 73          0.01          0.02                  0.60          0.00
## 74          0.01          0.01                  0.30          0.00
## 75          0.01          0.02                  0.60          0.00
## 76          0.01          0.01                  0.50          0.00
## 77          0.00          0.00                  0.10          0.00
## 78          7.90          0.00                  0.00          0.00
## 79          7.30          0.00                  0.00          0.00
## 80          8.80          0.00                  0.00          0.00
## 81          7.40          0.00                  0.00          0.00
## 82          8.10          0.00                  0.00          0.00
## 83          8.30          0.00                  0.00          0.00
```

```
## 84          5.10          0.00                  0.00          0.00
## 85          0.28          0.06                  0.39          0.00
## 86          0.29          0.14                  1.14          0.00
## 87          0.23          0.09                  0.59          0.00
## 88          0.16          1.10                  2.35          0.00
## 89          0.23          0.11                  1.08          0.00
## 90          0.08          0.21                  0.29          0.00
## 91          0.09          0.24                  0.23          0.00
## 92          0.00          0.00                  1.50          0.00
## 93          0.00          0.00                  1.45          0.00
## 94          0.00          0.00                  2.00          0.00
## 95          0.00          0.00                  0.50          0.00
## 96          0.00          0.00                  0.50          0.00
## 97          0.00          0.00                  0.50          0.00
## 98          0.00          0.00                  0.30          0.00
## 99          0.00          2.39                  0.00          0.00
## 100         0.00          0.56                  0.00          0.00
## 101         0.00          0.29                  0.00          0.00
## 102         0.00          0.29                  0.00          0.00
## 103         0.00          0.21                  0.00          0.00
## 104         0.00          1.05                  0.00          0.00
## 105         0.00          0.39                  0.00          0.00
## 106         1.20          0.00                  2.34          0.19
## 107         0.52          0.00                  1.50          0.28
## 108         1.12          0.00                  0.28          0.10
## 109         0.42          0.00                  0.12          0.90
## 110         0.49          0.00                  0.35          0.21
## 111         0.42          0.00                  1.30          0.16
## 112         0.53          0.00                  0.23          0.20
## 113         0.00          0.00                  0.00          0.00
## 114         0.00          0.34                  0.00          0.00
## 115         0.00          0.00                  0.00          0.00
## 116         0.00          0.00                  0.00          0.00
## 117         0.00          0.00                  0.00          0.00
## 118         0.00          0.00                  0.00          0.00
## 119         0.00          0.00                  0.00          0.00
## 120         0.50          0.00                  0.50          0.00
## 121         1.00          0.25                  0.00          0.00
## 122         0.30          0.50                  0.50          0.00
## 123         0.80          0.00                  0.00          0.00
## 124         1.82          0.00                  0.00          0.00
## 125         1.00          0.00                  0.00          0.00
## 126         0.62          0.35                  0.00          0.00
## 127         2.00          0.00                  0.00          0.00
## 128         2.00          0.00                  0.00          0.00
## 129         2.00          0.00                  0.00          0.00
## 130         1.00          0.00                  0.00          0.00
## 131         2.00          0.00                  0.00          0.00
## 132         1.00          0.00                  0.00          0.00
## 133         3.30          0.00                  0.00          0.00
## 134         1.00          0.12                  0.00          0.00
## 135         1.49          0.10                  0.00          0.00
```

```
## 136          1.40           0.11                    0.00         0.00
## 137          1.50           0.15                    0.00         0.00
## 138          1.20           0.18                    0.00         0.00
## 139          0.45           0.90                    0.00         0.00
## 140          0.51           0.11                    0.00         0.00
## 141          0.00           0.00                    0.00         0.00
## 142          1.50           0.00                    0.00         0.00
## 143          1.50           0.00                    0.00         0.00
## 144          1.00           0.00                    0.00         0.00
## 145          1.50           0.00                    0.00         0.00
## 146          1.00           0.00                    0.00         0.00
## 147          1.50           0.00                    0.00         0.00
## 148          1.56           0.09                    0.07         0.00
## 149          1.52           0.13                    0.00         0.00
## 150          1.04           0.02                    0.00         0.00
## 151          1.02           0.00                    0.00         0.00
## 152          1.11           0.00                    0.00         0.00
## 153          0.56           0.00                    0.00         0.00
## 154          0.54           0.00                    0.00         0.00
## 155          0.50           0.90                    0.00         0.00
## 156          0.20           0.30                    0.00         0.00
## 157          0.00           0.06                    0.00         0.00
## 158          0.00           0.01                    0.00         0.00
## 159          0.00           1.22                    0.00         0.00
## 160          0.00           1.00                    0.00         0.00
## 161          0.00           0.40                    0.00         0.00
## 162          2.19           0.00                    0.00         0.00
## 163          2.60           0.00                    0.00         0.00
## 164          1.40           0.00                    0.00         0.00
## 165          1.29           0.00                    0.00         0.00
## 166          0.46           0.00                    0.00         0.00
## 167          0.57           0.00                    1.70         0.00
## 168          1.50           0.00                    0.00         0.00
## 169          0.00           0.00                    0.00         0.00
## 170          0.00           0.00                    0.00         0.00
## 171          0.00           0.00                    0.00         0.00
## 172          0.00           0.00                    0.00         0.00
## 173          0.00           0.00                    0.00         0.00
## 174          0.00           0.00                    0.00         0.00
## 175          0.00           0.00                    0.00         0.00
##     TikTok..hrs. WeChat..hrs. Twitter..hrs. Linkedin..hrs. Messages..hrs.
## 1           0.00         0.00          0.00           4.50           0.10
## 2           0.00         0.00          0.00           5.50           0.04
## 3           0.00         0.00          0.00           9.50           0.01
## 4           0.00         0.00          0.00           9.00           0.20
## 5           0.00         0.00          0.00           7.50           0.10
## 6           0.00         0.00          0.00           8.00           0.01
## 7           0.00         0.00          0.00           6.50           0.00
## 8           0.00         0.00          0.00           2.50           0.20
## 9           0.00         0.00          0.00           2.67           0.80
## 10          0.00         0.00          0.00           1.55           0.50
## 11          0.00         0.00          0.00           1.95           0.40
```

```
## 12          0.00          0.00          0.00           0.85          0.70
## 13          0.00          0.00          0.00           0.25          0.00
## 14          0.00          0.00          0.00           1.70          0.50
## 15          0.00          0.00          0.50           2.30          0.00
## 16          0.00          0.00          0.20           2.00          0.00
## 17          0.00          0.00          1.20           1.50          0.00
## 18          0.00          0.00          0.00           1.00          0.00
## 19          0.00          0.00          0.00           1.00          2.13
## 20          0.00          0.00          0.00           3.00          1.37
## 21          0.00          0.00          0.00           2.00          1.70
## 22          0.00          0.00          0.00           0.68          0.00
## 23          0.00          0.00          0.00           0.45          0.00
## 24          0.00          0.00          0.00           0.25          0.00
## 25          0.00          0.00          0.00           0.49          0.00
## 26          0.00          0.00          0.00           1.00          0.00
## 27          0.00          0.00          0.00           0.80          0.00
## 28          0.00          0.00          0.00           0.75          0.00
## 29          0.00          0.00          0.00          21.90          0.00
## 30          0.00          0.00          0.00          22.80          0.00
## 31          0.00          0.00          0.00          13.80          0.00
## 32          0.00          0.00          0.00          10.20          0.00
## 33          0.00          0.00          0.00          12.60          0.00
## 34          0.00          0.00          0.00          13.10          0.00
## 35          0.00          0.00          0.00           9.20          0.80
## 36          0.00          0.00          0.00           0.04          0.90
## 37          0.00          0.00          0.00           0.13          1.12
## 38          0.00          0.00          0.00           0.11          1.16
## 39          0.00          0.00          0.00           0.08          0.59
## 40          0.00          0.00          0.00           0.02          0.40
## 41          0.00          0.00          0.00           0.10          0.31
## 42          0.00          0.00          0.00           0.04          0.19
## 43          0.00          0.00          0.00           2.00          0.50
## 44          0.00          0.00          0.00           1.00          0.50
## 45          0.00          0.00          0.00           2.00          0.00
## 46          0.00          0.00          0.00           0.00          0.00
## 47          0.00          0.00          0.00           0.00          0.00
## 48          0.00          0.00          0.00           1.00          0.00
## 49          0.00          0.00          0.00           2.00          0.25
## 50          0.00          0.00          0.00           0.31          0.00
## 51          0.00          0.00          0.00           1.40          0.00
## 52          0.00          0.00          0.00           0.11          0.00
## 53          0.00          0.00          0.00           0.46          0.00
## 54          0.00          0.00          0.00           1.51          0.00
## 55          0.00          0.00          0.00           0.13          0.00
## 56          0.00          0.00          0.00           0.42          0.00
## 57          0.00          0.37          0.00           0.00          0.08
## 58          0.00          0.57          0.00           0.00          0.00
## 59          0.00          0.72          0.00           0.00          0.02
## 60          0.00          0.75          0.00           0.00          0.02
## 61          0.00          0.75          0.00           0.00          0.02
## 62          0.00          1.33          0.00           0.00          0.03
## 63          0.00          0.30          0.00           0.00          0.13
```

```
## 64          0.00          0.00          0.00           3.21          1.31
## 65          0.00          0.00          0.00           3.49          1.45
## 66          0.00          0.00          0.00           4.05          1.16
## 67          0.00          0.00          0.00           0.28          1.17
## 68          0.00          0.00          0.00           1.12          1.45
## 69          0.00          0.00          0.00           0.56          1.37
## 70          0.00          0.00          0.00           2.30          0.40
## 71          0.00          0.00          0.00           6.00          0.10
## 72          0.00          0.00          0.00           5.00          0.00
## 73          0.00          0.00          0.00           6.00          0.00
## 74          0.00          0.00          0.00           8.00          0.01
## 75          0.00          0.00          0.00           6.00          0.01
## 76          0.00          0.00          0.00           4.00          0.00
## 77          0.00          0.00          0.00           2.00          0.00
## 78          0.00          0.00          0.00          22.70          0.00
## 79          0.00          0.00          0.00          22.30          0.10
## 80          0.00          0.00          0.00          20.40          0.40
## 81          0.00          0.00          0.00          19.50          0.00
## 82          0.00          0.00          0.00          18.70          0.00
## 83          0.00          0.00          0.00          17.40          0.20
## 84          0.00          0.00          0.00          10.50          0.00
## 85          0.00          0.00          0.00           1.55          0.42
## 86          0.00          0.00          0.00           0.54          0.14
## 87          0.00          0.00          0.00           1.07          0.35
## 88          0.00          0.00          0.00           0.41          0.42
## 89          0.00          0.00          0.00           0.59          1.05
## 90          0.00          0.00          0.00           1.02          0.24
## 91          0.00          0.00          0.00           0.33          1.46
## 92          0.00          0.00          0.00           3.60          0.06
## 93          0.00          0.00          0.00           4.60          0.21
## 94          0.00          0.00          0.00           4.80          0.68
## 95          0.00          0.00          0.00           8.00          0.20
## 96          0.00          0.00          0.00           2.40          0.30
## 97          0.00          0.00          0.00           1.10          0.04
## 98          0.00          0.00          0.00           2.00          0.00
## 99          0.00          0.00          0.02           1.36          0.15
## 100         0.00          0.00          0.04           1.20          0.22
## 101         0.00          0.00          0.05           1.19          0.09
## 102         0.00          0.00          0.22           2.01          0.04
## 103         0.00          0.00          0.14           3.04          0.16
## 104         0.00          0.00          0.09           1.56          0.05
## 105         0.00          0.00          0.05           1.42          0.05
## 106         0.00          0.00          4.23           0.32          0.00
## 107         0.00          0.00          8.50           0.12          0.00
## 108         0.00          0.00          4.27           0.08          0.00
## 109         0.00          0.00          2.20           0.12          0.00
## 110         0.00          0.00          5.30           2.04          0.00
## 111         0.00          0.00          4.27           1.36          0.00
## 112         0.00          0.00          5.39           0.12          0.00
## 113         0.00          0.00          0.37           3.45          0.13
## 114         0.00          0.00          0.56           4.10          0.09
## 115         0.00          0.00          0.53           4.60          0.11
```

```
## 116        0.00        0.00        0.78        3.86        0.15
## 117        0.00        0.00        0.54        2.45        0.16
## 118        0.00        0.00        0.60        3.20        0.10
## 119        0.00        0.00        0.40        2.40        0.20
## 120        0.00        0.00        0.00        4.00        1.00
## 121        0.00        0.00        0.00        3.00        0.00
## 122        0.00        0.00        0.60        2.00        0.00
## 123        0.00        0.00        0.00        6.80        0.31
## 124        0.00        0.00        0.00        9.74        0.57
## 125        0.00        0.00        0.00        5.00        0.00
## 126        0.00        0.00        0.00        8.87        0.00
## 127        0.00        0.00        0.00        7.00        6.00
## 128        0.00        0.00        0.00        4.00       10.00
## 129        0.00        0.00        0.00        5.00        8.00
## 130        0.00        0.00        0.00        4.00       10.00
## 131        0.00        0.00        0.00        5.00        6.00
## 132        0.00        0.00        0.00        6.00        7.00
## 133        0.00        0.00        0.00        8.00       10.30
## 134        0.00        0.00        0.00        3.50        0.10
## 135        0.00        0.00        0.00        2.50        0.50
## 136        0.00        0.00        0.00        1.30        0.30
## 137        0.00        0.00        0.00        1.20        0.20
## 138        0.00        0.00        0.00        0.34        0.30
## 139        0.00        0.00        0.00        0.22        0.00
## 140        0.00        0.00        0.00        0.17        0.00
## 141        0.00        0.00        0.00        0.50        0.01
## 142        0.00        0.00        0.00        0.50        0.01
## 143        0.00        0.00        0.00        0.50        0.00
## 144        0.00        0.00        0.00        0.50        0.00
## 145        0.00        0.00        0.00        0.50        0.50
## 146        0.00        0.00        0.00        0.50        0.00
## 147        0.00        0.00        0.00        0.50        0.00
## 148        0.00        0.00        0.00        0.47        0.04
## 149        0.00        0.00        0.00        3.05        0.03
## 150        0.00        0.00        0.00        2.05        0.04
## 151        0.00        0.00        0.00        3.01        0.04
## 152        0.00        0.00        0.00        2.07        0.03
## 153        0.00        0.00        0.00        1.15        0.05
## 154        0.00        0.00        0.00        1.13        0.05
## 155        0.00        0.00        0.00        0.90        0.15
## 156        0.00        0.00        0.00        1.30        0.12
## 157        0.00        0.00        0.00        0.70        0.04
## 158        0.00        0.00        0.00        0.25        0.06
## 159        0.00        0.00        0.00        1.23        0.03
## 160        0.00        0.00        0.50        2.43        0.06
## 161        0.00        0.00        0.00        2.50        0.08
## 162        0.00        0.00        0.00        0.20        0.02
## 163        0.00        0.00        0.00        0.12        0.07
## 164        0.00        0.00        0.00        0.11        0.03
## 165        0.00        0.00        0.00        0.20        0.05
## 166        0.00        0.00        0.00        0.00        0.00
## 167        0.46        0.00        0.00        0.14        0.00
```

```
## 168         0.00         0.00          0.00          0.00          0.00
## 169         0.60         7.10          0.00          0.35          0.82
## 170         3.90         6.83          0.33          0.15          1.40
## 171         2.33         7.50          0.21          0.04          1.28
## 172         2.50         9.50          0.67          0.50          1.50
## 173         1.50        10.50          0.33          0.33          1.35
## 174         1.33         5.00          0.50          0.67          1.80
## 175         2.70        10.00          0.60          2.30          1.00
##     Total.Social.Media.Screen.Time..hrs.
## 1                                  22.52
## 2                                  31.06
## 3                                  41.77
## 4                                  37.61
## 5                                  29.95
## 6                                  30.12
## 7                                  28.17
## 8                                  23.00
## 9                                  17.18
## 10                                 16.43
## 11                                 16.14
## 12                                 13.87
## 13                                 17.05
## 14                                 17.41
## 15                                 40.20
## 16                                 19.40
## 17                                 19.70
## 18                                 30.10
## 19                                 23.35
## 20                                 26.67
## 21                                 23.10
## 22                                 15.16
## 23                                 17.63
## 24                                 15.35
## 25                                 11.89
## 26                                 15.50
## 27                                 14.50
## 28                                 17.95
## 29                                 43.86
## 30                                 48.16
## 31                                 35.50
## 32                                 23.40
## 33                                 30.40
## 34                                 31.00
## 35                                 31.10
## 36                                 23.28
## 37                                 24.52
## 38                                 30.68
## 39                                 20.21
## 40                                 21.81
## 41                                 20.94
## 42                                 25.23
## 43                                 19.00
```

```
## 44                          19.00
## 45                          17.00
## 46                          15.70
## 47                          17.50
## 48                          18.30
## 49                          22.75
## 50                          24.69
## 51                          16.50
## 52                          26.90
## 53                          26.18
## 54                          18.88
## 55                          28.33
## 56                          22.71
## 57                           0.58
## 58                           0.67
## 59                           0.87
## 60                           1.20
## 61                           1.13
## 62                           1.75
## 63                           0.78
## 64                          17.08
## 65                          16.71
## 66                          22.66
## 67                          14.18
## 68                          13.95
## 69                          12.78
## 70                          14.62
## 71                          24.82
## 72                          24.52
## 73                          24.73
## 74                          14.93
## 75                          23.64
## 76                          25.02
## 77                          23.60
## 78                          49.40
## 79                          50.50
## 80                          55.60
## 81                          51.60
## 82                          51.20
## 83                          49.00
## 84                          34.30
## 85                          16.27
## 86                          13.67
## 87                          12.89
## 88                          15.99
## 89                          15.12
## 90                          11.24
## 91                          15.93
## 92                          21.97
## 93                          30.82
## 94                          37.43
## 95                          30.90
```

```
## 96                                20.40
## 97                                17.74
## 98                                21.30
## 99                                12.35
## 100                                8.22
## 101                                7.90
## 102                                9.75
## 103                               14.89
## 104                               11.05
## 105                               10.96
## 106                               36.12
## 107                               36.99
## 108                               23.40
## 109                               16.57
## 110                               30.29
## 111                               22.39
## 112                               23.24
## 113                               20.93
## 114                               21.62
## 115                               15.79
## 116                               15.65
## 117                               13.50
## 118                               13.90
## 119                               13.37
## 120                               23.50
## 121                               24.70
## 122                               22.60
## 123                               27.83
## 124                               25.74
## 125                               25.50
## 126                               23.43
## 127                               30.00
## 128                               31.00
## 129                               26.00
## 130                               28.00
## 131                               25.00
## 132                               26.00
## 133                               39.85
## 134                               20.62
## 135                               14.09
## 136                               15.76
## 137                               11.70
## 138                                7.62
## 139                               23.57
## 140                               16.66
## 141                               47.01
## 142                               39.51
## 143                               38.00
## 144                               39.50
## 145                               30.50
## 146                               28.00
## 147                               36.00
```

```
## 148                                    33.90
## 149                                    32.21
## 150                                    32.80
## 151                                    28.43
## 152                                    28.52
## 153                                    24.00
## 154                                    23.85
## 155                                    17.58
## 156                                    13.72
## 157                                    11.30
## 158                                    11.68
## 159                                    10.18
## 160                                    16.69
## 161                                    29.78
## 162                                    17.53
## 163                                    17.28
## 164                                    14.48
## 165                                    16.99
## 166                                    11.06
## 167                                    19.07
## 168                                    20.53
## 169                                    16.51
## 170                                    14.41
## 171                                    18.42
## 172                                    24.12
## 173                                    21.24
## 174                                    12.95
## 175                                    26.61
##     Number.of.times.opened..hourly.intervals. Social.Media.Addiction
## 1                                         111               Addicted
## 2                                         119               Addicted
## 3                                         124               Addicted
## 4                                         121               Addicted
## 5                                         116               Addicted
## 6                                         115               Addicted
## 7                                         113               Addicted
## 8                                         150               Addicted
## 9                                         121               Addicted
## 10                                        110               Addicted
## 11                                         85           Not Addicted
## 12                                         69           Not Addicted
## 13                                        200               Addicted
## 14                                        124               Addicted
## 15                                         88           Not Addicted
## 16                                         95           Not Addicted
## 17                                         30           Not Addicted
## 18                                        100           Not Addicted
## 19                                         80           Not Addicted
## 20                                        128               Addicted
## 21                                         75           Not Addicted
## 22                                        135               Addicted
## 23                                        150               Addicted
```

```
## 24                                  108              Addicted
## 25                                  128              Addicted
## 26                                   80          Not Addicted
## 27                                  102          Not Addicted
## 28                                  115              Addicted
## 29                                   95          Not Addicted
## 30                                  106              Addicted
## 31                                   94          Not Addicted
## 32                                  121              Addicted
## 33                                  112              Addicted
## 34                                  123              Addicted
## 35                                  128              Addicted
## 36                                   93          Not Addicted
## 37                                  115              Addicted
## 38                                  115              Addicted
## 39                                  126              Addicted
## 40                                  110              Addicted
## 41                                  119              Addicted
## 42                                  116              Addicted
## 43                                  110              Addicted
## 44                                  100          Not Addicted
## 45                                   95          Not Addicted
## 46                                  100          Not Addicted
## 47                                  100          Not Addicted
## 48                                   95          Not Addicted
## 49                                  110              Addicted
## 50                                   45          Not Addicted
## 51                                   44          Not Addicted
## 52                                   54          Not Addicted
## 53                                   66          Not Addicted
## 54                                   78          Not Addicted
## 55                                   62          Not Addicted
## 56                                   73          Not Addicted
## 57                                   37          Not Addicted
## 58                                   36          Not Addicted
## 59                                   54          Not Addicted
## 60                                   49          Not Addicted
## 61                                   41          Not Addicted
## 62                                   43          Not Addicted
## 63                                   37          Not Addicted
## 64                                  148              Addicted
## 65                                  192              Addicted
## 66                                  257              Addicted
## 67                                  187              Addicted
## 68                                  210              Addicted
## 69                                  192              Addicted
## 70                                  187              Addicted
## 71                                  100          Not Addicted
## 72                                  101          Not Addicted
## 73                                  110              Addicted
## 74                                  200              Addicted
## 75                                  125              Addicted
```

```
## 76                                  135              Addicted
## 77                                  130              Addicted
## 78                                  102          Not Addicted
## 79                                  117              Addicted
## 80                                  123              Addicted
## 81                                  112              Addicted
## 82                                  128              Addicted
## 83                                  115              Addicted
## 84                                   96          Not Addicted
## 85                                   89          Not Addicted
## 86                                  101          Not Addicted
## 87                                   96          Not Addicted
## 88                                   98          Not Addicted
## 89                                  100          Not Addicted
## 90                                   96          Not Addicted
## 91                                  111              Addicted
## 92                                  105              Addicted
## 93                                  141              Addicted
## 94                                  178              Addicted
## 95                                  129              Addicted
## 96                                  102          Not Addicted
## 97                                   90          Not Addicted
## 98                                  103          Not Addicted
## 99                                   81          Not Addicted
## 100                                  84          Not Addicted
## 101                                  99          Not Addicted
## 102                                 153              Addicted
## 103                                  95          Not Addicted
## 104                                 104          Not Addicted
## 105                                 100          Not Addicted
## 106                                 154              Addicted
## 107                                 137              Addicted
## 108                                  81          Not Addicted
## 109                                  37          Not Addicted
## 110                                  64          Not Addicted
## 111                                  49          Not Addicted
## 112                                  55          Not Addicted
## 113                                 143              Addicted
## 114                                 161              Addicted
## 115                                 114              Addicted
## 116                                 124              Addicted
## 117                                 110              Addicted
## 118                                 141              Addicted
## 119                                 130              Addicted
## 120                                 109              Addicted
## 121                                 130              Addicted
## 122                                  97          Not Addicted
## 123                                 196              Addicted
## 124                                 152              Addicted
## 125                                 150              Addicted
## 126                                 128              Addicted
## 127                                  94          Not Addicted
```

```
## 128                                  86          Not Addicted
## 129                                  81          Not Addicted
## 130                                  82          Not Addicted
## 131                                  80          Not Addicted
## 132                                  82          Not Addicted
## 133                                  97          Not Addicted
## 134                                 200              Addicted
## 135                                  79          Not Addicted
## 136                                 154              Addicted
## 137                                 107              Addicted
## 138                                  94          Not Addicted
## 139                                 256              Addicted
## 140                                 167              Addicted
## 141                                 147              Addicted
## 142                                 119              Addicted
## 143                                 113              Addicted
## 144                                 120              Addicted
## 145                                 115              Addicted
## 146                                 109              Addicted
## 147                                 116              Addicted
## 148                                 135              Addicted
## 149                                 121              Addicted
## 150                                 141              Addicted
## 151                                 132              Addicted
## 152                                 142              Addicted
## 153                                 134              Addicted
## 154                                 145              Addicted
## 155                                 119              Addicted
## 156                                 112              Addicted
## 157                                 126              Addicted
## 158                                 105              Addicted
## 159                                 105              Addicted
## 160                                 112              Addicted
## 161                                 134              Addicted
## 162                                 115              Addicted
## 163                                 117              Addicted
## 164                                  93          Not Addicted
## 165                                 108              Addicted
## 166                                  69          Not Addicted
## 167                                  75          Not Addicted
## 168                                 121              Addicted
## 169                                  83          Not Addicted
## 170                                  63          Not Addicted
## 171                                  97          Not Addicted
## 172                                 102          Not Addicted
## 173                                  98          Not Addicted
## 174                                  57          Not Addicted
## 175                                 127              Addicted
```

```
head(Students)
```

```
##       Student            Week Whatsapp..hrs. Instagram..hrs. Snapchat.hrs.
## 1 AJAY ADDALA  Feb 26 - Mar 4           8.90            7.10          1.90
## 2 AJAY ADDALA  Mar 5 - Mar 11          11.85           11.16          2.45
## 3 AJAY ADDALA Mar 12 - Mar 18          12.25           16.75          3.25
## 4 AJAY ADDALA Mar 19 - Mar 25          12.33           12.90          3.12
## 5 AJAY ADDALA  Mar 26 - Apr 1           8.50           11.90          1.90
## 6 AJAY ADDALA   Apr 2 - Apr 8           9.50           11.25          1.20
##   Telegram..hrs. Facebook.Messenger..hrs. BeReal..hrs. TikTok..hrs.
## 1           0.02                        0           0           0
## 2           0.06                        0           0           0
## 3           0.01                        0           0           0
## 4           0.06                        0           0           0
## 5           0.05                        0           0           0
## 6           0.16                        0           0           0
##   WeChat..hrs. Twitter..hrs. Linkedin..hrs. Messages..hrs.
## 1            0             0            4.5           0.10
## 2            0             0            5.5           0.04
## 3            0             0            9.5           0.01
## 4            0             0            9.0           0.20
## 5            0             0            7.5           0.10
## 6            0             0            8.0           0.01
##   Total.Social.Media.Screen.Time..hrs.
## 1                                22.52
## 2                                31.06
## 3                                41.77
## 4                                37.61
## 5                                29.95
## 6                                30.12
##   Number.of.times.opened..hourly.intervals. Social.Media.Addiction
## 1                                      111               Addicted
## 2                                      119               Addicted
## 3                                      124               Addicted
## 4                                      121               Addicted
## 5                                      116               Addicted
## 6                                      115               Addicted
```

```
summary(Students)
```

```
##    Student              Week           Whatsapp..hrs.   Instagram..hrs.
##  Length:175         Length:175         Min.   : 0.000   Min.   : 0.000
##  Class :character   Class :character   1st Qu.: 5.055   1st Qu.: 4.750
##  Mode  :character   Mode  :character   Median : 7.500   Median : 7.800
##                                        Mean   : 7.878   Mean   : 8.253
##                                        3rd Qu.:10.000   3rd Qu.:11.225
##                                        Max.   :22.500   Max.   :24.000
##  Snapchat.hrs.    Telegram..hrs.   Facebook.Messenger..hrs.  BeReal..hrs.
##  Min.   : 0.000   Min.   :0.0000   Min.   :0.0000           Min.   :0.0000
##  1st Qu.: 0.000   1st Qu.:0.0000   1st Qu.:0.0000           1st Qu.:0.0000
##  Median : 0.800   Median :0.0000   Median :0.0000           Median :0.0000
##  Mean   : 1.406   Mean   :0.1169   Mean   :0.1624           Mean   :0.1174
##  3rd Qu.: 1.535   3rd Qu.:0.0600   3rd Qu.:0.0000           3rd Qu.:0.0000
##  Max.   :12.100   Max.   :2.3900   Max.   :2.3500           Max.   :8.6000
##   TikTok..hrs.      WeChat..hrs.     Twitter..hrs.    Linkedin..hrs.
##  Min.   :0.00000   Min.   : 0.0000   Min.   :0.0000   Min.   : 0.000
##  1st Qu.:0.00000   1st Qu.: 0.0000   1st Qu.:0.0000   1st Qu.: 0.415
##  Median :0.00000   Median : 0.0000   Median :0.0000   Median : 1.420
##  Mean   :0.08754   Mean   : 0.3498   Mean   :0.2525   Mean   : 3.255
##  3rd Qu.:0.00000   3rd Qu.: 0.0000   3rd Qu.:0.0000   3rd Qu.: 4.000
##  Max.   :3.90000   Max.   :10.5000   Max.   :8.5000   Max.   :22.800
##  Messages..hrs.   Total.Social.Media.Screen.Time..hrs.
##  Min.   : 0.000   Min.   : 0.58
##  1st Qu.: 0.000   1st Qu.:15.68
##  Median : 0.060   Median :21.62
##  Mean   : 0.591   Mean   :22.47
##  3rd Qu.: 0.400   3rd Qu.:28.09
##  Max.   :10.300   Max.   :55.60
##  Number.of.times.opened..hourly.intervals. Social.Media.Addiction
##  Min.   : 30.0                             Length:175
##  1st Qu.: 94.0                             Class :character
##  Median :110.0                             Mode  :character
##  Mean   :111.2
##  3rd Qu.:128.0
##  Max.   :257.0
```

```
str(Students)
```

```
## 'data.frame':    175 obs. of  16 variables:
##  $ Student                                  : chr  "AJAY ADDALA" "AJAY ADDALA" "AJAY ADDALA"
"AJAY ADDALA" ...
##  $ Week                                     : chr  "Feb 26 - Mar 4" "Mar 5 - Mar 11" "Mar 12
- Mar 18" "Mar 19 - Mar 25" ...
##  $ Whatsapp..hrs.                           : num  8.9 11.8 12.2 12.3 8.5 ...
##  $ Instagram..hrs.                          : num  7.1 11.2 16.8 12.9 11.9 ...
##  $ Snapchat.hrs.                            : num  1.9 2.45 3.25 3.12 1.9 1.2 1.67 2 1.4 2.1
...
##  $ Telegram..hrs.                           : num  0.02 0.06 0.01 0.06 0.05 0.16 0 0.25 0.35
0.33 ...
##  $ Facebook.Messenger..hrs.                 : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ BeReal..hrs.                             : num  0 0 0 0 0 0 0 0.35 0.21 0.65 ...
##  $ TikTok..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ WeChat..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Twitter..hrs.                            : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Linkedin..hrs.                           : num  4.5 5.5 9.5 9 7.5 8 6.5 2.5 2.67 1.55 ...
##  $ Messages..hrs.                           : num  0.1 0.04 0.01 0.2 0.1 0.01 0 0.2 0.8 0.5
...
##  $ Total.Social.Media.Screen.Time..hrs.     : num  22.5 31.1 41.8 37.6 29.9 ...
##  $ Number.of.times.opened..hourly.intervals.: int  111 119 124 121 116 115 113 150 121 110
...
##  $ Social.Media.Addiction                   : chr  "Addicted" "Addicted" "Addicted" "Addicte
d" ...
```

```
# This is the class group data of the students of their weekly social media usage and it states
whether the students are addicted if  the number of times open is equal to or more 105 . If it l
ess than that , they are not addictive.
```

```
#Finding Z score for Vedasamhith(ROW 15-21)
Students_Zscore <- scale(Students[c(3:14)])
Students_Zscore
```

```
##        Whatsapp..hrs. Instagram..hrs. Snapchat.hrs. Telegram..hrs.
##   [1,]     0.21906630     -0.22655759   0.226966377    -0.32935512
##   [2,]     0.85136518      0.57126739   0.479778710    -0.19333825
##   [3,]     0.93710063      1.66975054   0.847505741    -0.36335933
##   [4,]     0.95424771      0.91319237   0.787750099    -0.19333825
##   [5,]     0.13333086      0.71668376   0.226966377    -0.22734247
##   [6,]     0.34766946      0.58895316  -0.094794775     0.14670390
##   [7,]     0.07974621      0.68720747   0.121244855    -0.39736355
##   [8,]    -0.46681723      0.73633462   0.272932256     0.45274184
##   [9,]    -0.72402356     -0.19708130  -0.002863018     0.79278399
##  [10,]    -0.23104477     -0.73747999   0.318898134     0.72477556
##  [11,]    -0.42394951     -0.93398860   0.847505741     2.05093997
##  [12,]    -0.50968495     -0.73747999  -0.025845957     2.39098212
##  [13,]    -0.35964793     -0.24620845   0.502761650     2.86704114
##  [14,]    -0.46681723     -0.34446276   0.318898134     1.60888517
##  [15,]     0.56200807      1.28655874   4.915486021    -0.39736355
##  [16,]    -0.57398653     -0.04969984   1.192249833    -0.39736355
##  [17,]    -0.98122988     -0.83573429   1.330147469    -0.39736355
##  [18,]    -0.93836216     -0.24620845   3.950202565    -0.39736355
##  [19,]    -0.56755638     -0.38376448   2.626385253    -0.39736355
##  [20,]    -0.76689128      0.79528721   1.743840379    -0.39736355
##  [21,]    -0.89549444      0.57912773   1.330147469    -0.39736355
##  [22,]     0.11189700     -0.48201879  -0.517680861    -0.39736355
##  [23,]    -0.46038707      0.39244455  -0.094794775    -0.39736355
##  [24,]    -0.78832514      0.29419024  -0.117777715    -0.39736355
##  [25,]    -0.56326960     -0.63922568  -0.117777715    -0.39736355
##  [26,]    -0.61685426      0.04855447  -0.186726533    -0.39736355
##  [27,]    -0.40251565     -0.34446276  -0.094794775    -0.39736355
##  [28,]    -0.08100774      0.12715792  -0.278658291    -0.39736355
##  [29,]    -0.08100774     -0.65887654   3.720373170    -0.19333825
##  [30,]     0.21906630     -0.08900156   3.306680261    -0.19333825
##  [31,]    -0.85262672      1.34551133   0.594693408    -0.39736355
##  [32,]    -0.70258970      0.06820533  -0.646385322    -0.39736355
##  [33,]    -0.25247863      0.55947687  -0.646385322    -0.39736355
##  [34,]    -0.03814002      0.38261912  -0.646385322    -0.39736355
##  [35,]     0.11189700      0.87389065  -0.646385322    -0.39736355
##  [36,]     0.10761023      0.80707772  -0.002863018    -0.39736355
##  [37,]    -0.52683204      1.57149623   0.043102861    -0.39736355
##  [38,]    -0.50539818      2.75840826   0.024716510    -0.39736355
##  [39,]    -0.56326960      0.85227470   0.084472152    -0.39736355
##  [40,]    -0.28891619      0.99965617  -0.039635721    -0.39736355
##  [41,]    -0.71973679      1.30620960  -0.182129945    -0.39736355
##  [42,]     0.09046314      1.40053374  -0.039635721    -0.39736355
##  [43,]     0.02616156     -0.24620845  -0.186726533     1.30284723
##  [44,]     0.24050016     -0.04969984  -0.416555927    -0.39736355
##  [45,]    -0.18817705     -0.24620845  -0.416555927     1.30284723
##  [46,]     0.06902928     -0.24620845  -0.416555927    -0.39736355
##  [47,]     0.13333086     -0.04969984  -0.186726533    -0.39736355
##  [48,]     0.24050016     -0.04969984  -0.508487685    -0.39736355
##  [49,]     0.45483877      0.14680878  -0.186726533     1.30284723
##  [50,]     2.59822481     -0.76892136  -0.627998970    -0.39736355
##  [51,]     0.88351597     -1.01259205  -0.646385322    -0.39736355
```

```
##  [52,]     2.81256341     -0.73747999  -0.582033091    -0.39736355
##  [53,]     2.79755971     -0.68835283  -0.627998970    -0.39736355
##  [54,]     1.31004980     -1.06564937  -0.646385322    -0.39736355
##  [55,]     3.03333218     -0.66280671  -0.582033091    -0.39736355
##  [56,]     1.99164656     -0.69228301  -0.485504746    -0.39736355
##  [57,]    -1.68854728     -1.59622263  -0.646385322    -0.39736355
##  [58,]    -1.68854728     -1.60211789  -0.646385322    -0.39736355
##  [59,]    -1.68854728     -1.59622263  -0.646385322    -0.39736355
##  [60,]    -1.66282664     -1.55888599  -0.646385322    -0.39736355
##  [61,]    -1.68426050     -1.55299074  -0.646385322    -0.39736355
##  [62,]    -1.67140019     -1.56281617  -0.646385322    -0.39736355
##  [63,]    -1.68854728     -1.55299074  -0.646385322    -0.39736355
##  [64,]    -0.61471087     -0.59206361   0.291318607    -0.39736355
##  [65,]    -0.99837697     -0.39555500   0.415426480    -0.39736355
##  [66,]    -1.03910131      0.76777600   0.392443541    -0.39736355
##  [67,]    -0.51825850     -0.60581921   0.318898134    -0.39736355
##  [68,]    -0.77546482     -0.52721577   0.066085801    -0.39736355
##  [69,]    -0.76260451     -0.82590886   0.493568474    -0.39736355
##  [70,]    -0.37036486     -0.77874680   0.033909685    -0.39736355
##  [71,]     0.77634667     -0.30516103  -0.641788734    -0.36335933
##  [72,]     0.71204509     -0.01039811  -0.641788734    -0.36335933
##  [73,]     0.45483877     -0.03004897  -0.641788734    -0.32935512
##  [74,]    -1.04553146     -0.91433774  -0.641788734    -0.36335933
##  [75,]     0.24050016     -0.04969984  -0.641788734    -0.32935512
##  [76,]     0.45483877      0.44157170  -0.641788734    -0.36335933
##  [77,]     0.88351597      0.24506309  -0.646385322    -0.39736355
##  [78,]     0.04759542      0.48087342   2.984919109    -0.39736355
##  [79,]     0.51914035      0.44157170   2.709123835    -0.39736355
##  [80,]     1.41936249      0.63808031   3.398612018    -0.39736355
##  [81,]     1.18359002      0.59877859   2.755089714    -0.39736355
##  [82,]     1.26932546      0.46122256   3.076850866    -0.39736355
##  [83,]     1.03355300      0.42192084   3.168782624    -0.39736355
##  [84,]     0.51914035      0.02890361   1.697874500    -0.39736355
##  [85,]     0.68418107     -1.13049722  -0.517680861    -0.19333825
##  [86,]     0.10546684     -1.02241748  -0.513084273     0.07869547
##  [87,]     0.05402558     -1.14425282  -0.540663800    -0.09132561
##  [88,]     0.12261393     -1.01259205  -0.572839916     3.34310015
##  [89,]     0.35195624     -1.12263687  -0.540663800    -0.02331718
##  [90,]    -0.34678761     -1.00473170  -0.609612619     0.31672498
##  [91,]    -0.15173948     -0.36214853  -0.605016031     0.41873762
##  [92,]     1.00783237     -0.79053731  -0.646385322    -0.39736355
##  [93,]     1.95092222     -0.13223345  -0.646385322    -0.39736355
##  [94,]     1.73015346      1.12935185  -0.646385322    -0.39736355
##  [95,]     1.35506090     -0.04969984  -0.646385322    -0.39736355
##  [96,]     0.92638370     -0.63922568  -0.646385322    -0.39736355
##  [97,]     0.26193402     -0.24620845  -0.646385322    -0.39736355
##  [98,]     0.45483877      0.14680878  -0.646385322    -0.39736355
##  [99,]     0.11832716     -1.62176875  -0.646385322     7.72964394
## [100,]    -0.35964793     -1.62176875  -0.646385322     1.50687252
## [101,]    -0.34250084     -1.62176875  -0.646385322     0.58875870
## [102,]    -0.14745271     -1.62176875  -0.646385322     0.58875870
## [103,]     0.74205250     -1.62176875  -0.646385322     0.31672498
```

```
## [104,]    0.09046314    -1.62176875  -0.646385322    3.17307908
## [105,]    0.25121709    -1.62176875  -0.646385322    0.92880086
## [106,]    0.31337529     2.01364062  -0.094794775   -0.39736355
## [107,]   -0.08315113     2.02936131  -0.407362752   -0.39736355
## [108,]   -0.14102255     0.40816524  -0.131567478   -0.39736355
## [109,]   -0.51825850    -0.17743044  -0.453328630   -0.39736355
## [110,]   -0.51611511     1.60686778  -0.421152515   -0.39736355
## [111,]   -0.74545742     0.43764153  -0.453328630   -0.39736355
## [112,]   -0.75831773     0.82083333  -0.402766164   -0.39736355
## [113,]    0.37553348    -0.17743044  -0.646385322   -0.39736355
## [114,]    0.18262874    -0.08900156  -0.646385322    0.75877978
## [115,]   -0.44538337    -0.68835283  -0.646385322   -0.39736355
## [116,]   -0.72831033    -0.36804379  -0.646385322   -0.39736355
## [117,]   -0.78832514    -0.41324077  -0.646385322   -0.39736355
## [118,]   -0.85905688    -0.41717094  -0.646385322   -0.39736355
## [119,]   -0.57827331    -0.60188904  -0.646385322   -0.39736355
## [120,]    0.45483877    -0.14795414  -0.416555927   -0.39736355
## [121,]    0.93710063    -0.01039811  -0.186726533    0.45274184
## [122,]    0.24050016     0.28436481  -0.508487685    1.30284723
## [123,]   -0.13459240     0.86799539  -0.278658291   -0.39736355
## [124,]    0.20620599    -0.68442266   0.190193674   -0.39736355
## [125,]    0.24050016     0.44157170  -0.186726533   -0.39736355
## [126,]   -0.31035005    -0.21476707  -0.361396873    0.79278399
## [127,]   -0.40251565     0.14680878   0.272932256   -0.39736355
## [128,]   -0.18817705    -0.04969984   0.272932256   -0.39736355
## [129,]   -0.18817705    -0.83573429   0.272932256   -0.39736355
## [130,]    0.02616156    -0.63922568  -0.186726533   -0.39736355
## [131,]   -0.61685426    -0.24620845   0.272932256   -0.39736355
## [132,]   -0.18817705    -0.63922568  -0.186726533   -0.39736355
## [133,]    0.29408481     0.14680878   0.870488681   -0.39736355
## [134,]   -0.50968495     0.42192084  -0.186726533    0.01068704
## [135,]   -0.99837697    -0.38769465   0.038506273   -0.05732139
## [136,]   -0.78832514     0.03872904  -0.002863018   -0.02331718
## [137,]   -0.95979602    -0.59009853   0.043102861    0.11269969
## [138,]   -0.97694311    -1.17372911  -0.094794775    0.21471233
## [139,]   -0.55255267     1.65992511  -0.439538867    2.66301584
## [140,]   -0.91907169     0.79135703  -0.411959339   -0.02331718
## [141,]    3.13407132     3.09443800  -0.646385322   -0.39736355
## [142,]    2.49105551     1.91538631   0.043102861   -0.39736355
## [143,]    2.27671690     1.81713200   0.043102861   -0.39736355
## [144,]    2.59822481     1.91538631  -0.186726533   -0.39736355
## [145,]    1.52653179     0.93284324   0.043102861   -0.39736355
## [146,]    0.88351597     1.22760616  -0.186726533   -0.39736355
## [147,]    2.38388620     1.32586047   0.043102861   -0.39736355
## [148,]    1.00140221     2.13547596   0.070682389   -0.09132561
## [149,]    0.48270278     1.78765571   0.052296037    0.04469125
## [150,]    0.05188219     2.60906172  -0.168340182   -0.32935512
## [151,]    0.24264355     1.39463848  -0.177533357   -0.39736355
## [152,]    0.30480174     1.52433417  -0.136164066   -0.39736355
## [153,]   -0.14530933     1.33372081  -0.388976400   -0.39736355
## [154,]    0.04759542     1.13524711  -0.398169576   -0.39736355
## [155,]    0.91137999    -1.03224291  -0.416555927    2.66301584
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## [156,]     0.34766946     -1.16979894  -0.554453564     0.62276292
## [157,]     0.56200807     -1.62176875  -0.646385322    -0.19333825
## [158,]     0.74633927     -1.62176875  -0.646385322    -0.36335933
## [159,]    -0.03814002     -1.62176875  -0.646385322     3.75115074
## [160,]     0.39053718     -1.03224291  -0.646385322     3.00305800
## [161,]     0.99068528      1.18830444  -0.646385322     0.96280507
## [162,]    -0.71973679      0.46122256   0.360267425    -0.39736355
## [163,]    -0.57184315      0.20183119   0.548727529    -0.39736355
## [164,]    -1.22986266      0.50052428  -0.002863018    -0.39736355
## [165,]    -0.59542039      0.41209541  -0.053425484    -0.39736355
## [166,]    -0.95979602     -0.20690673  -0.434942279    -0.39736355
## [167,]    -0.57398653      0.53982601  -0.384379812    -0.39736355
## [168,]    -0.56755638      1.09005013   0.043102861    -0.39736355
## [169,]    -1.67997373     -0.12830328  -0.646385322    -0.39736355
## [170,]    -1.68854728     -1.26805325  -0.646385322    -0.39736355
## [171,]    -1.53208010     -0.37786922  -0.646385322    -0.39736355
## [172,]    -1.65639649      0.20576136  -0.646385322    -0.39736355
## [173,]    -1.68211712     -0.20690673  -0.646385322    -0.39736355
## [174,]    -1.67783035     -0.91433774  -0.646385322    -0.39736355
## [175,]    -1.68640389      0.34331739  -0.646385322    -0.39736355
##        Facebook.Messenger..hrs. BeReal..hrs. TikTok..hrs. WeChat..hrs.
##   [1,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [2,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [3,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [4,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [5,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [6,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [7,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [8,]              -0.38621651   0.29879810   -0.1887538  -0.21483824
##   [9,]              -0.38621651   0.11893192   -0.1887538  -0.21483824
##  [10,]              -0.38621651   0.68422563   -0.1887538  -0.21483824
##  [11,]              -0.38621651   0.38873119   -0.1887538  -0.21483824
##  [12,]              -0.38621651   0.04184642   -0.1887538  -0.21483824
##  [13,]              -0.38621651   0.02899883   -0.1887538  -0.21483824
##  [14,]              -0.38621651   0.26025535   -0.1887538  -0.21483824
##  [15,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [16,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [17,]              -0.38621651   6.78682817   -0.1887538  -0.21483824
##  [18,]              -0.38621651  10.89805514   -0.1887538  -0.21483824
##  [19,]              -0.38621651   1.86620339   -0.1887538  -0.21483824
##  [20,]              -0.38621651   0.49151187   -0.1887538  -0.21483824
##  [21,]              -0.38621651   0.10608434   -0.1887538  -0.21483824
##  [22,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [23,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [24,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [25,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
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##  [28,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [29,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [30,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [31,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
```

```
##  [32,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [33,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [34,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [35,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [36,]              0.08941959  -0.15086735   -0.1887538  -0.21483824
##  [37,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [38,]             -0.05327124  -0.15086735   -0.1887538  -0.21483824
##  [39,]             -0.12461666  -0.15086735   -0.1887538  -0.21483824
##  [40,]              0.08941959  -0.15086735   -0.1887538  -0.21483824
##  [41,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [42,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [43,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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##  [46,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [47,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [48,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [49,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [50,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [51,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [52,]              2.34869104  -0.15086735   -0.1887538  -0.21483824
##  [53,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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##  [56,]             -0.29108929  -0.15086735   -0.1887538  -0.21483824
##  [57,]             -0.38621651  -0.15086735   -0.1887538   0.01238777
##  [58,]             -0.38621651  -0.15086735   -0.1887538   0.13521263
##  [59,]             -0.38621651  -0.15086735   -0.1887538   0.22733128
##  [60,]             -0.38621651  -0.15086735   -0.1887538   0.24575501
##  [61,]             -0.38621651  -0.15086735   -0.1887538   0.24575501
##  [62,]             -0.38621651  -0.15086735   -0.1887538   0.60194712
##  [63,]             -0.38621651  -0.15086735   -0.1887538  -0.03060094
##  [64,]              0.25589222  -0.15086735   -0.1887538  -0.21483824
##  [65,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [66,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [67,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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##  [69,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [70,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [71,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [72,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [73,]              1.04069178  -0.15086735   -0.1887538  -0.21483824
##  [74,]              0.32723763  -0.15086735   -0.1887538  -0.21483824
##  [75,]              1.04069178  -0.15086735   -0.1887538  -0.21483824
##  [76,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [77,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [78,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [79,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [80,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [81,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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##  [83,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
```

```
##  [84,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [85,]              0.54127388  -0.15086735   -0.1887538  -0.21483824
##  [86,]              2.32490923  -0.15086735   -0.1887538  -0.21483824
##  [87,]              1.01690997  -0.15086735   -0.1887538  -0.21483824
##  [88,]              5.20250761  -0.15086735   -0.1887538  -0.21483824
##  [89,]              2.18221840  -0.15086735   -0.1887538  -0.21483824
##  [90,]              0.30345583  -0.15086735   -0.1887538  -0.21483824
##  [91,]              0.16076500  -0.15086735   -0.1887538  -0.21483824
##  [92,]              3.18105420  -0.15086735   -0.1887538  -0.21483824
##  [93,]              3.06214518  -0.15086735   -0.1887538  -0.21483824
##  [94,]              4.37014444  -0.15086735   -0.1887538  -0.21483824
##  [95,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [96,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [97,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [98,]              0.32723763  -0.15086735   -0.1887538  -0.21483824
##  [99,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [100,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [101,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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## [115,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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## [123,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [124,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [125,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [126,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [127,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [128,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [129,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [130,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [131,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [132,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [133,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [134,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [135,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
```

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## [136,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [137,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [138,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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## [140,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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## [145,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [146,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [147,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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## [149,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [150,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [151,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [152,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [153,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [154,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [155,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [156,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [157,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [158,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [159,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [160,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [161,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [162,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [163,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [164,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [165,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [166,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [167,]              3.65669030  -0.15086735    0.8030659  -0.21483824
## [168,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [169,]             -0.38621651  -0.15086735    1.1049241   4.14544452
## [170,]             -0.38621651  -0.15086735    8.2201524   3.97963095
## [171,]             -0.38621651  -0.15086735    4.8350287   4.39109425
## [172,]             -0.38621651  -0.15086735    5.2015707   5.61934292
## [173,]             -0.38621651  -0.15086735    3.0454409   6.23346725
## [174,]             -0.38621651  -0.15086735    2.6788989   2.85578342
## [175,]             -0.38621651  -0.15086735    5.6327967   5.92640508
##        Twitter..hrs. Linkedin..hrs. Messages..hrs.
##   [1,]   -0.24600661    0.260299812  -0.2965877965
##   [2,]   -0.24600661    0.469409559  -0.3328328135
##   [3,]   -0.24600661    1.305848544  -0.3509553221
##   [4,]   -0.24600661    1.201293671  -0.2361794348
##   [5,]   -0.24600661    0.887629052  -0.2965877965
##   [6,]   -0.24600661    0.992183925  -0.3509553221
##   [7,]   -0.24600661    0.678519305  -0.3569961582
##   [8,]   -0.24600661   -0.157919680  -0.2361794348
##   [9,]   -0.24600661   -0.122371024   0.1262707355
##  [10,]   -0.24600661   -0.356573940  -0.0549543496
##  [11,]   -0.24600661   -0.272930041  -0.1153627114
```

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##  [12,]   -0.24600661   -0.502950762   0.0658623738
##  [13,]   -0.24600661   -0.628416610  -0.3569961582
##  [14,]   -0.24600661   -0.325207478  -0.0549543496
##  [15,]    0.24110763   -0.199741630  -0.3569961582
##  [16,]   -0.05116091   -0.262474554  -0.3569961582
##  [17,]    0.92306757   -0.367029427  -0.3569961582
##  [18,]   -0.24600661   -0.471584300  -0.3569961582
##  [19,]   -0.24600661   -0.471584300   0.9297019464
##  [20,]   -0.24600661   -0.053364807   0.4705983973
##  [21,]   -0.24600661   -0.262474554   0.6699459910
##  [22,]   -0.24600661   -0.538499419  -0.3569961582
##  [23,]   -0.24600661   -0.586594661  -0.3569961582
##  [24,]   -0.24600661   -0.628416610  -0.3569961582
##  [25,]   -0.24600661   -0.578230271  -0.3569961582
##  [26,]   -0.24600661   -0.471584300  -0.3569961582
##  [27,]   -0.24600661   -0.513406249  -0.3569961582
##  [28,]   -0.24600661   -0.523861737  -0.3569961582
##  [29,]   -0.24600661    3.898809400  -0.3569961582
##  [30,]   -0.24600661    4.087008172  -0.3569961582
##  [31,]   -0.24600661    2.205020454  -0.3569961582
##  [32,]   -0.24600661    1.452225367  -0.3569961582
##  [33,]   -0.24600661    1.954088758  -0.3569961582
##  [34,]   -0.24600661    2.058643631  -0.3569961582
##  [35,]   -0.24600661    1.243115620   0.1262707355
##  [36,]   -0.24600661   -0.672329657   0.1866790972
##  [37,]   -0.24600661   -0.653509779   0.3195774930
##  [38,]   -0.24600661   -0.657691974   0.3437408377
##  [39,]   -0.24600661   -0.663965267  -0.0005868241
##  [40,]   -0.24600661   -0.676511852  -0.1153627114
##  [41,]   -0.24600661   -0.659783072  -0.1697302369
##  [42,]   -0.24600661   -0.672329657  -0.2422202710
##  [43,]   -0.24600661   -0.262474554  -0.0549543496
##  [44,]   -0.24600661   -0.471584300  -0.0549543496
##  [45,]   -0.24600661   -0.262474554  -0.3569961582
##  [46,]   -0.24600661   -0.680694047  -0.3569961582
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##  [48,]   -0.24600661   -0.471584300  -0.3569961582
##  [49,]   -0.24600661   -0.262474554  -0.2059752539
##  [50,]   -0.24600661   -0.615870025  -0.3569961582
##  [51,]   -0.24600661   -0.387940402  -0.3569961582
##  [52,]   -0.24600661   -0.657691974  -0.3569961582
##  [53,]   -0.24600661   -0.584503563  -0.3569961582
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##  [63,]   -0.24600661   -0.680694047  -0.2784652880
```

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##  [64,]   -0.24600661   -0.009451761   0.4343533803
##  [65,]   -0.24600661    0.049098968   0.5189250867
##  [66,]   -0.24600661    0.166200426   0.3437408377
##  [67,]   -0.24600661   -0.622143318   0.3497816739
##  [68,]   -0.24600661   -0.446491131   0.5189250867
##  [69,]   -0.24600661   -0.563592589   0.4705983973
##  [70,]   -0.24600661   -0.199741630  -0.1153627114
##  [71,]   -0.24600661    0.573964432  -0.2965877965
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##  [74,]   -0.24600661    0.992183925  -0.3509553221
##  [75,]   -0.24600661    0.573964432  -0.3509553221
##  [76,]   -0.24600661    0.155744939  -0.3569961582
##  [77,]   -0.24600661   -0.262474554  -0.3569961582
##  [78,]   -0.24600661    4.066097197  -0.3569961582
##  [79,]   -0.24600661    3.982453298  -0.2965877965
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##  [81,]   -0.24600661    3.396946008  -0.3569961582
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##  [85,]   -0.24600661   -0.356573940  -0.1032810390
##  [86,]   -0.24600661   -0.567774783  -0.2724244518
##  [87,]   -0.24600661   -0.456946618  -0.1455668922
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##  [89,]   -0.24600661   -0.557319296   0.2772916398
##  [90,]   -0.24600661   -0.467402105  -0.2120160901
##  [91,]   -0.24600661   -0.611687830   0.5249659229
##  [92,]   -0.24600661    0.072101041  -0.3207511412
##  [93,]   -0.24600661    0.281210787  -0.2301385986
##  [94,]   -0.24600661    0.323032736   0.0537807015
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##  [96,]   -0.24600661   -0.178830655  -0.1757710731
##  [97,]   -0.24600661   -0.450673325  -0.3328328135
##  [98,]   -0.24600661   -0.262474554  -0.3569961582
##  [99,]   -0.22652204   -0.396304791  -0.2663836157
## [100,]   -0.20703747   -0.429762351  -0.2240977624
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## [102,]   -0.03167634   -0.260383456  -0.3328328135
## [103,]   -0.10961462   -0.045000417  -0.2603427795
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## [112,]    5.00508492   -0.655600877  -0.3569961582
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## [115,]    0.27033449    0.281210787  -0.2905469603
```

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## [116,]    0.51389161    0.126469575  -0.2663836157
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## [118,]    0.33853048   -0.011542858  -0.2965877965
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## [120,]   -0.24600661    0.155744939   0.2470874590
## [121,]   -0.24600661   -0.053364807  -0.3569961582
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## [145,]   -0.24600661   -0.576139173  -0.0549543496
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## [153,]   -0.24600661   -0.440217838  -0.3267919774
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## [156,]   -0.24600661   -0.408851376  -0.2845061242
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## [166,]   -0.24600661   -0.680694047  -0.3569961582
## [167,]   -0.24600661   -0.651418682  -0.3569961582
```

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## [168,]   -0.24600661   -0.680694047  -0.3569961582
## [169,]   -0.24600661   -0.607505635   0.1383524079
## [170,]    0.07548879   -0.649327585   0.4887209058
## [171,]   -0.04141863   -0.672329657   0.4162308718
## [172,]    0.40672647   -0.576139173   0.5491292676
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##   [6,]                           0.724135051
##   [7,]                           0.539557122
##   [8,]                           0.050188970
##   [9,]                          -0.500705158
##  [10,]                          -0.571696669
##  [11,]                          -0.599146720
##  [12,]                          -0.814014361
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##  [14,]                          -0.478934428
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##  [18,]                           0.722241944
##  [19,]                           0.083318342
##  [20,]                           0.397574099
##  [21,]                           0.059654505
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##  [23,]                          -0.458110251
##  [24,]                          -0.673924446
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##  [27,]                          -0.754381492
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##  [36,]                           0.076692468
##  [37,]                           0.194065100
##  [38,]                           0.777142046
##  [39,]                          -0.213899452
##  [40,]                          -0.062450894
##  [41,]                          -0.144801048
##  [42,]                           0.261270397
##  [43,]                          -0.328432424
```

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##  [44,]                       -0.328432424
##  [45,]                       -0.517743121
##  [46,]                       -0.640795074
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##  [48,]                       -0.394691168
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##  [57,]                       -2.071983943
##  [58,]                       -2.063464961
##  [59,]                       -2.044533892
##  [60,]                       -2.013297627
##  [61,]                       -2.019923501
##  [62,]                       -1.961237185
##  [63,]                       -2.053052873
##  [64,]                       -0.510170693
##  [65,]                       -0.545193172
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##  [67,]                       -0.784671203
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##  [70,]                       -0.743022850
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##  [72,]                        0.194065100
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##  [78,]                        2.549090170
##  [79,]                        2.653211053
##  [80,]                        3.135953330
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##  [88,]                       -0.613345023
##  [89,]                       -0.695695176
##  [90,]                       -1.062957928
##  [91,]                       -0.619024344
##  [92,]                       -0.047306039
##  [93,]                        0.790393795
##  [94,]                        1.416065649
##  [95,]                        0.797966223
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## [110,]                       0.740226461
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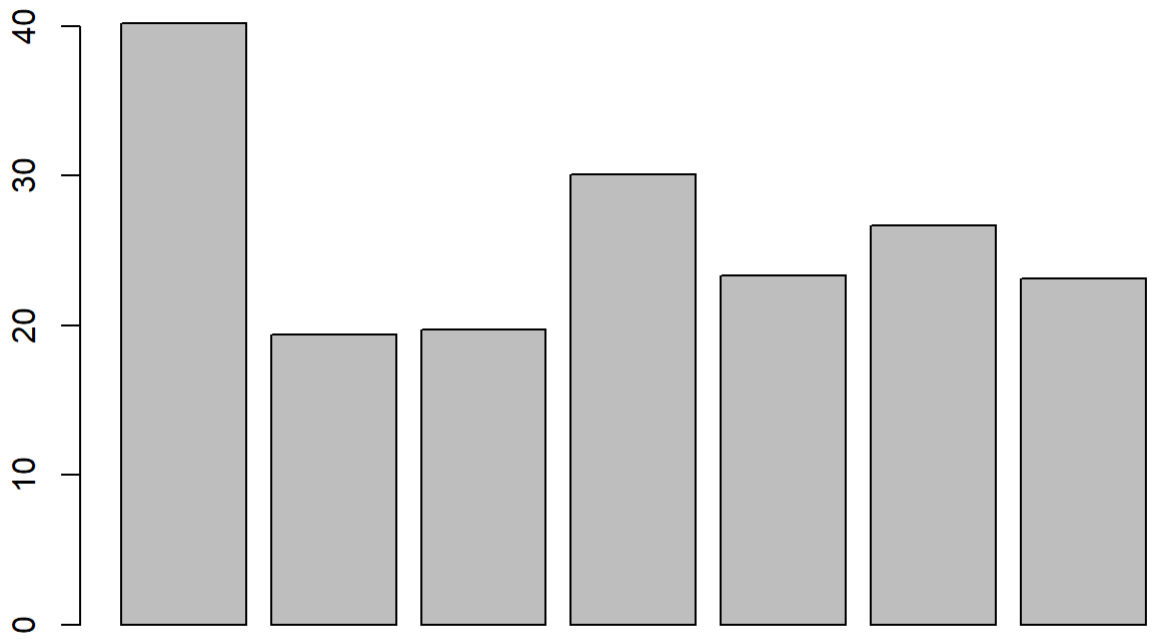
## [118,]                      -0.811174701
## [119,]                      -0.861342036
## [120,]                       0.097516644
## [121,]                       0.211103063
## [122,]                       0.012326831
## [123,]                       0.507374303
## [124,]                       0.309544625
## [125,]                       0.286827341
## [126,]                       0.090890770
## [127,]                       0.712776410
## [128,]                       0.807431758
## [129,]                       0.334155016
## [130,]                       0.523465713
## [131,]                       0.239499667
## [132,]                       0.334155016
## [133,]                       1.645131592
## [134,]                      -0.175090759
## [135,]                      -0.793190185
## [136,]                      -0.635115753
## [137,]                      -1.019416468
## [138,]                      -1.405610289
## [139,]                       0.104142519
## [140,]                      -0.549925939
## [141,]                       2.322863887
## [142,]                       1.612948774
## [143,]                       1.470019197
## [144,]                       1.612002220
## [145,]                       0.760104084
## [146,]                       0.523465713
## [147,]                       1.280708500
```

```
## [148,]                          1.081932269
## [149,]                          0.921964730
## [150,]                          0.977811385
## [151,]                          0.564167512
## [152,]                          0.572686494
## [153,]                          0.144844319
## [154,]                          0.130646016
## [155,]                         -0.462843019
## [156,]                         -0.828212664
## [157,]                         -1.057278607
## [158,]                         -1.021309575
## [159,]                         -1.163292597
## [160,]                         -0.547086279
## [161,]                          0.691952233
## [162,]                         -0.467575786
## [163,]                         -0.491239623
## [164,]                         -0.756274599
## [165,]                         -0.518689674
## [166,]                         -1.079995891
## [167,]                         -0.321806549
## [168,]                         -0.183609741
## [169,]                         -0.564124241
## [170,]                         -0.762900473
## [171,]                         -0.383332526
## [172,]                          0.156202960
## [173,]                         -0.116404443
## [174,]                         -0.901097282
## [175,]                          0.391894778
## attr(,"scaled:center")
##                        Whatsapp..hrs.                       Instagram..hrs.
##                             7.87794286                            8.25291429
##                         Snapchat.hrs.                        Telegram..hrs.
##                             1.40622857                            0.11685714
##             Facebook.Messenger..hrs.                          BeReal..hrs.
##                             0.16240000                            0.11742857
##                          TikTok..hrs.                          WeChat..hrs.
##                             0.08754286                            0.34982857
##                         Twitter..hrs.                        Linkedin..hrs.
##                             0.25251429                            3.25520000
##                       Messages..hrs. Total.Social.Media.Screen.Time..hrs.
##                             0.59097143                           22.46977143
## attr(,"scaled:scale")
##                        Whatsapp..hrs.                       Instagram..hrs.
##                             4.6655151                             5.0888354
##                         Snapchat.hrs.                        Telegram..hrs.
##                             2.1755268                             0.2940812
##             Facebook.Messenger..hrs.                          BeReal..hrs.
##                             0.4204895                             0.7783564
##                          TikTok..hrs.                          WeChat..hrs.
##                             0.4637940                             1.6283348
##                         Twitter..hrs.                        Linkedin..hrs.
##                             1.0264533                             4.7821779
```

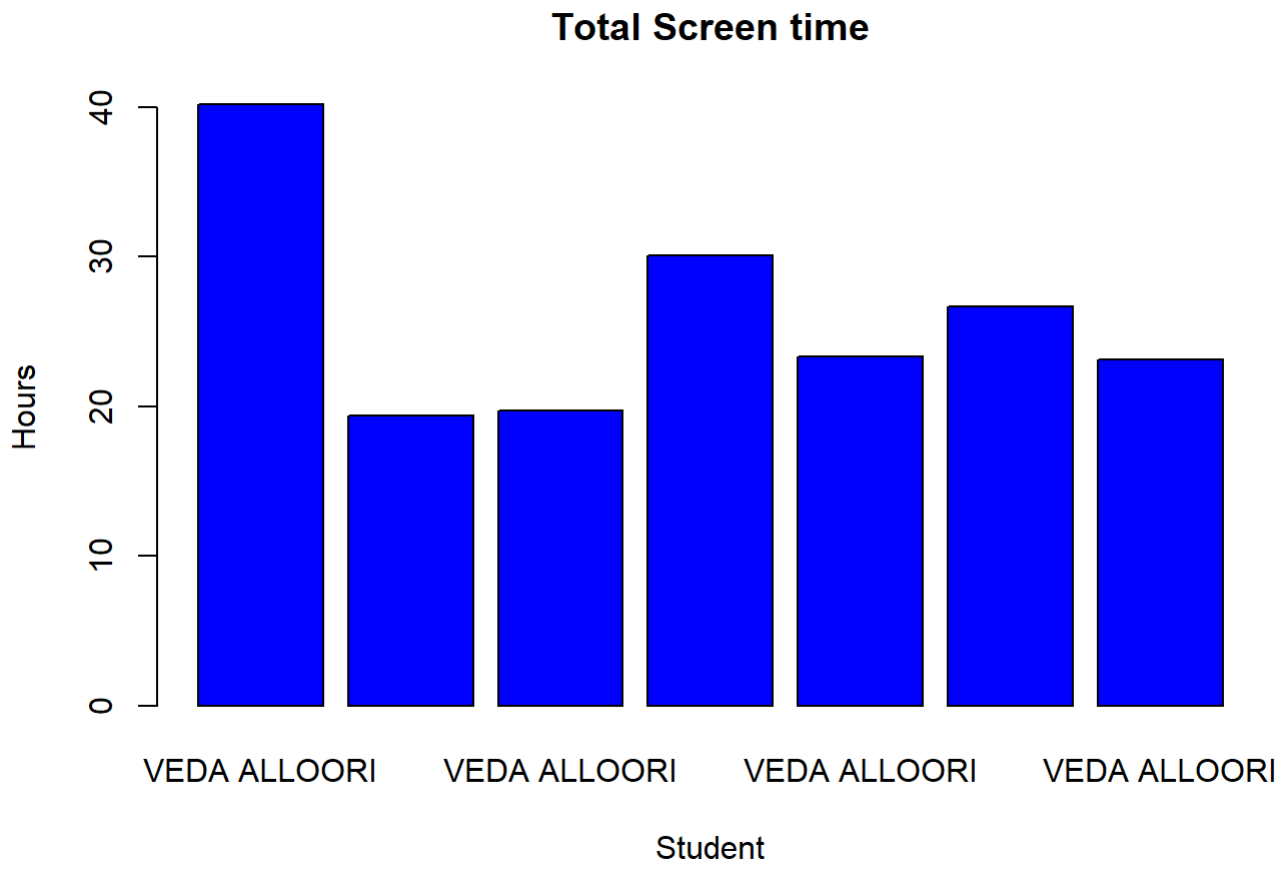
```
##                       Messages..hrs. Total.Social.Media.Screen.Time..hrs.
##                            1.6554000                           10.5646434
```

```
options(max.print = 10000)
## Have found my z score which is from 15-21 rows.Have calculated the mean of the total screen t
ime which is 0.341186. It represents the social media usage is higher than the average social me
dia usage of the class by approximately 0.34 standard deviations.

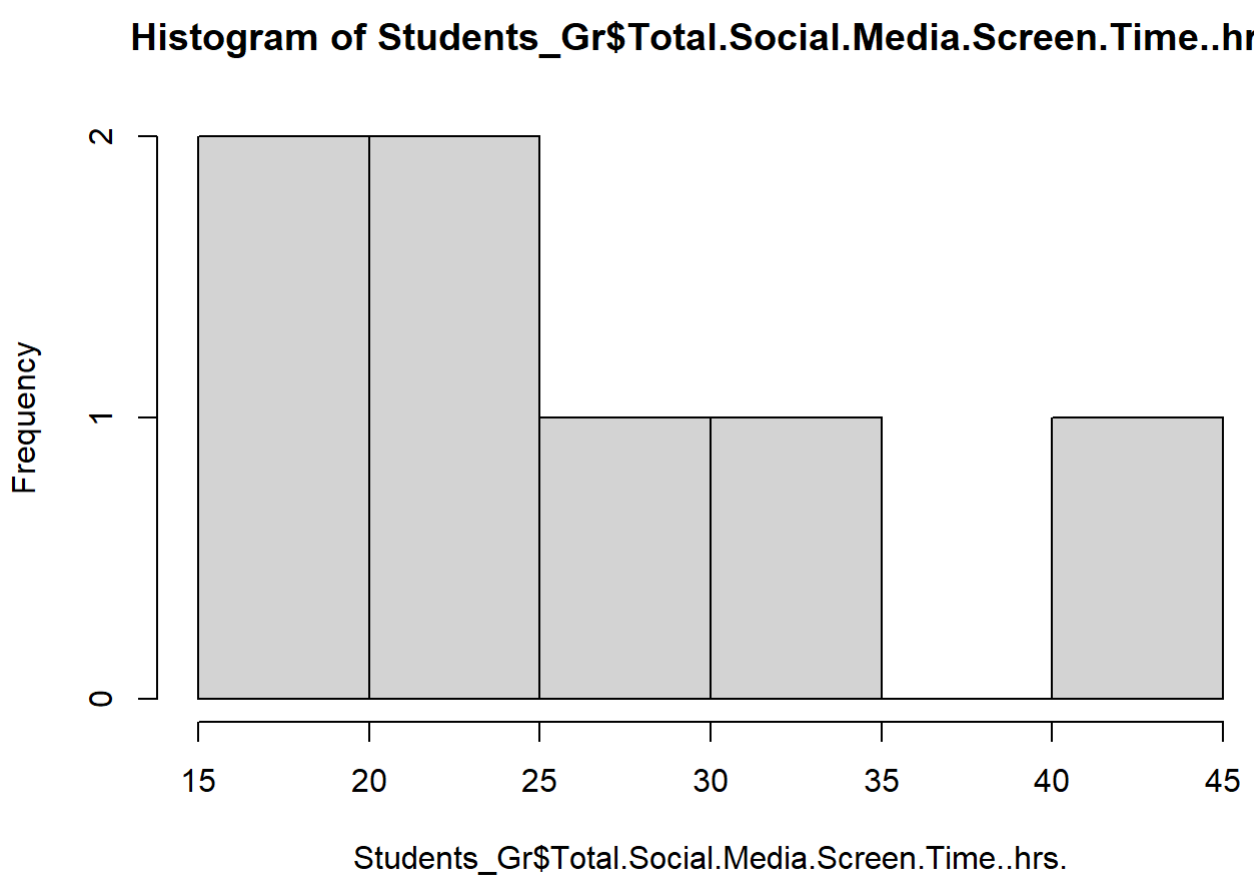
Students_Gr<-Students[Students$Student == "VEDA ALLOORI",]
barplot(Students_Gr$Total.Social.Media.Screen.Time..hrs.)
```



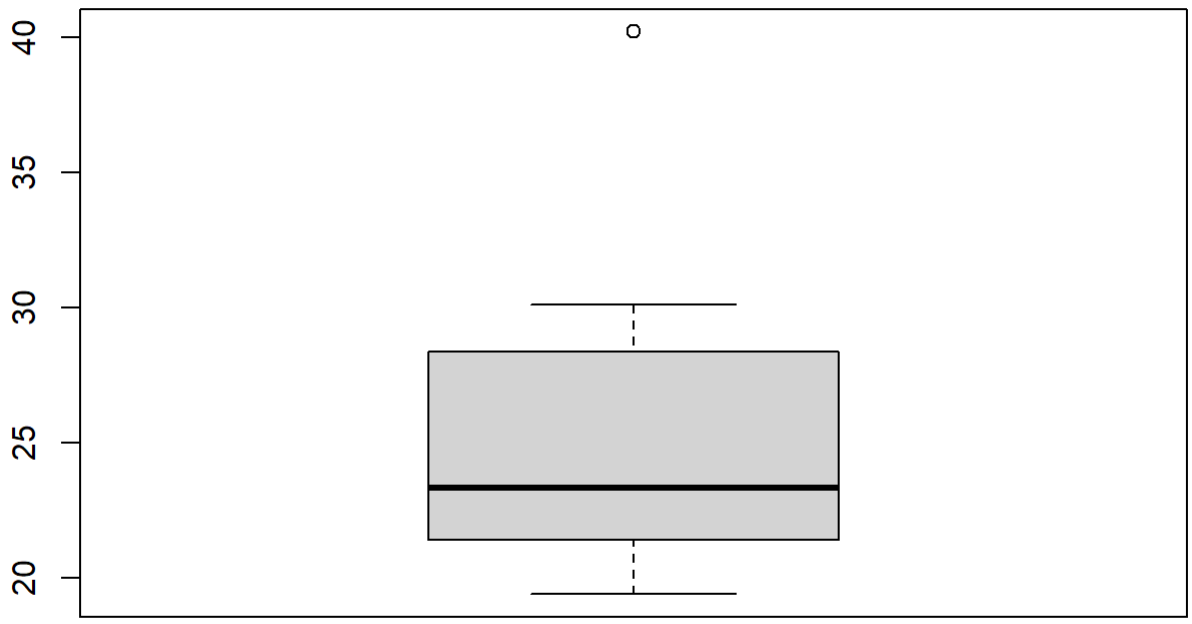

```
barplot(Students_Gr$Total.Social.Media.Screen.Time..hrs., main = "Total Screen time", xlab = "St
udent", ylab = "Hours", col = "Blue", names.arg = Students_Gr$Student)
```




```
hist(Students_Gr$Total.Social.Media.Screen.Time..hrs.)
```




```
boxplot(Students_Gr$Total.Social.Media.Screen.Time..hrs.)
```




```
##Have plotted a barplot filtering to veda alloori on the total screen time for each week


#Finding Correlation between them
cor(Students[c(3:13)])
```

```
##                          Whatsapp..hrs. Instagram..hrs. Snapchat.hrs.
## Whatsapp..hrs.             1.0000000000      0.25487897    0.04811842
## Instagram..hrs.            0.2548789656      1.00000000    0.20144491
## Snapchat.hrs.              0.0481184165      0.20144491    1.00000000
## Telegram..hrs.            -0.0002569017     -0.27773237   -0.12424477
## Facebook.Messenger..hrs.   0.2286272776      0.04139167   -0.19076447
## BeReal..hrs.              -0.1223150175     -0.04597406    0.34295577
## TikTok..hrs.              -0.3082530890     -0.07112222   -0.12121539
## WeChat..hrs.              -0.3587517029     -0.07515441   -0.13966638
## Twitter..hrs.             -0.1000433919      0.21312020   -0.07077947
## Linkedin..hrs.             0.1643679011      0.11423405    0.59290470
## Messages..hrs.            -0.1128451109     -0.07351400    0.06218064
##                          Telegram..hrs. Facebook.Messenger..hrs. BeReal..hrs.
## Whatsapp..hrs.            -0.0002569017              0.228627278  -0.12231502
## Instagram..hrs.           -0.2777323745              0.041391669  -0.04597406
## Snapchat.hrs.             -0.1242447747             -0.190764471   0.34295577
## Telegram..hrs.             1.0000000000              0.001358027  -0.03207028
## Facebook.Messenger..hrs.   0.0013580274              1.000000000  -0.03528130
## BeReal..hrs.              -0.0320702803             -0.035281296   1.00000000
## TikTok..hrs.              -0.0754349212             -0.050273757  -0.02864044
## WeChat..hrs.              -0.0858595098             -0.083450937  -0.03259835
## Twitter..hrs.             -0.0739021429              0.344564911   0.07017669
## Linkedin..hrs.            -0.1199925729             -0.104529421  -0.06465528
## Messages..hrs.            -0.0924818889             -0.083958112  -0.03023836
##                          TikTok..hrs. WeChat..hrs. Twitter..hrs. Linkedin..hrs.
## Whatsapp..hrs.            -0.30825309  -0.35875170   -0.10004339     0.16436790
## Instagram..hrs.           -0.07112222  -0.07515441    0.21312020     0.11423405
## Snapchat.hrs.             -0.12121539  -0.13966638   -0.07077947     0.59290470
## Telegram..hrs.            -0.07543492  -0.08585951   -0.07390214    -0.11999257
## Facebook.Messenger..hrs.  -0.05027376  -0.08345094    0.34456491    -0.10452942
## BeReal..hrs.              -0.02864044  -0.03259835    0.07017669    -0.06465528
## TikTok..hrs.               1.00000000   0.88399209    0.02852397    -0.10383164
## WeChat..hrs.               0.88399209   1.00000000    0.02303780    -0.11875755
## Twitter..hrs.              0.02852397   0.02303780    1.00000000    -0.11846484
## Linkedin..hrs.            -0.10383164  -0.11875755   -0.11846484     1.00000000
## Messages..hrs.             0.08046736   0.07757079   -0.07389937     0.05440543
##                          Messages..hrs.
## Whatsapp..hrs.              -0.11284511
## Instagram..hrs.             -0.07351400
## Snapchat.hrs.                0.06218064
## Telegram..hrs.              -0.09248189
## Facebook.Messenger..hrs.    -0.08395811
## BeReal..hrs.                -0.03023836
## TikTok..hrs.                 0.08046736
## WeChat..hrs.                 0.07757079
## Twitter..hrs.               -0.07389937
## Linkedin..hrs.               0.05440543
## Messages..hrs.               1.00000000
```

```
######PCA
Students_pca <- prcomp(Students[3:13], scale = TRUE)
Students_pca
```

```
## Standard deviations (1, .., p=11):
##  [1] 1.5159965 1.3362933 1.2300271 1.1059818 0.9951442 0.9554044 0.8833315
##  [8] 0.8344923 0.6512791 0.5124242 0.3367610
##
## Rotation (n x k) = (11 x 11):
##                                  PC1        PC2         PC3         PC4
## Whatsapp..hrs.           -0.39168477  0.1715611 -0.10801924 -0.35118117
## Instagram..hrs.          -0.21618594 -0.0891135 -0.53353494 -0.17784950
## Snapchat.hrs.            -0.29598832 -0.5536959 -0.07123748  0.21209415
## Telegram..hrs.            0.02583290  0.2461894  0.43898077  0.14664574
## Facebook.Messenger..hrs. -0.06122393  0.4031643 -0.37244898  0.07061816
## BeReal..hrs.             -0.04428598 -0.2099665 -0.02468688  0.74632116
## TikTok..hrs.              0.54527903 -0.2053547 -0.20279685 -0.13051521
## WeChat..hrs.              0.55993528 -0.2094978 -0.18840754 -0.12206903
## Twitter..hrs.             0.03437454  0.2146198 -0.52973897  0.34560767
## Linkedin..hrs.           -0.29331090 -0.4574943 -0.04328743 -0.20815016
## Messages..hrs.            0.08826666 -0.2176861  0.08628207 -0.14786486
##                                  PC5         PC6         PC7         PC8
## Whatsapp..hrs.            0.18685625 -0.11451661  0.52033027  0.24654030
## Instagram..hrs.           0.06993528  0.35635252 -0.12048825  0.53725157
## Snapchat.hrs.             0.12297710 -0.20306836 -0.03650218  0.06741939
## Telegram..hrs.            0.32346824 -0.41435075 -0.24375453  0.61044566
## Facebook.Messenger..hrs. -0.05184865 -0.54634117  0.30190959 -0.21843115
## BeReal..hrs.              0.02565614  0.08260979  0.47587146  0.13180450
## TikTok..hrs.              0.22500689 -0.15680524  0.16110800  0.10573497
## WeChat..hrs.              0.21011075 -0.10834234  0.11779690  0.08296863
## Twitter..hrs.            -0.13204695 -0.18165053 -0.48384459  0.06083257
## Linkedin..hrs.            0.16270253 -0.44257220 -0.22536426 -0.24457867
## Messages..hrs.           -0.83570873 -0.27653111  0.10798487  0.35597999
##                                  PC9         PC10         PC11
## Whatsapp..hrs.            0.54001865 -0.092442982  0.049321139
## Instagram..hrs.          -0.39366213  0.197048253 -0.014135627
## Snapchat.hrs.            -0.11762274 -0.691881725  0.031300220
## Telegram..hrs.           -0.11019464  0.062337339  0.010350919
## Facebook.Messenger..hrs. -0.49823309 -0.036967035  0.019070944
## BeReal..hrs.              0.06922897  0.374489650 -0.002068864
## TikTok..hrs.              0.07645893 -0.044651364 -0.694368827
## WeChat..hrs.              0.04413898  0.006023841  0.716628118
## Twitter..hrs.             0.51161801 -0.051282720  0.008142159
## Linkedin..hrs.            0.06526334  0.567599220 -0.009444762
## Messages..hrs.            0.02442628  0.040026662  0.007304666
```

```
(eigen_Students <- Students_pca$sdev^2)
```

```
##  [1] 2.2982455 1.7856798 1.5129667 1.2231957 0.9903120 0.9127976 0.7802745
##  [8] 0.6963773 0.4241644 0.2625785 0.1134080
```

```
names(eigen_Students) <- paste("PC",3:13,sep="")
eigen_Students
```

```
##       PC3       PC4       PC5       PC6       PC7       PC8       PC9      PC10
## 2.2982455 1.7856798 1.5129667 1.2231957 0.9903120 0.9127976 0.7802745 0.6963773
##      PC11      PC12      PC13
## 0.4241644 0.2625785 0.1134080
```

```
sumlambdas <- sum(eigen_Students)
sumlambdas
```

```
## [1] 11
```

```
propvar <- eigen_Students/sumlambdas
propvar
```

```
##        PC3        PC4        PC5        PC6        PC7        PC8        PC9
## 0.20893141 0.16233452 0.13754243 0.11119961 0.09002836 0.08298160 0.07093405
##       PC10       PC11       PC12       PC13
## 0.06330703 0.03856040 0.02387077 0.01030982
```

```
cumvar_Students <- cumsum(propvar)
cumvar_Students
```

```
##       PC3       PC4       PC5       PC6       PC7       PC8       PC9      PC10
## 0.2089314 0.3712659 0.5088084 0.6200080 0.7100363 0.7930179 0.8639520 0.9272590
##      PC11      PC12      PC13
## 0.9658194 0.9896902 1.0000000
```

```
matlambdas <- rbind(eigen_Students,propvar,cumvar_Students)
rownames(matlambdas) <- c("Eigenvalues","Prop. variance","Cum. prop. variance")
round(matlambdas,4)
```

```
##                        PC3    PC4    PC5    PC6    PC7    PC8    PC9   PC10
## Eigenvalues         2.2982 1.7857 1.5130 1.2232 0.9903 0.9128 0.7803 0.6964
## Prop. variance      0.2089 0.1623 0.1375 0.1112 0.0900 0.0830 0.0709 0.0633
## Cum. prop. variance 0.2089 0.3713 0.5088 0.6200 0.7100 0.7930 0.8640 0.9273
##                       PC11   PC12   PC13
## Eigenvalues         0.4242 0.2626 0.1134
## Prop. variance      0.0386 0.0239 0.0103
## Cum. prop. variance 0.9658 0.9897 1.0000
```

```
summary(Students_pca)
```

```
## Importance of components:
##                           PC1    PC2    PC3    PC4     PC5     PC6     PC7
## Standard deviation     1.5160 1.3363 1.2300 1.1060 0.99514 0.95540 0.88333
## Proportion of Variance 0.2089 0.1623 0.1375 0.1112 0.09003 0.08298 0.07093
## Cumulative Proportion  0.2089 0.3713 0.5088 0.6200 0.71004 0.79302 0.86395
##                           PC8     PC9    PC10    PC11
## Standard deviation     0.83449 0.65128 0.51242 0.33676
## Proportion of Variance 0.06331 0.03856 0.02387 0.01031
## Cumulative Proportion  0.92726 0.96582 0.98969 1.00000
```

```
Students_pca$rotation
```

```
##                                 PC1        PC2         PC3         PC4
## Whatsapp..hrs.           -0.39168477  0.1715611 -0.10801924 -0.35118117
## Instagram..hrs.          -0.21618594 -0.0891135 -0.53353494 -0.17784950
## Snapchat.hrs.            -0.29598832 -0.5536959 -0.07123748  0.21209415
## Telegram..hrs.            0.02583290  0.2461894  0.43898077  0.14664574
## Facebook.Messenger..hrs. -0.06122393  0.4031643 -0.37244898  0.07061816
## BeReal..hrs.             -0.04428598 -0.2099665 -0.02468688  0.74632116
## TikTok..hrs.              0.54527903 -0.2053547 -0.20279685 -0.13051521
## WeChat..hrs.              0.55993528 -0.2094978 -0.18840754 -0.12206903
## Twitter..hrs.             0.03437454  0.2146198 -0.52973897  0.34560767
## Linkedin..hrs.           -0.29331090 -0.4574943 -0.04328743 -0.20815016
## Messages..hrs.            0.08826666 -0.2176861  0.08628207 -0.14786486
##                                 PC5         PC6         PC7         PC8
## Whatsapp..hrs.            0.18685625 -0.11451661  0.52033027  0.24654030
## Instagram..hrs.           0.06993528  0.35635252 -0.12048825  0.53725157
## Snapchat.hrs.             0.12297710 -0.20306836 -0.03650218  0.06741939
## Telegram..hrs.            0.32346824 -0.41435075 -0.24375453  0.61044566
## Facebook.Messenger..hrs. -0.05184865 -0.54634117  0.30190959 -0.21843115
## BeReal..hrs.              0.02565614  0.08260979  0.47587146  0.13180450
## TikTok..hrs.              0.22500689 -0.15680524  0.16110800  0.10573497
## WeChat..hrs.              0.21011075 -0.10834234  0.11779690  0.08296863
## Twitter..hrs.            -0.13204695 -0.18165053 -0.48384459  0.06083257
## Linkedin..hrs.            0.16270253 -0.44257220 -0.22536426 -0.24457867
## Messages..hrs.           -0.83570873 -0.27653111  0.10798487  0.35597999
##                                 PC9         PC10         PC11
## Whatsapp..hrs.            0.54001865 -0.092442982  0.049321139
## Instagram..hrs.          -0.39366213  0.197048253 -0.014135627
## Snapchat.hrs.            -0.11762274 -0.691881725  0.031300220
## Telegram..hrs.           -0.11019464  0.062337339  0.010350919
## Facebook.Messenger..hrs. -0.49823309 -0.036967035  0.019070944
## BeReal..hrs.              0.06922897  0.374489650 -0.002068864
## TikTok..hrs.              0.07645893 -0.044651364 -0.694368827
## WeChat..hrs.              0.04413898  0.006023841  0.716628118
## Twitter..hrs.             0.51161801 -0.051282720  0.008142159
## Linkedin..hrs.            0.06526334  0.567599220 -0.009444762
## Messages..hrs.            0.02442628  0.040026662  0.007304666
```

```
print(Students_pca)
```

```
## Standard deviations (1, .., p=11):
##  [1] 1.5159965 1.3362933 1.2300271 1.1059818 0.9951442 0.9554044 0.8833315
##  [8] 0.8344923 0.6512791 0.5124242 0.3367610
##
## Rotation (n x k) = (11 x 11):
##                                  PC1        PC2         PC3         PC4
## Whatsapp..hrs.           -0.39168477  0.1715611 -0.10801924 -0.35118117
## Instagram..hrs.          -0.21618594 -0.0891135 -0.53353494 -0.17784950
## Snapchat.hrs.            -0.29598832 -0.5536959 -0.07123748  0.21209415
## Telegram..hrs.            0.02583290  0.2461894  0.43898077  0.14664574
## Facebook.Messenger..hrs. -0.06122393  0.4031643 -0.37244898  0.07061816
## BeReal..hrs.             -0.04428598 -0.2099665 -0.02468688  0.74632116
## TikTok..hrs.              0.54527903 -0.2053547 -0.20279685 -0.13051521
## WeChat..hrs.              0.55993528 -0.2094978 -0.18840754 -0.12206903
## Twitter..hrs.             0.03437454  0.2146198 -0.52973897  0.34560767
## Linkedin..hrs.           -0.29331090 -0.4574943 -0.04328743 -0.20815016
## Messages..hrs.            0.08826666 -0.2176861  0.08628207 -0.14786486
##                                  PC5         PC6         PC7         PC8
## Whatsapp..hrs.            0.18685625 -0.11451661  0.52033027  0.24654030
## Instagram..hrs.           0.06993528  0.35635252 -0.12048825  0.53725157
## Snapchat.hrs.             0.12297710 -0.20306836 -0.03650218  0.06741939
## Telegram..hrs.            0.32346824 -0.41435075 -0.24375453  0.61044566
## Facebook.Messenger..hrs. -0.05184865 -0.54634117  0.30190959 -0.21843115
## BeReal..hrs.              0.02565614  0.08260979  0.47587146  0.13180450
## TikTok..hrs.              0.22500689 -0.15680524  0.16110800  0.10573497
## WeChat..hrs.              0.21011075 -0.10834234  0.11779690  0.08296863
## Twitter..hrs.            -0.13204695 -0.18165053 -0.48384459  0.06083257
## Linkedin..hrs.            0.16270253 -0.44257220 -0.22536426 -0.24457867
## Messages..hrs.           -0.83570873 -0.27653111  0.10798487  0.35597999
##                                  PC9         PC10         PC11
## Whatsapp..hrs.            0.54001865 -0.092442982  0.049321139
## Instagram..hrs.          -0.39366213  0.197048253 -0.014135627
## Snapchat.hrs.            -0.11762274 -0.691881725  0.031300220
## Telegram..hrs.           -0.11019464  0.062337339  0.010350919
## Facebook.Messenger..hrs. -0.49823309 -0.036967035  0.019070944
## BeReal..hrs.              0.06922897  0.374489650 -0.002068864
## TikTok..hrs.              0.07645893 -0.044651364 -0.694368827
## WeChat..hrs.              0.04413898  0.006023841  0.716628118
## Twitter..hrs.             0.51161801 -0.051282720  0.008142159
## Linkedin..hrs.            0.06526334  0.567599220 -0.009444762
## Messages..hrs.            0.02442628  0.040026662  0.007304666
```

```
Students_pca$x
```

```
##                PC1           PC2          PC3         PC4          PC5
##   [1,] -0.416389889 -0.2965640115  0.256251509 -0.22115646  0.197705566
##   [2,] -0.972379460 -0.4534547890 -0.208196487 -0.54970124  0.511050897
##   [3,] -1.603608671 -1.1608229630 -0.942139583 -0.89353994  0.745355281
##   [4,] -1.383890607 -0.9926696594 -0.447019742 -0.74795734  0.630366509
##   [5,] -0.768091364 -0.6572135229 -0.220113513 -0.47442175  0.382717109
##   [6,] -0.754996653 -0.3748129436  0.002786294 -0.55409202  0.557704368
##   [7,] -0.657828390 -0.5382830720 -0.261863691 -0.44525877  0.319106416
##   [8,] -0.241218540 -0.2491805225  0.168869482  0.38661833  0.288527863
##   [9,]  0.181264122 -0.0311034891  0.897756127  0.43909203 -0.050468698
##  [10,]  0.035667587 -0.0653674965  1.060596899  0.91778417  0.149274460
##  [11,]  0.014725383 -0.0102237768  1.729244473  1.09805661  0.649976432
##  [12,]  0.371936274  0.6634589679  1.879305661  0.72004385  0.452513629
##  [13,]  0.062844523  0.6220812586  1.741575471  0.84096111  1.066546131
##  [14,]  0.075466200  0.1514879311  1.273592275  0.73738908  0.412912005
##  [15,] -2.120985868 -2.6571640142 -1.195287512  0.64677671  0.833500499
##  [16,] -0.276765699 -0.7054638643  0.063137968  0.40574054  0.098294777
##  [17,] -0.231228101 -1.9813994657 -0.166149448  6.25401279  0.016524790
##  [18,] -1.342560665 -4.5435864826 -0.149622042  9.37582774  0.630809870
##  [19,] -0.552670521 -2.1184306487  0.312007334  2.05837855 -0.779349285
##  [20,] -0.570577812 -1.5717901672 -0.256434873  0.68637631 -0.426218831
##  [21,] -0.255028051 -1.2123325065 -0.061977235  0.40863833 -0.726748853
##  [22,]  0.128428320  0.4819762509  0.456683538 -0.13079298 -0.033241419
##  [23,]  0.052474117  0.0937210477  0.023901062  0.01436224 -0.034840356
##  [24,]  0.221233179  0.0780742638  0.115194401  0.15083309 -0.112619988
##  [25,]  0.320153552  0.1769050486  0.586721646  0.22735908 -0.127680209
##  [26,]  0.181581063  0.0958082650  0.225850386  0.08703363 -0.080720299
##  [27,]  0.167648803  0.1358346473  0.407647495  0.10986330 -0.063654595
##  [28,] -0.002750549  0.2555529458  0.134842909 -0.12374179  0.005091954
##  [29,] -2.308434627 -3.8617659870  0.167455957 -0.02643501  1.227485170
##  [30,] -2.481920506 -3.7181082802 -0.147682230 -0.36008280  1.303155908
##  [31,] -1.022822818 -1.7174178610 -0.612183174 -0.45223175  0.497514289
##  [32,] -0.217306627 -0.5462724675  0.174095209 -0.38428482  0.161114976
##  [33,] -0.647016284 -0.7424294479 -0.158360354 -0.73419069  0.361232695
##  [34,] -0.723402376 -0.7377301123 -0.091679168 -0.79977142  0.405925950
##  [35,] -0.606515982 -0.4878696028 -0.292997209 -0.84153990 -0.068240313
##  [36,] -0.242835271  0.2159478970 -0.391753355 -0.26830800 -0.381368067
##  [37,] -0.152425215 -0.1198887459 -0.635112690 -0.21206882 -0.536476766
##  [38,] -0.414436644 -0.1767957614 -1.302541342 -0.43057201 -0.477531985
##  [39,] -0.021561562 -0.0008870563 -0.286423315 -0.01138847 -0.323866907
##  [40,] -0.143703910  0.2187825548 -0.474928361 -0.12557275 -0.194777160
##  [41,]  0.005800621  0.1047528800 -0.498637489 -0.07125657 -0.210875534
##  [42,] -0.362268779  0.0820879972 -0.563767216 -0.34580080  0.035505235
##  [43,]  0.002692584  0.4895491948  1.077027421  0.07478310  0.350384792
##  [44,] -0.038303371  0.3131580562  0.228094977 -0.28998546 -0.208072435
##  [45,]  0.128012345  0.6457829134  1.090491789  0.14597068  0.534489507
##  [46,]  0.106015509  0.4626686952  0.334452375 -0.10663156 -0.035459434
##  [47,] -0.029679656  0.3289331811  0.206289887 -0.11541655  0.018562354
##  [48,] -0.037752867  0.4298105942  0.208583172 -0.26482228  0.033041040
##  [49,] -0.263508663  0.5609455571  0.808003211 -0.12332750  0.584181064
##  [50,] -0.728057610  1.0305796946  0.352392800 -0.96021213  0.385124872
##  [51,] -0.065166189  0.6640205762  0.659064484 -0.36604519  0.082503255
```

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##  [52,] -0.987588280  2.1608493413 -0.707612611 -0.82948716  0.284421196
##  [53,] -0.832751965  1.0432480987  0.286516894 -1.05107280  0.433109829
##  [54,] -0.307590359  1.2587406480  0.153139876 -0.41881900  0.094417690
##  [55,] -1.091430038  2.1901569567 -0.771481723 -0.92116812  0.331575970
##  [56,] -0.561785727  0.8686150351  0.330449015 -0.72867135  0.293475462
##  [57,]  1.285809880  0.3505735238  1.222315308  0.66706703 -0.479195377
##  [58,]  1.351592692  0.3358873736  1.198149777  0.66026821 -0.413413803
##  [59,]  1.402965111  0.3134333555  1.178691034  0.64618845 -0.403743157
##  [60,]  1.395135171  0.3106590865  1.152521141  0.62826658 -0.392454924
##  [61,]  1.402256016  0.3064565217  1.151691084  0.63474528 -0.396047689
##  [62,]  1.599320680  0.2336019436  1.088956070  0.58760318 -0.324540390
##  [63,]  1.255058882  0.3491519891  1.209955056  0.66015972 -0.510446229
##  [64,]  0.072727229 -0.2362413777  0.342478270  0.13374389 -0.685773044
##  [65,]  0.173390234 -0.6923652025  0.514151496  0.18981673 -0.756316636
##  [66,] -0.105161853 -0.8057329281 -0.120674265 -0.00612513 -0.519939026
##  [67,]  0.241315525 -0.1939011278  0.595811513  0.20286000 -0.661037349
##  [68,]  0.363304886 -0.2222312490  0.606657288  0.16401402 -0.847466504
##  [69,]  0.326392566 -0.3660094465  0.735077834  0.33480722 -0.792047745
##  [70,]  0.140173840 -0.0873120940  0.633982619  0.10208878 -0.223092245
##  [71,] -0.526214261  0.6146019449 -0.171500254 -0.57344567  0.167884773
##  [72,] -0.450509165  0.3026005015  0.036319252 -0.61800620  0.242267234
##  [73,] -0.478773642  0.6523287681 -0.362413162 -0.47875357  0.176201582
##  [74,]  0.220736240 -0.0149331611  0.504670291  0.06210344 -0.077005616
##  [75,] -0.390039030  0.6159927420 -0.328254831 -0.40088022  0.129728406
##  [76,] -0.444381338  0.6973827912 -0.522287735 -0.49735947  0.142470397
##  [77,] -0.388414206  0.5904263679 -0.105944659 -0.59903999  0.178540779
##  [78,] -2.441856538 -3.6608139533 -0.498944835 -0.49502791  1.202002642
##  [79,] -2.506559138 -3.3985895892 -0.500432070 -0.70365217  1.189355812
##  [80,] -2.973194236 -3.5011086149 -0.718800060 -0.85260277  1.240007602
##  [81,] -2.648001614 -3.0430399264 -0.639222339 -0.82439874  1.285379725
##  [82,] -2.698015408 -3.1176975826 -0.590772464 -0.72697851  1.304131015
##  [83,] -2.533982662 -3.1074805579 -0.528692959 -0.57897213  1.123435301
##  [84,] -1.399616970 -1.6598757810 -0.106621018 -0.32219768  0.685151371
##  [85,] -0.038014900  0.9236459236  0.498988063 -0.19640307 -0.136183704
##  [86,]  0.108776834  1.7316978625 -0.046838723  0.22340495 -0.133689312
##  [87,]  0.217806803  1.1014859927  0.444361101  0.09816100 -0.230376044
##  [88,]  0.048677748  3.7062737766  0.327346774  0.86553174  0.623807368
##  [89,]  0.093615640  1.5910962869  0.037312438  0.04032074 -0.581332674
##  [90,]  0.416467823  0.8905323475  0.857699828  0.22093952 -0.081178096
##  [91,]  0.318535349  0.7373528227  0.661223585 -0.03492339 -0.598209402
##  [92,] -0.512002416  1.8854002718 -0.818251077 -0.29839805 -0.019136526
##  [93,] -1.069768418  1.8252026131 -1.228297083 -0.81199424  0.167586635
##  [94,] -1.323320744  2.1213030339 -2.342025859 -0.91715516 -0.083723366
##  [95,] -0.924969118  0.4808123350 -0.397801238 -0.92405907  0.299883909
##  [96,] -0.280812196  0.9823850926  0.018939153 -0.43385423 -0.062456586
##  [97,] -0.039651072  0.9919248213 -0.120760165 -0.19060193 -0.072099015
##  [98,] -0.228386981  0.7173973012 -0.184367342 -0.39743361  0.066907232
##  [99,]  0.587307419  2.5760961303  4.632195209  1.19788418  2.446089316
## [100,]  0.627986437  0.9723972507  1.946923816  0.46064272  0.300552610
## [101,]  0.591569214  0.7694517747  1.530191138  0.33539773  0.070778260
## [102,]  0.467904863  0.7665880257  1.411358858  0.29291428  0.138495258
## [103,]  0.053016965  0.7211770711  1.234075763 -0.14184260  0.201464920
```

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## [104,]  0.465257385  1.4581907905  2.591812124  0.56326475  1.015261999
## [105,]  0.351563537  0.9382822024  1.611163359  0.17032278  0.319729739
## [106,] -0.802964190  3.1712124867 -5.185198537  1.45937157 -0.607737821
## [107,] -0.286084958  3.3571247181 -6.589191025  2.92117618 -1.168741357
## [108,]  0.054101688  1.3371645928 -2.467887729  1.48833774 -0.571715025
## [109,]  0.329698286  0.6969350721 -0.907497392  1.69821143 -0.408974769
## [110,] -0.074581531  1.3916323963 -3.661093266  1.72417436 -0.664408468
## [111,]  0.149279673  2.2483331102 -3.312357543  1.80023644 -0.802410077
## [112,]  0.323589741  1.5000852150 -3.139324707  2.03705871 -0.824810449
## [113,] -0.153159965  0.3665977338  0.065615921 -0.31244579  0.002510135
## [114,] -0.102489844  0.5930564314  0.440773094 -0.05163079  0.364490542
## [115,]  0.212592390  0.1973580957  0.332859777  0.07231547 -0.157974988
## [116,]  0.310056526  0.2380803296  0.072286781  0.22751899 -0.265972036
## [117,]  0.422311469  0.3152052680  0.240028820  0.23630388 -0.302492870
## [118,]  0.403675129  0.2521061557  0.208884723  0.25475926 -0.267895739
## [119,]  0.381331583  0.3383039935  0.392779229  0.14755391 -0.280321048
## [120,] -0.331158400  0.4853349434 -0.186605727 -0.43905134 -0.386897013
## [121,] -0.515042335  0.3856139254  0.444522888 -0.41058949  0.548550480
## [122,] -0.180093329  1.3278002391  0.015128499  0.16755881  0.501551751
## [123,] -0.496463285 -0.4392062951 -0.293237435 -0.52770516  0.096227473
## [124,] -0.599571704 -0.8174482377  0.451758482 -0.42304062  0.077765876
## [125,] -0.484533082 -0.1747922104 -0.112656105 -0.45805592  0.243058239
## [126,] -0.281800116 -0.1913215055  0.796890389 -0.17884116  0.589389464
## [127,] -0.107749282 -1.4936891915  0.375949224 -0.70531538 -2.802162442
## [128,]  0.248064230 -1.6784083062  0.693282551 -0.97235038 -4.897274671
## [129,]  0.250018774 -1.4410273363  0.999364409 -0.69743529 -3.908547623
## [130,]  0.427611892 -1.3345902236  1.017407430 -1.04026612 -4.954980319
## [131,]  0.183837022 -1.3041052059  0.626893989 -0.47309333 -2.937744086
## [132,]  0.228935392 -1.1681936261  0.866091724 -0.78407868 -3.412471608
## [133,] -0.389523057 -2.3661632513  0.473205547 -1.25082412 -4.735293038
## [134,] -0.078574328 -0.0709362428  0.176778995 -0.07491419  0.131980754
## [135,]  0.302105595 -0.1810163025  0.645526339  0.28628950 -0.246213042
## [136,]  0.203704849 -0.0106022607  0.413636868  0.20299242 -0.111089308
## [137,]  0.397520783  0.0467685239  0.819787820  0.41802672 -0.090375531
## [138,]  0.631940565  0.2664270433  1.200629144  0.54205958 -0.198099641
## [139,]  0.009768048  0.9312790055  0.727699858  0.20699270  0.976294211
## [140,]  0.266607898  0.2739656934  0.049941752  0.10426815 -0.020188598
## [141,] -1.778822656  0.7689214602 -1.766614990 -1.84855072  0.754591072
## [142,] -1.476149198  0.3819075640 -1.117209035 -1.26680551  0.636773499
## [143,] -1.371488034  0.3552061782 -1.042155451 -1.17316612  0.594899929
## [144,] -1.450632171  0.5288642551 -1.112934130 -1.35229359  0.633583381
## [145,] -0.859820925  0.2395553275 -0.463261273 -0.79710629  0.140461197
## [146,] -0.630318428  0.2959773356 -0.560757836 -0.62779878  0.265079221
## [147,] -1.307258618  0.4173711938 -0.791621266 -1.12342956  0.580567973
## [148,] -0.947264811  0.2328413984 -1.001510619 -0.72169944  0.451402500
## [149,] -0.808531691 -0.0941058513 -0.660760616 -0.58479609  0.473349685
## [150,] -0.699851842 -0.1167856636 -1.191381066 -0.63860162  0.263097034
## [151,] -0.569945513 -0.0793294987 -0.601938972 -0.54331699  0.223343622
## [152,] -0.577454229 -0.0118876855 -0.672809981 -0.53763003  0.222183105
## [153,] -0.227621308  0.1532413001 -0.495110615 -0.36102135  0.052258684
## [154,] -0.256324179  0.2110265001 -0.409219449 -0.39454671  0.072612825
## [155,] -0.022135058  1.3248376189  2.005958426  0.13356616  1.011797779
```

```
## [156,]  0.190376617  0.7801280418  1.249248271  0.01282246  0.248683865
## [157,]  0.242796303  0.7750835757  1.116794903 -0.08798101  0.001810857
## [158,]  0.194871226  0.8052701807  1.027363356 -0.15984717 -0.044149091
## [159,]  0.546722439  1.5938245716  2.907858563  0.67904654  1.188666740
## [160,]  0.176786440  1.4164612365  1.951280278  0.42739095  1.029372303
## [161,] -0.611010506  0.7053829438  0.064533538 -0.65067111  0.693458073
## [162,]  0.020895467 -0.1875818019 -0.013891751  0.19881997 -0.041131663
## [163,] -0.029164684 -0.2423650244  0.098432053  0.23200238 -0.036424855
## [164,]  0.325743174 -0.0702430753  0.047447196  0.29698307 -0.186470445
## [165,]  0.106871110  0.0632390093  0.029924829  0.07347810 -0.087357981
## [166,]  0.505936380  0.2928403784  0.425926260  0.24378308 -0.227214397
## [167,]  0.463130719  1.6773776984 -1.725940210  0.13617344 -0.078372306
## [168,] -0.069577533 -0.0201345454 -0.342469706 -0.02323665 -0.004430329
## [169,]  4.002758103 -1.0410900990 -0.567448082 -0.35170843  0.422879932
## [170,]  8.093698041 -2.3555397738 -1.508398676 -0.98638906  1.565642339
## [171,]  6.220852426 -1.7978602920 -1.334603243 -0.83297045  1.054186487
## [172,]  7.029901559 -2.1805400411 -2.168403890 -0.97567240  1.257726189
## [173,]  6.288409090 -1.8691664633 -1.454711957 -0.78048524  0.981630895
## [174,]  4.357348282 -1.0786575320 -0.434378836 -0.19377952 -0.096683475
## [175,]  7.279584804 -2.4719150226 -2.390085553 -1.14061786  1.745949890
##                PC6          PC7         PC8          PC9         PC10
##   [1,]  0.24747579 -0.002491862 -0.41097552  0.259032678 -0.129055509
##   [2,]  0.26915385  0.136961144  0.20957343  0.254449443 -0.079494628
##   [3,]  0.28138438 -0.113222262  0.53084940 -0.102054558  0.338048377
##   [4,] -0.03396056 -0.016448949  0.29480453  0.189306650  0.184576114
##   [5,]  0.27351286 -0.326995740 -0.01651304 -0.128884109  0.427164975
##   [6,]  0.08256475 -0.308943155  0.12942300  0.039269563  0.685288614
##   [7,]  0.47031325 -0.265420761 -0.12683669 -0.130169204  0.367749901
##   [8,]  0.54128754 -0.352954686  0.60082825 -0.576689919  0.074468674
##   [9,]  0.02240509 -0.501606401  0.32154405 -0.354445273  0.093659687
##  [10,] -0.06331690  0.127067998  0.20020743  0.113577887 -0.213748070
##  [11,] -0.81281754 -0.458174016  0.81135459 -0.138022208 -0.583302785
##  [12,] -0.67348937 -0.671133864  1.11953802 -0.231023487 -0.164412569
##  [13,] -0.64880424 -0.811094985  1.62517489 -0.477437734 -0.510487151
##  [14,] -0.31150185 -0.467295468  0.82937724 -0.293187729 -0.200365065
##  [15,] -0.04468280 -0.299459341  0.88172382 -0.477694330 -3.399259313
##  [16,]  0.44615440 -0.438091696 -0.36970628 -0.280804951 -1.002131760
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## [104,]  0.0097227483
## [105,] -0.0056198205
## [106,]  0.0903276401
## [107,]  0.0566941537
## [108,] -0.0029394027
## [109,] -0.0492205059
## [110,] -0.0402661622
## [111,]  0.0003350810
## [112,] -0.0414353090
## [113,] -0.0347499229
## [114,] -0.0335001643
## [115,] -0.0691065901
```

```
## [116,] -0.0839675594
## [117,] -0.0853635634
## [118,] -0.0900666401
## [119,] -0.0731721766
## [120,] -0.0015665960
## [121,]  0.0111530400
## [122,]  0.0007688892
## [123,] -0.0719346341
## [124,] -0.0231656894
## [125,] -0.0423423210
## [126,] -0.0610244377
## [127,] -0.0329767240
## [128,]  0.0039479633
## [129,]  0.0042588040
## [130,]  0.0084652840
## [131,] -0.0340426196
## [132,] -0.0192940102
## [133,]  0.0370833642
## [134,] -0.0714370791
## [135,] -0.0740095736
## [136,] -0.0691327730
## [137,] -0.0660981623
## [138,] -0.0598144376
## [139,] -0.0654736609
## [140,] -0.0981170632
## [141,]  0.0574161440
## [142,]  0.0639496382
## [143,]  0.0547229740
## [144,]  0.0619975135
## [145,]  0.0324292803
## [146,] -0.0128516759
## [147,]  0.0669531174
## [148,] -0.0052354267
## [149,] -0.0333836083
## [150,] -0.0750018279
## [151,] -0.0513143164
## [152,] -0.0469746995
## [153,] -0.0724880874
## [154,] -0.0604165040
## [155,]  0.0448229207
## [156,] -0.0073925794
## [157,] -0.0009251753
## [158,]  0.0073833739
## [159,]  0.0092130526
## [160,]  0.0160076861
## [161,] -0.0109158078
## [162,] -0.0632908346
## [163,] -0.0460524188
## [164,] -0.1001505656
## [165,] -0.0692812655
## [166,] -0.0902698956
## [167,] -0.6920773876
```

```
## [168,] -0.0742945703
## [169,]  2.0958195384
## [170,] -2.9423396624
## [171,] -0.3030793771
## [172,]  0.3119325072
## [173,]  2.2507222045
## [174,]  0.0975684772
## [175,]  0.2228110233
```

```
# Identifying the hours by their social media addiction
Studentsp_pca <- cbind(data.frame(Students$Social.Media.Addiction),Students_pca$x)
Studentsp_pca
```

```
##     Students.Social.Media.Addiction          PC1           PC2          PC3
## 1                          Addicted -0.416389889 -0.2965640115  0.256251509
## 2                          Addicted -0.972379460 -0.4534547890 -0.208196487
## 3                          Addicted -1.603608671 -1.1608229630 -0.942139583
## 4                          Addicted -1.383890607 -0.9926696594 -0.447019742
## 5                          Addicted -0.768091364 -0.6572135229 -0.220113513
## 6                          Addicted -0.754996653 -0.3748129436  0.002786294
## 7                          Addicted -0.657828390 -0.5382830720 -0.261863691
## 8                          Addicted -0.241218540 -0.2491805225  0.168869482
## 9                          Addicted  0.181264122 -0.0311034891  0.897756127
## 10                         Addicted  0.035667587 -0.0653674965  1.060596899
## 11                     Not Addicted  0.014725383 -0.0102237768  1.729244473
## 12                     Not Addicted  0.371936274  0.6634589679  1.879305661
## 13                         Addicted  0.062844523  0.6220812586  1.741575471
## 14                         Addicted  0.075466200  0.1514879311  1.273592275
## 15                     Not Addicted -2.120985868 -2.6571640142 -1.195287512
## 16                     Not Addicted -0.276765699 -0.7054638643  0.063137968
## 17                     Not Addicted -0.231228101 -1.9813994657 -0.166149448
## 18                     Not Addicted -1.342560665 -4.5435864826 -0.149622042
## 19                     Not Addicted -0.552670521 -2.1184306487  0.312007334
## 20                         Addicted -0.570577812 -1.5717901672 -0.256434873
## 21                     Not Addicted -0.255028051 -1.2123325065 -0.061977235
## 22                         Addicted  0.128428320  0.4819762509  0.456683538
## 23                         Addicted  0.052474117  0.0937210477  0.023901062
## 24                         Addicted  0.221233179  0.0780742638  0.115194401
## 25                         Addicted  0.320153552  0.1769050486  0.586721646
## 26                     Not Addicted  0.181581063  0.0958082650  0.225850386
## 27                     Not Addicted  0.167648803  0.1358346473  0.407647495
## 28                         Addicted -0.002750549  0.2555529458  0.134842909
## 29                     Not Addicted -2.308434627 -3.8617659870  0.167455957
## 30                         Addicted -2.481920506 -3.7181082802 -0.147682230
## 31                     Not Addicted -1.022822818 -1.7174178610 -0.612183174
## 32                         Addicted -0.217306627 -0.5462724675  0.174095209
## 33                         Addicted -0.647016284 -0.7424294479 -0.158360354
## 34                         Addicted -0.723402376 -0.7377301123 -0.091679168
## 35                         Addicted -0.606515982 -0.4878696028 -0.292997209
## 36                     Not Addicted -0.242835271  0.2159478970 -0.391753355
## 37                         Addicted -0.152425215 -0.1198887459 -0.635112690
## 38                         Addicted -0.414436644 -0.1767957614 -1.302541342
## 39                         Addicted -0.021561562 -0.0008870563 -0.286423315
## 40                         Addicted -0.143703910  0.2187825548 -0.474928361
## 41                         Addicted  0.005800621  0.1047528800 -0.498637489
## 42                         Addicted -0.362268779  0.0820879972 -0.563767216
## 43                         Addicted  0.002692584  0.4895491948  1.077027421
## 44                     Not Addicted -0.038303371  0.3131580562  0.228094977
## 45                     Not Addicted  0.128012345  0.6457829134  1.090491789
## 46                     Not Addicted  0.106015509  0.4626686952  0.334452375
## 47                     Not Addicted -0.029679656  0.3289331811  0.206289887
## 48                     Not Addicted -0.037752867  0.4298105942  0.208583172
## 49                         Addicted -0.263508663  0.5609455571  0.808003211
## 50                     Not Addicted -0.728057610  1.0305796946  0.352392800
## 51                     Not Addicted -0.065166189  0.6640205762  0.659064484
```

```
## 52                  Not Addicted -0.987588280  2.1608493413 -0.707612611
## 53                  Not Addicted -0.832751965  1.0432480987  0.286516894
## 54                  Not Addicted -0.307590359  1.2587406480  0.153139876
## 55                  Not Addicted -1.091430038  2.1901569567 -0.771481723
## 56                  Not Addicted -0.561785727  0.8686150351  0.330449015
## 57                  Not Addicted  1.285809880  0.3505735238  1.222315308
## 58                  Not Addicted  1.351592692  0.3358873736  1.198149777
## 59                  Not Addicted  1.402965111  0.3134333555  1.178691034
## 60                  Not Addicted  1.395135171  0.3106590865  1.152521141
## 61                  Not Addicted  1.402256016  0.3064565217  1.151691084
## 62                  Not Addicted  1.599320680  0.2336019436  1.088956070
## 63                  Not Addicted  1.255058882  0.3491519891  1.209955056
## 64                      Addicted  0.072727229 -0.2362413777  0.342478270
## 65                      Addicted  0.173390234 -0.6923652025  0.514151496
## 66                      Addicted -0.105161853 -0.8057329281 -0.120674265
## 67                      Addicted  0.241315525 -0.1939011278  0.595811513
## 68                      Addicted  0.363304886 -0.2222312490  0.606657288
## 69                      Addicted  0.326392566 -0.3660094465  0.735077834
## 70                      Addicted  0.140173840 -0.0873120940  0.633982619
## 71                  Not Addicted -0.526214261  0.6146019449 -0.171500254
## 72                  Not Addicted -0.450509165  0.3026005015  0.036319252
## 73                      Addicted -0.478773642  0.6523287681 -0.362413162
## 74                      Addicted  0.220736240 -0.0149331611  0.504670291
## 75                      Addicted -0.390039030  0.6159927420 -0.328254831
## 76                      Addicted -0.444381338  0.6973827912 -0.522287735
## 77                      Addicted -0.388414206  0.5904263679 -0.105944659
## 78                  Not Addicted -2.441856538 -3.6608139533 -0.498944835
## 79                      Addicted -2.506559138 -3.3985895892 -0.500432070
## 80                      Addicted -2.973194236 -3.5011086149 -0.718800060
## 81                      Addicted -2.648001614 -3.0430399264 -0.639222339
## 82                      Addicted -2.698015408 -3.1176975826 -0.590772464
## 83                      Addicted -2.533982662 -3.1074805579 -0.528692959
## 84                  Not Addicted -1.399616970 -1.6598757810 -0.106621018
## 85                  Not Addicted -0.038014900  0.9236459236  0.498988063
## 86                  Not Addicted  0.108776834  1.7316978625 -0.046838723
## 87                  Not Addicted  0.217806803  1.1014859927  0.444361101
## 88                  Not Addicted  0.048677748  3.7062737766  0.327346774
## 89                  Not Addicted  0.093615640  1.5910962869  0.037312438
## 90                  Not Addicted  0.416467823  0.8905323475  0.857699828
## 91                      Addicted  0.318535349  0.7373528227  0.661223585
## 92                      Addicted -0.512002416  1.8854002718 -0.818251077
## 93                      Addicted -1.069768418  1.8252026131 -1.228297083
## 94                      Addicted -1.323320744  2.1213030339 -2.342025859
## 95                      Addicted -0.924969118  0.4808123350 -0.397801238
## 96                  Not Addicted -0.280812196  0.9823850926  0.018939153
## 97                  Not Addicted -0.039651072  0.9919248213 -0.120760165
## 98                  Not Addicted -0.228386981  0.7173973012 -0.184367342
## 99                  Not Addicted  0.587307419  2.5760961303  4.632195209
## 100                 Not Addicted  0.627986437  0.9723972507  1.946923816
## 101                 Not Addicted  0.591569214  0.7694517747  1.530191138
## 102                     Addicted  0.467904863  0.7665880257  1.411358858
## 103                 Not Addicted  0.053016965  0.7211770711  1.234075763
```

```
## 104                   Not Addicted  0.465257385  1.4581907905  2.591812124
## 105                   Not Addicted  0.351563537  0.9382822024  1.611163359
## 106                       Addicted -0.802964190  3.1712124867 -5.185198537
## 107                       Addicted -0.286084958  3.3571247181 -6.589191025
## 108                   Not Addicted  0.054101688  1.3371645928 -2.467887729
## 109                   Not Addicted  0.329698286  0.6969350721 -0.907497392
## 110                   Not Addicted -0.074581531  1.3916323963 -3.661093266
## 111                   Not Addicted  0.149279673  2.2483331102 -3.312357543
## 112                   Not Addicted  0.323589741  1.5000852150 -3.139324707
## 113                       Addicted -0.153159965  0.3665977338  0.065615921
## 114                       Addicted -0.102489844  0.5930564314  0.440773094
## 115                       Addicted  0.212592390  0.1973580957  0.332859777
## 116                       Addicted  0.310056526  0.2380803296  0.072286781
## 117                       Addicted  0.422311469  0.3152052680  0.240028820
## 118                       Addicted  0.403675129  0.2521061557  0.208884723
## 119                       Addicted  0.381331583  0.3383039935  0.392779229
## 120                       Addicted -0.331158400  0.4853349434 -0.186605727
## 121                       Addicted -0.515042335  0.3856139254  0.444522888
## 122                   Not Addicted -0.180093329  1.3278002391  0.015128499
## 123                       Addicted -0.496463285 -0.4392062951 -0.293237435
## 124                       Addicted -0.599571704 -0.8174482377  0.451758482
## 125                       Addicted -0.484533082 -0.1747922104 -0.112656105
## 126                       Addicted -0.281800116 -0.1913215055  0.796890389
## 127                   Not Addicted -0.107749282 -1.4936891915  0.375949224
## 128                   Not Addicted  0.248064230 -1.6784083062  0.693282551
## 129                   Not Addicted  0.250018774 -1.4410273363  0.999364409
## 130                   Not Addicted  0.427611892 -1.3345902236  1.017407430
## 131                   Not Addicted  0.183837022 -1.3041052059  0.626893989
## 132                   Not Addicted  0.228935392 -1.1681936261  0.866091724
## 133                   Not Addicted -0.389523057 -2.3661632513  0.473205547
## 134                       Addicted -0.078574328 -0.0709362428  0.176778995
## 135                   Not Addicted  0.302105595 -0.1810163025  0.645526339
## 136                       Addicted  0.203704849 -0.0106022607  0.413636868
## 137                       Addicted  0.397520783  0.0467685239  0.819787820
## 138                   Not Addicted  0.631940565  0.2664270433  1.200629144
## 139                       Addicted  0.009768048  0.9312790055  0.727699858
## 140                       Addicted  0.266607898  0.2739656934  0.049941752
## 141                       Addicted -1.778822656  0.7689214602 -1.766614990
## 142                       Addicted -1.476149198  0.3819075640 -1.117209035
## 143                       Addicted -1.371488034  0.3552061782 -1.042155451
## 144                       Addicted -1.450632171  0.5288642551 -1.112934130
## 145                       Addicted -0.859820925  0.2395553275 -0.463261273
## 146                       Addicted -0.630318428  0.2959773356 -0.560757836
## 147                       Addicted -1.307258618  0.4173711938 -0.791621266
## 148                       Addicted -0.947264811  0.2328413984 -1.001510619
## 149                       Addicted -0.808531691 -0.0941058513 -0.660760616
## 150                       Addicted -0.699851842 -0.1167856636 -1.191381066
## 151                       Addicted -0.569945513 -0.0793294987 -0.601938972
## 152                       Addicted -0.577454229 -0.0118876855 -0.672809981
## 153                       Addicted -0.227621308  0.1532413001 -0.495110615
## 154                       Addicted -0.256324179  0.2110265001 -0.409219449
## 155                       Addicted -0.022135058  1.3248376189  2.005958426
```

```
## 156                      Addicted  0.190376617  0.7801280418  1.249248271
## 157                      Addicted  0.242796303  0.7750835757  1.116794903
## 158                      Addicted  0.194871226  0.8052701807  1.027363356
## 159                      Addicted  0.546722439  1.5938245716  2.907858563
## 160                      Addicted  0.176786440  1.4164612365  1.951280278
## 161                      Addicted -0.611010506  0.7053829438  0.064533538
## 162                      Addicted  0.020895467 -0.1875818019 -0.013891751
## 163                      Addicted -0.029164684 -0.2423650244  0.098432053
## 164                  Not Addicted  0.325743174 -0.0702430753  0.047447196
## 165                      Addicted  0.106871110  0.0632390093  0.029924829
## 166                  Not Addicted  0.505936380  0.2928403784  0.425926260
## 167                  Not Addicted  0.463130719  1.6773776984 -1.725940210
## 168                      Addicted -0.069577533 -0.0201345454 -0.342469706
## 169                  Not Addicted  4.002758103 -1.0410900990 -0.567448082
## 170                  Not Addicted  8.093698041 -2.3555397738 -1.508398676
## 171                  Not Addicted  6.220852426 -1.7978602920 -1.334603243
## 172                  Not Addicted  7.029901559 -2.1805400411 -2.168403890
## 173                  Not Addicted  6.288409090 -1.8691664633 -1.454711957
## 174                  Not Addicted  4.357348282 -1.0786575320 -0.434378836
## 175                      Addicted  7.279584804 -2.4719150226 -2.390085553
##             PC4          PC5         PC6          PC7         PC8          PC9
## 1   -0.22115646  0.197705566  0.24747579 -0.002491862 -0.41097552  0.259032678
## 2   -0.54970124  0.511050897  0.26915385  0.136961144  0.20957343  0.254449443
## 3   -0.89353994  0.745355281  0.28138438 -0.113222262  0.53084940 -0.102054558
## 4   -0.74795734  0.630366509 -0.03396056 -0.016448949  0.29480453  0.189306650
## 5   -0.47442175  0.382717109  0.27351286 -0.326995740 -0.01651304 -0.128884109
## 6   -0.55409202  0.557704368  0.08256475 -0.308943155  0.12942300  0.039269563
## 7   -0.44525877  0.319106416  0.47031325 -0.265420761 -0.12683669 -0.130169204
## 8    0.38661833  0.288527863  0.54128754 -0.352954686  0.60082825 -0.576689919
## 9    0.43909203 -0.050468698  0.02240509 -0.501606401  0.32154405 -0.354445273
## 10   0.91778417  0.149274460 -0.06331690  0.127067998  0.20020743  0.113577887
## 11   1.09805661  0.649976432 -0.81281754 -0.458174016  0.81135459 -0.138022208
## 12   0.72004385  0.452513629 -0.67348937 -0.671133864  1.11953802 -0.231023487
## 13   0.84096111  1.066546131 -0.64880424 -0.811094985  1.62517489 -0.477437734
## 14   0.73738908  0.412912005 -0.31150185 -0.467295468  0.82937724 -0.293187729
## 15   0.64677671  0.833500499 -0.04468280 -0.299459341  0.88172382 -0.477694330
## 16   0.40574054  0.098294777  0.44615440 -0.438091696 -0.36970628 -0.280804951
## 17   6.25401279  0.016524790  0.62710805  2.293320658  0.11614677  0.764386933
## 18   9.37582774  0.630809870  0.89849133  4.694586102  1.11641393 -0.073042752
## 19   2.05837855 -0.779349285 -0.02609655  0.793367121  0.31227940 -0.256775670
## 20   0.68637631 -0.426218831  0.42440670 -0.218204345  0.39017227 -0.803849162
## 21   0.40863833 -0.726748853  0.45169313 -0.358736667  0.28574992 -0.775004404
## 22  -0.13079298 -0.033241419  0.71833898  0.189780997 -0.49249803  0.343198418
## 23   0.01436224 -0.034840356  1.03090306 -0.217955602 -0.12350852 -0.362968633
## 24   0.15083309 -0.112619988  1.05662058 -0.366489113 -0.24846649 -0.501408427
## 25   0.22735908 -0.127680209  0.67601179 -0.148230461 -0.70673491 -0.009148412
## 26   0.08703363 -0.080720299  0.89404310 -0.280499012 -0.38116654 -0.293768103
## 27   0.10986330 -0.063654595  0.72928589 -0.115548728 -0.52304582 -0.036847964
## 28  -0.12374179  0.005091954  0.90249528  0.003984529 -0.20024099 -0.027942729
## 29  -0.02643501  1.227485170 -2.23157619 -1.093725004 -1.31007165  0.077267999
## 30  -0.36008280  1.303155908 -2.06214687 -1.033563218 -1.00384540  0.075917554
## 31  -0.45223175  0.497514289  0.03994428 -1.191181195 -0.34445942 -0.848881033
```

```
## 32  -0.38428482  0.161114976  0.15278134 -0.744256840 -0.89325905 -0.168182074
## 33  -0.73419069  0.361232695  0.05419121 -0.682344945 -0.64109720 -0.085755424
## 34  -0.79977142  0.405925950 -0.07965091 -0.573071732 -0.70884310  0.106437220
## 35  -0.84153990 -0.068240313  0.30552491 -0.318219003 -0.03642242 -0.047354657
## 36  -0.26830800 -0.381368067  0.72268630  0.245905852  0.35609874 -0.459571173
## 37  -0.21206882 -0.536476766  1.14325882 -0.239684829  0.70812029 -0.985547801
## 38  -0.43057201 -0.477531985  1.51069416 -0.338598344  1.33868115 -1.486131037
## 39  -0.01138847 -0.323866907  0.96290405 -0.198533374  0.19891356 -0.747312119
## 40  -0.12557275 -0.194777160  0.92956323 -0.013953428  0.25282491 -0.752839069
## 41  -0.07125657 -0.210875534  1.25463691 -0.351297649  0.33020133 -0.971155543
## 42  -0.34580080  0.035505235  1.32206044 -0.023092232  0.61944142 -0.471625551
## 43   0.07478310  0.350384792 -0.16518613 -0.339346952  0.71326427  0.003180270
## 44  -0.28998546 -0.208072435  0.72399573  0.218452148 -0.13055552  0.242309193
## 45   0.14597068  0.534489507 -0.01044576 -0.475100485  0.53740537 -0.092911168
## 46  -0.10663156 -0.035459434  0.84967577  0.167417555 -0.33478162  0.206044761
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## 128  0.087429671  0.0039479633
## 129  0.002874583  0.0042588040
## 130  0.269480049  0.0084652840
## 131  0.110308919 -0.0340426196
## 132  0.454136856 -0.0192940102
## 133  0.150147207  0.0370833642
## 134  0.254827329 -0.0714370791
## 135 -0.128622517 -0.0740095736
## 136 -0.180536427 -0.0691327730
## 137 -0.326205541 -0.0660981623
## 138 -0.437511659 -0.0598144376
## 139  0.451269200 -0.0654736609
## 140  0.121526340 -0.0981170632
## 141  0.378947460  0.0574161440
## 142 -0.270984589  0.0639496382
## 143 -0.270773123  0.0547229740
## 144 -0.122118675  0.0619975135
## 145 -0.363581605  0.0324292803
## 146 -0.099131754 -0.0128516759
## 147 -0.377484371  0.0669531174
## 148 -0.098901827 -0.0052354267
## 149  0.213844802 -0.0333836083
## 150  0.426416139 -0.0750018279
## 151  0.285545647 -0.0513143164
## 152  0.164922318 -0.0469746995
## 153  0.235176435 -0.0724880874
## 154  0.182221629 -0.0604165040
## 155 -0.146113104  0.0448229207
## 156 -0.106131452 -0.0073925794
## 157 -0.275421759 -0.0009251753
## 158 -0.355987696  0.0073833739
## 159  0.088610852  0.0092130526
## 160  0.236687055  0.0160076861
## 161  0.525351081 -0.0109158078
## 162 -0.515515530 -0.0632908346
## 163 -0.718978246 -0.0460524188
## 164 -0.219810672 -0.1001505656
## 165 -0.249736180 -0.0692812655
## 166 -0.099008080 -0.0902698956
## 167 -0.199638030 -0.6920773876
```

```
## 168 -0.210455496 -0.0742945703
## 169  0.159219546  2.0958195384
## 170 -0.409478299 -2.9423396624
## 171 -0.104866563 -0.3030793771
## 172  0.049596197  0.3119325072
## 173  0.063814349  2.2507222045
## 174 -0.037217857  0.0975684772
## 175  0.267120715  0.2228110233
```

```
tabmeansPC <- aggregate(Studentsp_pca[,2:12],by=list(Social.Media.Addiction=Students$Social.Medi
a.Addiction),mean)
tabmeansPC
```

```
##   Social.Media.Addiction        PC1          PC2        PC3        PC4
## 1               Addicted -0.3545062 -0.009464451 -0.1212344 -0.2017889
## 2           Not Addicted  0.4726749  0.012619268  0.1616459  0.2690519
##          PC5        PC6         PC7         PC8         PC9        PC10
## 1  0.1842352  0.1881806 -0.09598392  0.08223388 -0.07975959  0.08815311
## 2 -0.2456469 -0.2509074  0.12797856 -0.10964517  0.10634613 -0.11753748
##          PC11
## 1 -0.02125277
## 2  0.02833703
```

```
tabmeansPC <- tabmeansPC[rev(order(tabmeansPC$Social.Media.Addiction)),]
tabmeansPC
```

```
##   Social.Media.Addiction        PC1          PC2        PC3        PC4
## 2           Not Addicted  0.4726749  0.012619268  0.1616459  0.2690519
## 1               Addicted -0.3545062 -0.009464451 -0.1212344 -0.2017889
##          PC5        PC6         PC7         PC8         PC9        PC10
## 2 -0.2456469 -0.2509074  0.12797856 -0.10964517  0.10634613 -0.11753748
## 1  0.1842352  0.1881806 -0.09598392  0.08223388 -0.07975959  0.08815311
##          PC11
## 2  0.02833703
## 1 -0.02125277
```

```
tabfmeans <- t(tabmeansPC[,-1])
tabfmeans
```

```
##                2           1
## PC1   0.47267490 -0.354506173
## PC2   0.01261927 -0.009464451
## PC3   0.16164586 -0.121234394
## PC4   0.26905186 -0.201788898
## PC5  -0.24564694  0.184235202
## PC6  -0.25090743  0.188180569
## PC7   0.12797856 -0.095983921
## PC8  -0.10964517  0.082233880
## PC9   0.10634613 -0.079759595
## PC10 -0.11753748  0.088153110
## PC11  0.02833703 -0.021252771
```

```
colnames(tabfmeans) <- t(as.vector(tabmeansPC[1]$Social.Media.Addiction))
tabfmeans
```

```
##      Not Addicted     Addicted
## PC1    0.47267490 -0.354506173
## PC2    0.01261927 -0.009464451
## PC3    0.16164586 -0.121234394
## PC4    0.26905186 -0.201788898
## PC5   -0.24564694  0.184235202
## PC6   -0.25090743  0.188180569
## PC7    0.12797856 -0.095983921
## PC8   -0.10964517  0.082233880
## PC9    0.10634613 -0.079759595
## PC10  -0.11753748  0.088153110
## PC11   0.02833703 -0.021252771
```

```
# Standard deviations of scores for all the PC's classified by social media addiction status
tabsdsPC <- aggregate(Studentsp_pca[,2:12],by=list(Social.Media.Addiction=Students$Social.Media.
Addiction),sd)
tabfsds <- t(tabsdsPC[,-1])
colnames(tabfsds) <- t(as.vector(tabsdsPC[1]$Social.Media.Addiction))
tabfsds
```

```
##        Addicted Not Addicted
## PC1  1.08372296    1.8537746
## PC2  1.15499257    1.5536383
## PC3  1.18211895    1.2812769
## PC4  0.61917436    1.4949496
## PC5  0.53646371    1.3551843
## PC6  0.91320884    0.9586231
## PC7  0.66373809    1.1028453
## PC8  0.77600187    0.9002706
## PC9  0.56201152    0.7448054
## PC10 0.45876004    0.5579865
## PC11 0.05769738    0.5106703
```

```
t.test(PC1~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC1 by Students$Social.Media.Addiction
## t = -3.4477, df = 111.33, p-value = 0.000799
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -1.302594 -0.351768
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                -0.3545062                 0.4726749
```

```
t.test(PC2~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC2 by Students$Social.Media.Addiction
## t = -0.1035, df = 131.21, p-value = 0.9177
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.4441613  0.3999939
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##               -0.009464451               0.012619268
```

```
t.test(PC3~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC3 by Students$Social.Media.Addiction
## t = -1.4938, df = 152.26, p-value = 0.1373
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.65702270  0.09126219
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                -0.1212344                 0.1616459
```

```
t.test(PC4~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC4 by Students$Social.Media.Addiction
## t = -2.5674, df = 93.114, p-value = 0.01184
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.8350122 -0.1066694
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                -0.2017889                 0.2690519
```

```
t.test(PC5~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC5 by Students$Social.Media.Addiction
## t = 2.5987, df = 91.472, p-value = 0.01091
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  0.1013116 0.7584527
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                 0.1842352                -0.2456469
```

```
t.test(PC6~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC6 by Students$Social.Media.Addiction
## t = 3.0598, df = 155.25, p-value = 0.00261
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  0.1556234 0.7225526
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                 0.1881806                -0.2509074
```

```
t.test(PC7~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC7 by Students$Social.Media.Addiction
## t = -1.5596, df = 113.41, p-value = 0.1216
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.5084587  0.0605337
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                -0.09598392                 0.12797856
```

```
t.test(PC8~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC8 by Students$Social.Media.Addiction
## t = 1.4791, df = 145.64, p-value = 0.1413
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.0645054  0.4482635
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                 0.08223388                -0.10964517
```

```
t.test(PC9~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC9 by Students$Social.Media.Addiction
## t = -1.8115, df = 132.62, p-value = 0.07233
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.38932230  0.01711086
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                -0.07975959                 0.10634613
```

```
t.test(PC10~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC10 by Students$Social.Media.Addiction
## t = 2.6006, df = 140.97, p-value = 0.0103
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  0.04932606 0.36205513
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##                0.08815311               -0.11753748
```

```
t.test(PC11~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  Welch Two Sample t-test
##
## data:  PC11 by Students$Social.Media.Addiction
## t = -0.83698, df = 75.419, p-value = 0.4053
## alternative hypothesis: true difference in means between group Addicted and group Not Addicte
d is not equal to 0
## 95 percent confidence interval:
##  -0.16760859  0.06842899
## sample estimates:
##     mean in group Addicted mean in group Not Addicted
##               -0.02125277                0.02833703
```

```
# T tests for the social media apps

## F ratio test
var.test(PC1~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC1 by Students$Social.Media.Addiction
## F = 0.34176, num df = 99, denom df = 74, p-value = 7.519e-07
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.2210794 0.5212652
## sample estimates:
## ratio of variances
##          0.3417611
```

```
var.test(PC2~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC2 by Students$Social.Media.Addiction
## F = 0.55266, num df = 99, denom df = 74, p-value = 0.005951
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.3575067 0.8429359
## sample estimates:
## ratio of variances
##          0.5526607
```

```
var.test(PC3~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC3 by Students$Social.Media.Addiction
## F = 0.85121, num df = 99, denom df = 74, p-value = 0.452
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.5506327 1.2982921
## sample estimates:
## ratio of variances
##          0.8512094
```

```
var.test(PC4~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC4 by Students$Social.Media.Addiction
## F = 0.17154, num df = 99, denom df = 74, p-value = 1.897e-15
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.1109682 0.2616428
## sample estimates:
## ratio of variances
##          0.1715429
```

```
var.test(PC5~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC5 by Students$Social.Media.Addiction
## F = 0.15671, num df = 99, denom df = 74, p-value < 2.2e-16
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.1013700 0.2390122
## sample estimates:
## ratio of variances
##          0.1567054
```

```
var.test(PC6~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC6 by Students$Social.Media.Addiction
## F = 0.9075, num df = 99, denom df = 74, p-value = 0.6478
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.5870431 1.3841413
## sample estimates:
## ratio of variances
##          0.9074954
```

```
var.test(PC7~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC7 by Students$Social.Media.Addiction
## F = 0.36221, num df = 99, denom df = 74, p-value = 2.798e-06
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.2343095 0.5524593
## sample estimates:
## ratio of variances
##          0.3622132
```

```
var.test(PC8~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC8 by Students$Social.Media.Addiction
## F = 0.74298, num df = 99, denom df = 74, p-value = 0.1673
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.4806235 1.1332230
## sample estimates:
## ratio of variances
##          0.7429839
```

```
var.test(PC9~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC9 by Students$Social.Media.Addiction
## F = 0.56938, num df = 99, denom df = 74, p-value = 0.008982
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.3683243 0.8684419
## sample estimates:
## ratio of variances
##          0.5693834
```

```
var.test(PC10~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC10 by Students$Social.Media.Addiction
## F = 0.67596, num df = 99, denom df = 74, p-value = 0.06898
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.4372697 1.0310028
## sample estimates:
## ratio of variances
##          0.6759644
```

```
var.test(PC11~Students$Social.Media.Addiction,data=Studentsp_pca)
```

```
##
##  F test to compare two variances
##
## data:  PC11 by Students$Social.Media.Addiction
## F = 0.012765, num df = 99, denom df = 74, p-value < 2.2e-16
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.008257649 0.019470041
## sample estimates:
## ratio of variances
##          0.0127653
```

```
# Levene's test
library(car)
(LTPC1 <- leveneTest(PC1~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value  Pr(>F)
## group   1  3.4194 0.06614 .
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(p_PC1_1sided <- LTPC1[[3]][1]/2)
```

```
## [1] 0.0330701
```

```
(LTPC2 <- leveneTest(PC2~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value   Pr(>F)
## group   1  8.0804 0.005013 **
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(p_PC2_1sided=LTPC2[[3]][1]/2)
```

```
## [1] 0.002506632
```

```
(LTPC3 <- leveneTest(PC3~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.8895 0.3469
##       173
```

```
(p_PC3_1sided <- LTPC3[[3]][1]/2)
```

```
## [1] 0.1734678
```

```
(LTPC4 <- leveneTest(PC4~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value  Pr(>F)
## group   1  6.6201 0.01092 *
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(p_PC4_1sided <- LTPC4[[3]][1]/2)
```

```
## [1] 0.005461163
```

```
(LTPC5 <- leveneTest(PC5~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value   Pr(>F)
## group   1  9.8267 0.002021 **
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(p_PC5_1sided <- LTPC5[[3]][1]/2)
```

```
## [1] 0.001010535
```

```
(LTPC6 <- leveneTest(PC6~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.1901 0.6634
##       173
```

```
(p_PC6_1sided <- LTPC6[[3]][1]/2)
```

```
## [1] 0.3316914
```

```
(LTPC7 <- leveneTest(PC7~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value    Pr(>F)
## group   1   12.64 0.0004871 ***
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(p_PC7_1sided=LTPC7[[3]][1]/2)
```

```
## [1] 0.0002435595
```

```
(LTPC8 <- leveneTest(PC8~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.2753 0.6005
##       173
```

```
(p_PC8_1sided <- LTPC8[[3]][1]/2)
```

```
## [1] 0.3002367
```

```
(LTPC9 <- leveneTest(PC9~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.9891 0.3214
##       173
```

```
(p_PC9_1sided <- LTPC9[[3]][1]/2)
```

```
## [1] 0.1606811
```

```
(LTPC10 <- leveneTest(PC10~Students$Social.Media.Addiction,data=Studentsp_pca))
```

```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  0.3851 0.5357
##       173
```

```
(p_PC10_1sided <- LTPC10[[3]][1]/2)
```

```
## [1] 0.2678559
```

```
(LTPC11 <- leveneTest(PC11~Students$Social.Media.Addiction,data=Studentsp_pca))
```

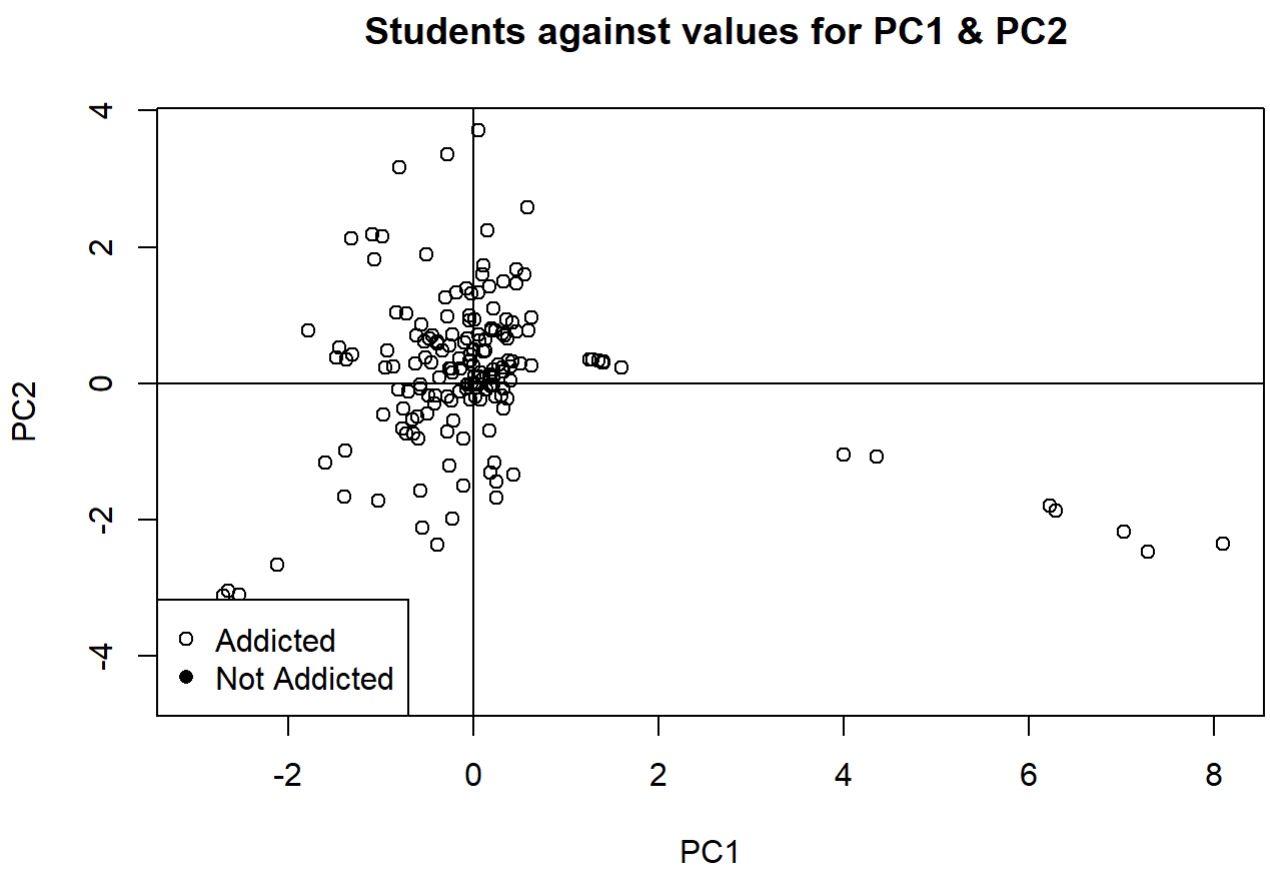
```
## Warning in leveneTest.default(y = y, group = group, ...): group coerced to
## factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value  Pr(>F)
## group   1  6.4691 0.01185 *
##       173
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

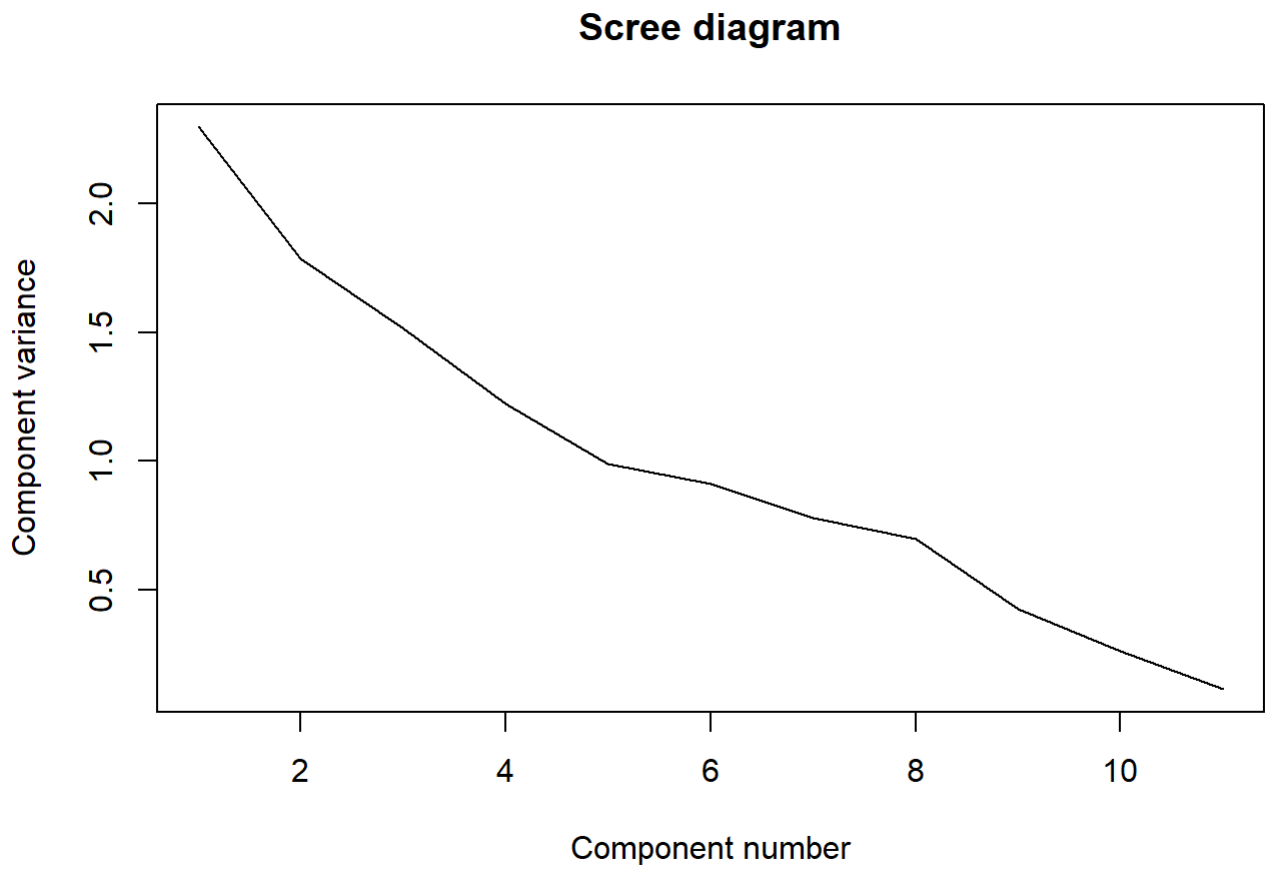
```
(p_PC11_1sided <- LTPC11[[3]][1]/2)
```

```
## [1] 0.005926287
```

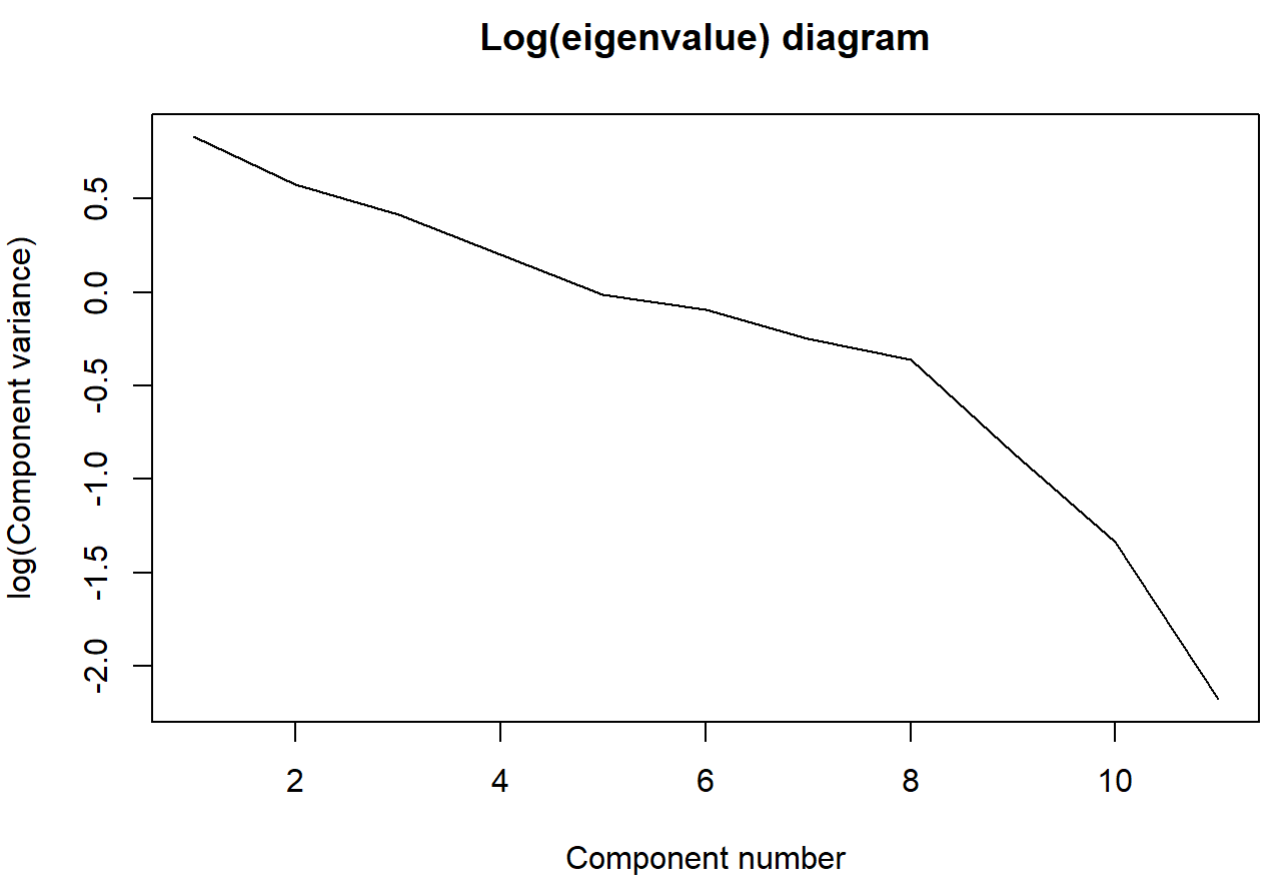
```
# Plotting the scores for the first and second components in the social media for the students d
ata
plot(Studentsp_pca$PC1, Studentsp_pca$PC2,pch=ifelse(Studentsp_pca$Social.Media.Addiction ==
"S",1,16),xlab="PC1", ylab="PC2", main=" Students against values for PC1 & PC2")
abline(h=0)
abline(v=0)
legend("bottomleft", legend=c("Addicted","Not Addicted"), pch=c(1,16))
```



```
# This code generates a scatterplot of the first two principal components ,  with the points col
ored according to whether the student is addicted to social media or not.
plot(eigen_Students, xlab = "Component number", ylab = "Component variance", type = "l", main =
"Scree diagram")
```




```
plot(log(eigen_Students), xlab = "Component number",ylab = "log(Component variance)", type="l",m
ain = "Log(eigenvalue) diagram")
```




```
print(summary(Students_pca))
```

```
## Importance of components:
##                           PC1    PC2    PC3    PC4     PC5     PC6     PC7
## Standard deviation     1.5160 1.3363 1.2300 1.1060 0.99514 0.95540 0.88333
## Proportion of Variance 0.2089 0.1623 0.1375 0.1112 0.09003 0.08298 0.07093
## Cumulative Proportion  0.2089 0.3713 0.5088 0.6200 0.71004 0.79302 0.86395
##                           PC8     PC9    PC10    PC11
## Standard deviation     0.83449 0.65128 0.51242 0.33676
## Proportion of Variance 0.06331 0.03856 0.02387 0.01031
## Cumulative Proportion  0.92726 0.96582 0.98969 1.00000
```

```
diag(cov(Students_pca$x))
```

```
##       PC1       PC2       PC3       PC4       PC5       PC6       PC7       PC8
## 2.2982455 1.7856798 1.5129667 1.2231957 0.9903120 0.9127976 0.7802745 0.6963773
##       PC9      PC10      PC11
## 0.4241644 0.2625785 0.1134080
```

```
xlim <- range(Students_pca$x[,1])
Students_pca$x[,1]
```

```
##   [1] -0.416389889 -0.972379460 -1.603608671 -1.383890607 -0.768091364
##   [6] -0.754996653 -0.657828390 -0.241218540  0.181264122  0.035667587
##  [11]  0.014725383  0.371936274  0.062844523  0.075466200 -2.120985868
##  [16] -0.276765699 -0.231228101 -1.342560665 -0.552670521 -0.570577812
##  [21] -0.255028051  0.128428320  0.052474117  0.221233179  0.320153552
##  [26]  0.181581063  0.167648803 -0.002750549 -2.308434627 -2.481920506
##  [31] -1.022822818 -0.217306627 -0.647016284 -0.723402376 -0.606515982
##  [36] -0.242835271 -0.152425215 -0.414436644 -0.021561562 -0.143703910
##  [41]  0.005800621 -0.362268779  0.002692584 -0.038303371  0.128012345
##  [46]  0.106015509 -0.029679656 -0.037752867 -0.263508663 -0.728057610
##  [51] -0.065166189 -0.987588280 -0.832751965 -0.307590359 -1.091430038
##  [56] -0.561785727  1.285809880  1.351592692  1.402965111  1.395135171
##  [61]  1.402256016  1.599320680  1.255058882  0.072727229  0.173390234
##  [66] -0.105161853  0.241315525  0.363304886  0.326392566  0.140173840
##  [71] -0.526214261 -0.450509165 -0.478773642  0.220736240 -0.390039030
##  [76] -0.444381338 -0.388414206 -2.441856538 -2.506559138 -2.973194236
##  [81] -2.648001614 -2.698015408 -2.533982662 -1.399616970 -0.038014900
##  [86]  0.108776834  0.217806803  0.048677748  0.093615640  0.416467823
##  [91]  0.318535349 -0.512002416 -1.069768418 -1.323320744 -0.924969118
##  [96] -0.280812196 -0.039651072 -0.228386981  0.587307419  0.627986437
## [101]  0.591569214  0.467904863  0.053016965  0.465257385  0.351563537
## [106] -0.802964190 -0.286084958  0.054101688  0.329698286 -0.074581531
## [111]  0.149279673  0.323589741 -0.153159965 -0.102489844  0.212592390
## [116]  0.310056526  0.422311469  0.403675129  0.381331583 -0.331158400
## [121] -0.515042335 -0.180093329 -0.496463285 -0.599571704 -0.484533082
## [126] -0.281800116 -0.107749282  0.248064230  0.250018774  0.427611892
## [131]  0.183837022  0.228935392 -0.389523057 -0.078574328  0.302105595
## [136]  0.203704849  0.397520783  0.631940565  0.009768048  0.266607898
## [141] -1.778822656 -1.476149198 -1.371488034 -1.450632171 -0.859820925
## [146] -0.630318428 -1.307258618 -0.947264811 -0.808531691 -0.699851842
## [151] -0.569945513 -0.577454229 -0.227621308 -0.256324179 -0.022135058
## [156]  0.190376617  0.242796303  0.194871226  0.546722439  0.176786440
## [161] -0.611010506  0.020895467 -0.029164684  0.325743174  0.106871110
## [166]  0.505936380  0.463130719 -0.069577533  4.002758103  8.093698041
## [171]  6.220852426  7.029901559  6.288409090  4.357348282  7.279584804
```

```
Students_pca$x
```

```
##                PC1           PC2          PC3         PC4          PC5
##   [1,] -0.416389889 -0.2965640115  0.256251509 -0.22115646  0.197705566
##   [2,] -0.972379460 -0.4534547890 -0.208196487 -0.54970124  0.511050897
##   [3,] -1.603608671 -1.1608229630 -0.942139583 -0.89353994  0.745355281
##   [4,] -1.383890607 -0.9926696594 -0.447019742 -0.74795734  0.630366509
##   [5,] -0.768091364 -0.6572135229 -0.220113513 -0.47442175  0.382717109
##   [6,] -0.754996653 -0.3748129436  0.002786294 -0.55409202  0.557704368
##   [7,] -0.657828390 -0.5382830720 -0.261863691 -0.44525877  0.319106416
##   [8,] -0.241218540 -0.2491805225  0.168869482  0.38661833  0.288527863
##   [9,]  0.181264122 -0.0311034891  0.897756127  0.43909203 -0.050468698
##  [10,]  0.035667587 -0.0653674965  1.060596899  0.91778417  0.149274460
##  [11,]  0.014725383 -0.0102237768  1.729244473  1.09805661  0.649976432
##  [12,]  0.371936274  0.6634589679  1.879305661  0.72004385  0.452513629
##  [13,]  0.062844523  0.6220812586  1.741575471  0.84096111  1.066546131
##  [14,]  0.075466200  0.1514879311  1.273592275  0.73738908  0.412912005
##  [15,] -2.120985868 -2.6571640142 -1.195287512  0.64677671  0.833500499
##  [16,] -0.276765699 -0.7054638643  0.063137968  0.40574054  0.098294777
##  [17,] -0.231228101 -1.9813994657 -0.166149448  6.25401279  0.016524790
##  [18,] -1.342560665 -4.5435864826 -0.149622042  9.37582774  0.630809870
##  [19,] -0.552670521 -2.1184306487  0.312007334  2.05837855 -0.779349285
##  [20,] -0.570577812 -1.5717901672 -0.256434873  0.68637631 -0.426218831
##  [21,] -0.255028051 -1.2123325065 -0.061977235  0.40863833 -0.726748853
##  [22,]  0.128428320  0.4819762509  0.456683538 -0.13079298 -0.033241419
##  [23,]  0.052474117  0.0937210477  0.023901062  0.01436224 -0.034840356
##  [24,]  0.221233179  0.0780742638  0.115194401  0.15083309 -0.112619988
##  [25,]  0.320153552  0.1769050486  0.586721646  0.22735908 -0.127680209
##  [26,]  0.181581063  0.0958082650  0.225850386  0.08703363 -0.080720299
##  [27,]  0.167648803  0.1358346473  0.407647495  0.10986330 -0.063654595
##  [28,] -0.002750549  0.2555529458  0.134842909 -0.12374179  0.005091954
##  [29,] -2.308434627 -3.8617659870  0.167455957 -0.02643501  1.227485170
##  [30,] -2.481920506 -3.7181082802 -0.147682230 -0.36008280  1.303155908
##  [31,] -1.022822818 -1.7174178610 -0.612183174 -0.45223175  0.497514289
##  [32,] -0.217306627 -0.5462724675  0.174095209 -0.38428482  0.161114976
##  [33,] -0.647016284 -0.7424294479 -0.158360354 -0.73419069  0.361232695
##  [34,] -0.723402376 -0.7377301123 -0.091679168 -0.79977142  0.405925950
##  [35,] -0.606515982 -0.4878696028 -0.292997209 -0.84153990 -0.068240313
##  [36,] -0.242835271  0.2159478970 -0.391753355 -0.26830800 -0.381368067
##  [37,] -0.152425215 -0.1198887459 -0.635112690 -0.21206882 -0.536476766
##  [38,] -0.414436644 -0.1767957614 -1.302541342 -0.43057201 -0.477531985
##  [39,] -0.021561562 -0.0008870563 -0.286423315 -0.01138847 -0.323866907
##  [40,] -0.143703910  0.2187825548 -0.474928361 -0.12557275 -0.194777160
##  [41,]  0.005800621  0.1047528800 -0.498637489 -0.07125657 -0.210875534
##  [42,] -0.362268779  0.0820879972 -0.563767216 -0.34580080  0.035505235
##  [43,]  0.002692584  0.4895491948  1.077027421  0.07478310  0.350384792
##  [44,] -0.038303371  0.3131580562  0.228094977 -0.28998546 -0.208072435
##  [45,]  0.128012345  0.6457829134  1.090491789  0.14597068  0.534489507
##  [46,]  0.106015509  0.4626686952  0.334452375 -0.10663156 -0.035459434
##  [47,] -0.029679656  0.3289331811  0.206289887 -0.11541655  0.018562354
##  [48,] -0.037752867  0.4298105942  0.208583172 -0.26482228  0.033041040
##  [49,] -0.263508663  0.5609455571  0.808003211 -0.12332750  0.584181064
##  [50,] -0.728057610  1.0305796946  0.352392800 -0.96021213  0.385124872
##  [51,] -0.065166189  0.6640205762  0.659064484 -0.36604519  0.082503255
```

```
##  [52,] -0.987588280  2.1608493413 -0.707612611 -0.82948716  0.284421196
##  [53,] -0.832751965  1.0432480987  0.286516894 -1.05107280  0.433109829
##  [54,] -0.307590359  1.2587406480  0.153139876 -0.41881900  0.094417690
##  [55,] -1.091430038  2.1901569567 -0.771481723 -0.92116812  0.331575970
##  [56,] -0.561785727  0.8686150351  0.330449015 -0.72867135  0.293475462
##  [57,]  1.285809880  0.3505735238  1.222315308  0.66706703 -0.479195377
##  [58,]  1.351592692  0.3358873736  1.198149777  0.66026821 -0.413413803
##  [59,]  1.402965111  0.3134333555  1.178691034  0.64618845 -0.403743157
##  [60,]  1.395135171  0.3106590865  1.152521141  0.62826658 -0.392454924
##  [61,]  1.402256016  0.3064565217  1.151691084  0.63474528 -0.396047689
##  [62,]  1.599320680  0.2336019436  1.088956070  0.58760318 -0.324540390
##  [63,]  1.255058882  0.3491519891  1.209955056  0.66015972 -0.510446229
##  [64,]  0.072727229 -0.2362413777  0.342478270  0.13374389 -0.685773044
##  [65,]  0.173390234 -0.6923652025  0.514151496  0.18981673 -0.756316636
##  [66,] -0.105161853 -0.8057329281 -0.120674265 -0.00612513 -0.519939026
##  [67,]  0.241315525 -0.1939011278  0.595811513  0.20286000 -0.661037349
##  [68,]  0.363304886 -0.2222312490  0.606657288  0.16401402 -0.847466504
##  [69,]  0.326392566 -0.3660094465  0.735077834  0.33480722 -0.792047745
##  [70,]  0.140173840 -0.0873120940  0.633982619  0.10208878 -0.223092245
##  [71,] -0.526214261  0.6146019449 -0.171500254 -0.57344567  0.167884773
##  [72,] -0.450509165  0.3026005015  0.036319252 -0.61800620  0.242267234
##  [73,] -0.478773642  0.6523287681 -0.362413162 -0.47875357  0.176201582
##  [74,]  0.220736240 -0.0149331611  0.504670291  0.06210344 -0.077005616
##  [75,] -0.390039030  0.6159927420 -0.328254831 -0.40088022  0.129728406
##  [76,] -0.444381338  0.6973827912 -0.522287735 -0.49735947  0.142470397
##  [77,] -0.388414206  0.5904263679 -0.105944659 -0.59903999  0.178540779
##  [78,] -2.441856538 -3.6608139533 -0.498944835 -0.49502791  1.202002642
##  [79,] -2.506559138 -3.3985895892 -0.500432070 -0.70365217  1.189355812
##  [80,] -2.973194236 -3.5011086149 -0.718800060 -0.85260277  1.240007602
##  [81,] -2.648001614 -3.0430399264 -0.639222339 -0.82439874  1.285379725
##  [82,] -2.698015408 -3.1176975826 -0.590772464 -0.72697851  1.304131015
##  [83,] -2.533982662 -3.1074805579 -0.528692959 -0.57897213  1.123435301
##  [84,] -1.399616970 -1.6598757810 -0.106621018 -0.32219768  0.685151371
##  [85,] -0.038014900  0.9236459236  0.498988063 -0.19640307 -0.136183704
##  [86,]  0.108776834  1.7316978625 -0.046838723  0.22340495 -0.133689312
##  [87,]  0.217806803  1.1014859927  0.444361101  0.09816100 -0.230376044
##  [88,]  0.048677748  3.7062737766  0.327346774  0.86553174  0.623807368
##  [89,]  0.093615640  1.5910962869  0.037312438  0.04032074 -0.581332674
##  [90,]  0.416467823  0.8905323475  0.857699828  0.22093952 -0.081178096
##  [91,]  0.318535349  0.7373528227  0.661223585 -0.03492339 -0.598209402
##  [92,] -0.512002416  1.8854002718 -0.818251077 -0.29839805 -0.019136526
##  [93,] -1.069768418  1.8252026131 -1.228297083 -0.81199424  0.167586635
##  [94,] -1.323320744  2.1213030339 -2.342025859 -0.91715516 -0.083723366
##  [95,] -0.924969118  0.4808123350 -0.397801238 -0.92405907  0.299883909
##  [96,] -0.280812196  0.9823850926  0.018939153 -0.43385423 -0.062456586
##  [97,] -0.039651072  0.9919248213 -0.120760165 -0.19060193 -0.072099015
##  [98,] -0.228386981  0.7173973012 -0.184367342 -0.39743361  0.066907232
##  [99,]  0.587307419  2.5760961303  4.632195209  1.19788418  2.446089316
## [100,]  0.627986437  0.9723972507  1.946923816  0.46064272  0.300552610
## [101,]  0.591569214  0.7694517747  1.530191138  0.33539773  0.070778260
## [102,]  0.467904863  0.7665880257  1.411358858  0.29291428  0.138495258
## [103,]  0.053016965  0.7211770711  1.234075763 -0.14184260  0.201464920
```

```
## [104,]  0.465257385  1.4581907905  2.591812124  0.56326475  1.015261999
## [105,]  0.351563537  0.9382822024  1.611163359  0.17032278  0.319729739
## [106,] -0.802964190  3.1712124867 -5.185198537  1.45937157 -0.607737821
## [107,] -0.286084958  3.3571247181 -6.589191025  2.92117618 -1.168741357
## [108,]  0.054101688  1.3371645928 -2.467887729  1.48833774 -0.571715025
## [109,]  0.329698286  0.6969350721 -0.907497392  1.69821143 -0.408974769
## [110,] -0.074581531  1.3916323963 -3.661093266  1.72417436 -0.664408468
## [111,]  0.149279673  2.2483331102 -3.312357543  1.80023644 -0.802410077
## [112,]  0.323589741  1.5000852150 -3.139324707  2.03705871 -0.824810449
## [113,] -0.153159965  0.3665977338  0.065615921 -0.31244579  0.002510135
## [114,] -0.102489844  0.5930564314  0.440773094 -0.05163079  0.364490542
## [115,]  0.212592390  0.1973580957  0.332859777  0.07231547 -0.157974988
## [116,]  0.310056526  0.2380803296  0.072286781  0.22751899 -0.265972036
## [117,]  0.422311469  0.3152052680  0.240028820  0.23630388 -0.302492870
## [118,]  0.403675129  0.2521061557  0.208884723  0.25475926 -0.267895739
## [119,]  0.381331583  0.3383039935  0.392779229  0.14755391 -0.280321048
## [120,] -0.331158400  0.4853349434 -0.186605727 -0.43905134 -0.386897013
## [121,] -0.515042335  0.3856139254  0.444522888 -0.41058949  0.548550480
## [122,] -0.180093329  1.3278002391  0.015128499  0.16755881  0.501551751
## [123,] -0.496463285 -0.4392062951 -0.293237435 -0.52770516  0.096227473
## [124,] -0.599571704 -0.8174482377  0.451758482 -0.42304062  0.077765876
## [125,] -0.484533082 -0.1747922104 -0.112656105 -0.45805592  0.243058239
## [126,] -0.281800116 -0.1913215055  0.796890389 -0.17884116  0.589389464
## [127,] -0.107749282 -1.4936891915  0.375949224 -0.70531538 -2.802162442
## [128,]  0.248064230 -1.6784083062  0.693282551 -0.97235038 -4.897274671
## [129,]  0.250018774 -1.4410273363  0.999364409 -0.69743529 -3.908547623
## [130,]  0.427611892 -1.3345902236  1.017407430 -1.04026612 -4.954980319
## [131,]  0.183837022 -1.3041052059  0.626893989 -0.47309333 -2.937744086
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## [167,]  0.463130719  1.6773776984 -1.725940210  0.13617344 -0.078372306
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## [169,]  4.002758103 -1.0410900990 -0.567448082 -0.35170843  0.422879932
## [170,]  8.093698041 -2.3555397738 -1.508398676 -0.98638906  1.565642339
## [171,]  6.220852426 -1.7978602920 -1.334603243 -0.83297045  1.054186487
## [172,]  7.029901559 -2.1805400411 -2.168403890 -0.97567240  1.257726189
## [173,]  6.288409090 -1.8691664633 -1.454711957 -0.78048524  0.981630895
## [174,]  4.357348282 -1.0786575320 -0.434378836 -0.19377952 -0.096683475
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##                PC6          PC7         PC8          PC9         PC10
##   [1,]  0.24747579 -0.002491862 -0.41097552  0.259032678 -0.129055509
##   [2,]  0.26915385  0.136961144  0.20957343  0.254449443 -0.079494628
##   [3,]  0.28138438 -0.113222262  0.53084940 -0.102054558  0.338048377
##   [4,] -0.03396056 -0.016448949  0.29480453  0.189306650  0.184576114
##   [5,]  0.27351286 -0.326995740 -0.01651304 -0.128884109  0.427164975
##   [6,]  0.08256475 -0.308943155  0.12942300  0.039269563  0.685288614
##   [7,]  0.47031325 -0.265420761 -0.12683669 -0.130169204  0.367749901
##   [8,]  0.54128754 -0.352954686  0.60082825 -0.576689919  0.074468674
##   [9,]  0.02240509 -0.501606401  0.32154405 -0.354445273  0.093659687
##  [10,] -0.06331690  0.127067998  0.20020743  0.113577887 -0.213748070
##  [11,] -0.81281754 -0.458174016  0.81135459 -0.138022208 -0.583302785
##  [12,] -0.67348937 -0.671133864  1.11953802 -0.231023487 -0.164412569
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##  [14,] -0.31150185 -0.467295468  0.82937724 -0.293187729 -0.200365065
##  [15,] -0.04468280 -0.299459341  0.88172382 -0.477694330 -3.399259313
##  [16,]  0.44615440 -0.438091696 -0.36970628 -0.280804951 -1.002131760
##  [17,]  0.62710805  2.293320658  0.11614677  0.764386933  1.274008273
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## [151,]  1.08073021 -0.087912879  0.46034252 -0.332585797  0.285545647
## [152,]  1.20009252 -0.029060973  0.59406007 -0.367917385  0.164922318
## [153,]  1.31685186 -0.186412083  0.41499088 -0.518472329  0.235176435
## [154,]  1.22775223 -0.060846068  0.35632245 -0.335360207  0.182221629
## [155,] -0.90331196 -0.078183792  1.30501568  0.647620255 -0.146113104
## [156,] -0.04640023  0.126621602 -0.18953315  0.643417709 -0.106131452
## [157,]  0.19370594  0.517946552 -0.87041200  1.028462434 -0.275421759
## [158,]  0.28135013  0.677814338 -0.90144003  1.140894001 -0.355987696
## [159,] -1.41934808 -0.781444755  1.36026686  0.276795184  0.088610852
## [160,] -1.15293833 -0.737352643  1.30071791  0.624686406  0.236687055
## [161,]  0.49367809  0.038387022  1.36729598  0.051491097  0.525351081
## [162,]  1.01249897 -0.364714709 -0.10273079 -0.586739968 -0.515515530
## [163,]  0.86390894 -0.256355102 -0.17807802 -0.427283281 -0.718978246
## [164,]  1.16532111 -0.616735339 -0.22511114 -0.836057349 -0.219810672
## [165,]  1.05975260 -0.277052233 -0.11991510 -0.451164938 -0.249736180
## [166,]  0.98523231 -0.371975642 -0.56855321 -0.362849034 -0.099008080
## [167,] -1.18040226  1.110739361 -0.85423026 -2.390978274 -0.199638030
## [168,]  1.30541235 -0.341599237  0.25717130 -0.717824094 -0.210455496
## [169,]  0.29402341  0.010587165 -0.06114405 -0.449583412  0.159219546
## [170,] -1.34566640  1.161946282  0.21749121  0.701478642 -0.409478299
## [171,] -0.50867679  0.693123807  0.38324107  0.131796917 -0.104866563
## [172,] -0.63773688  0.537694869  0.85785579  0.155952577  0.049596197
## [173,] -0.40933043  0.457499668  0.40907092 -0.007234324  0.063814349
## [174,] -0.37521629  0.021231576 -0.19948386  0.192470094 -0.037217857
## [175,] -0.75683972  0.526705910  0.79170395  0.114418809  0.267120715
##                PC11
##   [1,] -0.0188736494
##   [2,]  0.0081155271
##   [3,] -0.0014659352
##   [4,]  0.0117896081
##   [5,] -0.0413045777
##   [6,] -0.0365117048
##   [7,] -0.0470660203
##   [8,] -0.0533181776
##   [9,] -0.0552382234
##  [10,] -0.0141991420
##  [11,]  0.0087169819
```

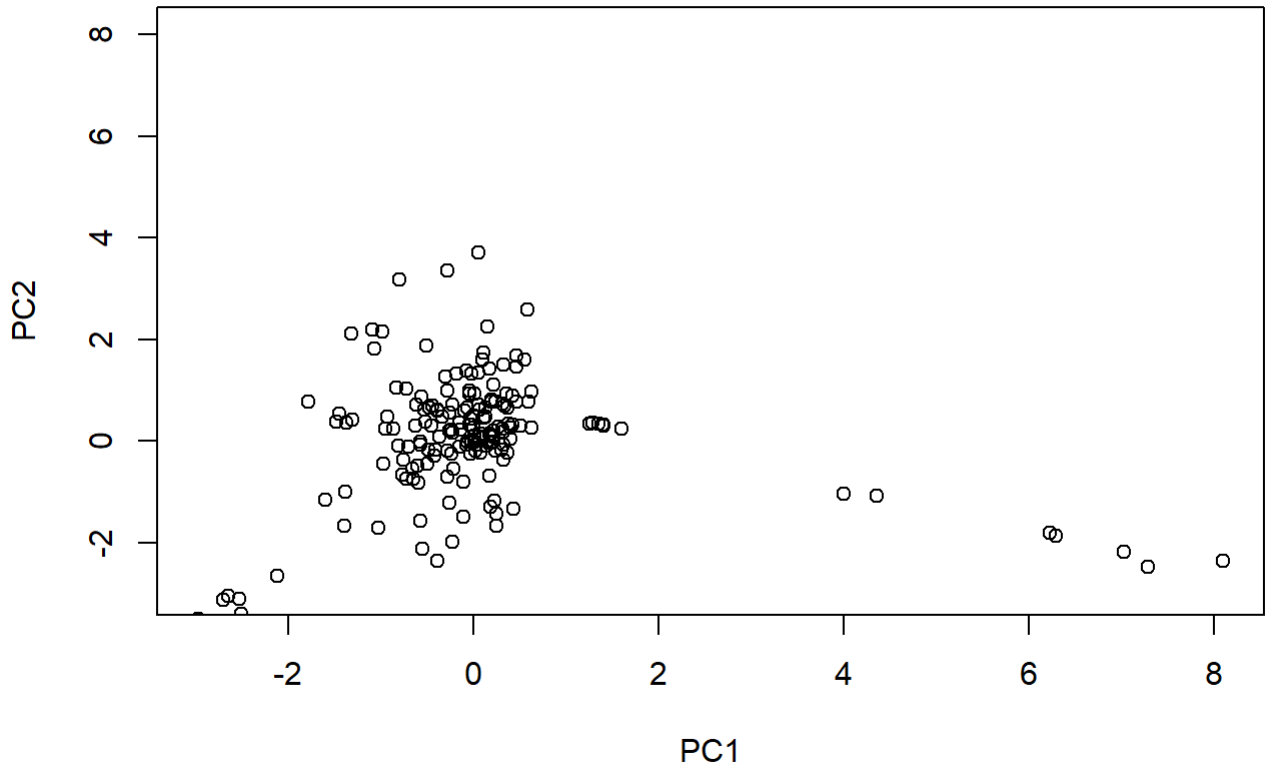
```
##  [12,] -0.0178917745
##  [13,]  0.0021597085
##  [14,] -0.0216510185
##  [15,]  0.1305694060
##  [16,] -0.0248955986
##  [17,] -0.0349873144
##  [18,]  0.0237650930
##  [19,]  0.0306468935
##  [20,] -0.0279345467
##  [21,] -0.0399419742
##  [22,] -0.0374566235
##  [23,] -0.0643527383
##  [24,] -0.0794625037
##  [25,] -0.0556420868
##  [26,] -0.0711725057
##  [27,] -0.0517730539
##  [28,] -0.0482387906
##  [29,]  0.0483836367
##  [30,]  0.0404019187
##  [31,] -0.1019556494
##  [32,] -0.1082361976
##  [33,] -0.0977206183
##  [34,] -0.0856366948
##  [35,] -0.0739485583
##  [36,] -0.0254701383
##  [37,] -0.0698707323
##  [38,] -0.0841366620
##  [39,] -0.0619927613
##  [40,] -0.0510672983
##  [41,] -0.0861998371
##  [42,] -0.0480595147
##  [43,] -0.0174615071
##  [44,] -0.0324853189
##  [45,] -0.0374329562
##  [46,] -0.0383960084
##  [47,] -0.0308086431
##  [48,] -0.0375691175
##  [49,] -0.0029773611
##  [50,]  0.0865052105
##  [51,]  0.0026500174
##  [52,]  0.1506231998
##  [53,]  0.0949014994
##  [54,]  0.0491646814
##  [55,]  0.1604167133
##  [56,]  0.0615617661
##  [57,]  0.0499974533
##  [58,]  0.1377475290
##  [59,]  0.2037672630
##  [60,]  0.2177110200
##  [61,]  0.2165705444
##  [62,]  0.4726451278
##  [63,]  0.0188000613
```

```
##  [64,] -0.0333869035
##  [65,] -0.0633837708
##  [66,] -0.0849417835
##  [67,] -0.0346487351
##  [68,] -0.0567820916
##  [69,] -0.0377923053
##  [70,] -0.0412174212
##  [71,]  0.0018935474
##  [72,] -0.0220524684
##  [73,] -0.0134063438
##  [74,] -0.0927704124
##  [75,] -0.0236558644
##  [76,] -0.0210104039
##  [77,] -0.0117773072
##  [78,]  0.0119036941
##  [79,]  0.0283151887
##  [80,]  0.0965948021
##  [81,]  0.0653918416
##  [82,]  0.0832160402
##  [83,]  0.0784705273
##  [84,]  0.0253598243
##  [85,]  0.0198707561
##  [86,]  0.0275346247
##  [87,] -0.0009682919
##  [88,]  0.1165314769
##  [89,]  0.0403847504
##  [90,] -0.0346363716
##  [91,] -0.0288749901
##  [92,]  0.0695935559
##  [93,]  0.1032214794
##  [94,]  0.1011233306
##  [95,]  0.0228207186
##  [96,]  0.0215124045
##  [97,] -0.0153943497
##  [98,] -0.0224604400
##  [99,]  0.0585426676
## [100,] -0.0286594843
## [101,] -0.0377916611
## [102,] -0.0286632948
## [103,]  0.0102530044
## [104,]  0.0097227483
## [105,] -0.0056198205
## [106,]  0.0903276401
## [107,]  0.0566941537
## [108,] -0.0029394027
## [109,] -0.0492205059
## [110,] -0.0402661622
## [111,]  0.0003350810
## [112,] -0.0414353090
## [113,] -0.0347499229
## [114,] -0.0335001643
## [115,] -0.0691065901
```

```
## [116,] -0.0839675594
## [117,] -0.0853635634
## [118,] -0.0900666401
## [119,] -0.0731721766
## [120,] -0.0015665960
## [121,]  0.0111530400
## [122,]  0.0007688892
## [123,] -0.0719346341
## [124,] -0.0231656894
## [125,] -0.0423423210
## [126,] -0.0610244377
## [127,] -0.0329767240
## [128,]  0.0039479633
## [129,]  0.0042588040
## [130,]  0.0084652840
## [131,] -0.0340426196
## [132,] -0.0192940102
## [133,]  0.0370833642
## [134,] -0.0714370791
## [135,] -0.0740095736
## [136,] -0.0691327730
## [137,] -0.0660981623
## [138,] -0.0598144376
## [139,] -0.0654736609
## [140,] -0.0981170632
## [141,]  0.0574161440
## [142,]  0.0639496382
## [143,]  0.0547229740
## [144,]  0.0619975135
## [145,]  0.0324292803
## [146,] -0.0128516759
## [147,]  0.0669531174
## [148,] -0.0052354267
## [149,] -0.0333836083
## [150,] -0.0750018279
## [151,] -0.0513143164
## [152,] -0.0469746995
## [153,] -0.0724880874
## [154,] -0.0604165040
## [155,]  0.0448229207
## [156,] -0.0073925794
## [157,] -0.0009251753
## [158,]  0.0073833739
## [159,]  0.0092130526
## [160,]  0.0160076861
## [161,] -0.0109158078
## [162,] -0.0632908346
## [163,] -0.0460524188
## [164,] -0.1001505656
## [165,] -0.0692812655
## [166,] -0.0902698956
## [167,] -0.6920773876
```

```
## [168,] -0.0742945703
## [169,]  2.0958195384
## [170,] -2.9423396624
## [171,] -0.3030793771
## [172,]  0.3119325072
## [173,]  2.2507222045
## [174,]  0.0975684772
## [175,]  0.2228110233
```

```
plot(Students_pca$x,xlim=xlim,ylim=xlim)
```



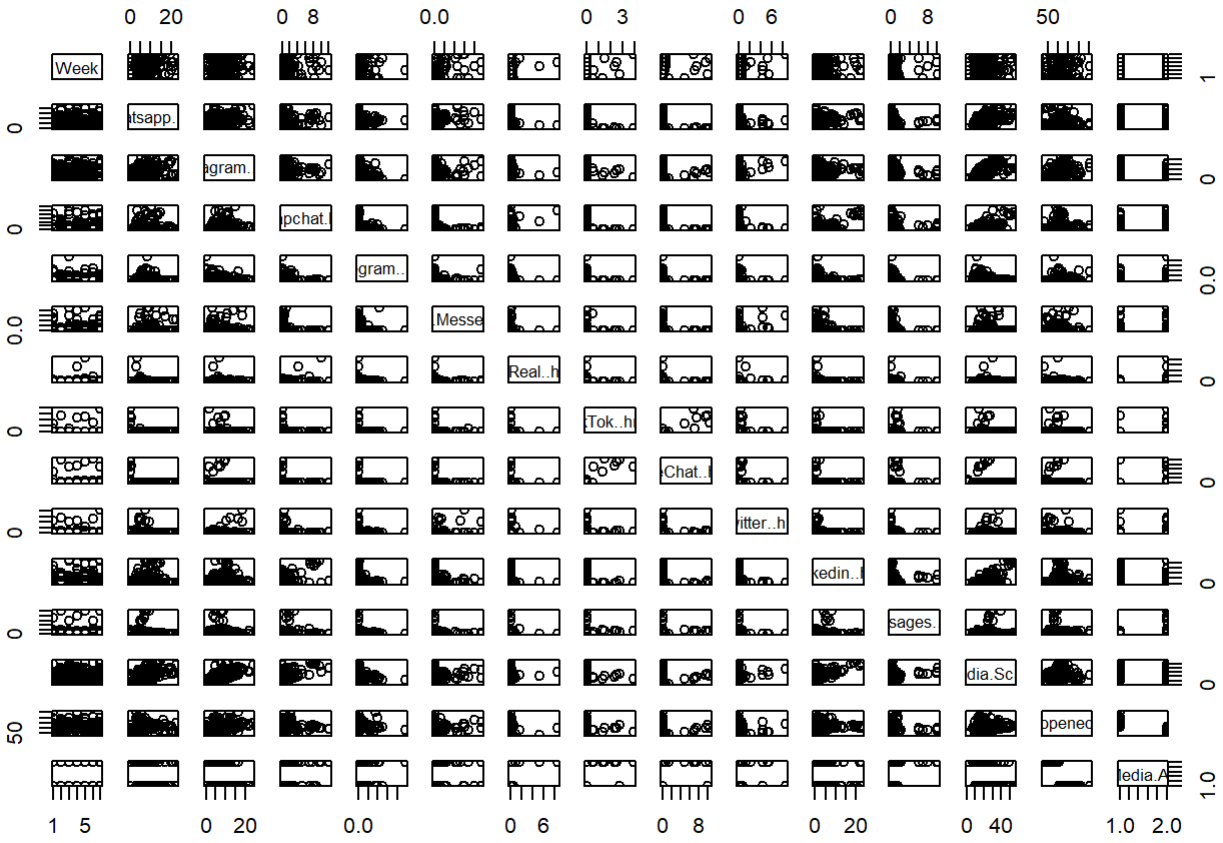

```
Students_pca$rotation[,1]
```

```
##           Whatsapp..hrs.          Instagram..hrs.           Snapchat.hrs.
##              -0.39168477              -0.21618594              -0.29598832
##           Telegram..hrs. Facebook.Messenger..hrs.            BeReal..hrs.
##               0.02583290              -0.06122393              -0.04428598
##             TikTok..hrs.             WeChat..hrs.           Twitter..hrs.
##               0.54527903               0.55993528               0.03437454
##           Linkedin..hrs.           Messages..hrs.
##              -0.29331090               0.08826666
```

```
Students_pca$rotation
```

```
##                                  PC1        PC2         PC3         PC4
## Whatsapp..hrs.           -0.39168477  0.1715611 -0.10801924 -0.35118117
## Instagram..hrs.          -0.21618594 -0.0891135 -0.53353494 -0.17784950
## Snapchat.hrs.            -0.29598832 -0.5536959 -0.07123748  0.21209415
## Telegram..hrs.            0.02583290  0.2461894  0.43898077  0.14664574
## Facebook.Messenger..hrs. -0.06122393  0.4031643 -0.37244898  0.07061816
## BeReal..hrs.             -0.04428598 -0.2099665 -0.02468688  0.74632116
## TikTok..hrs.              0.54527903 -0.2053547 -0.20279685 -0.13051521
## WeChat..hrs.              0.55993528 -0.2094978 -0.18840754 -0.12206903
## Twitter..hrs.             0.03437454  0.2146198 -0.52973897  0.34560767
## Linkedin..hrs.           -0.29331090 -0.4574943 -0.04328743 -0.20815016
## Messages..hrs.            0.08826666 -0.2176861  0.08628207 -0.14786486
##                                  PC5         PC6         PC7         PC8
## Whatsapp..hrs.            0.18685625 -0.11451661  0.52033027  0.24654030
## Instagram..hrs.           0.06993528  0.35635252 -0.12048825  0.53725157
## Snapchat.hrs.             0.12297710 -0.20306836 -0.03650218  0.06741939
## Telegram..hrs.            0.32346824 -0.41435075 -0.24375453  0.61044566
## Facebook.Messenger..hrs. -0.05184865 -0.54634117  0.30190959 -0.21843115
## BeReal..hrs.              0.02565614  0.08260979  0.47587146  0.13180450
## TikTok..hrs.              0.22500689 -0.15680524  0.16110800  0.10573497
## WeChat..hrs.              0.21011075 -0.10834234  0.11779690  0.08296863
## Twitter..hrs.            -0.13204695 -0.18165053 -0.48384459  0.06083257
## Linkedin..hrs.            0.16270253 -0.44257220 -0.22536426 -0.24457867
## Messages..hrs.           -0.83570873 -0.27653111  0.10798487  0.35597999
##                                  PC9         PC10         PC11
## Whatsapp..hrs.            0.54001865 -0.092442982  0.049321139
## Instagram..hrs.          -0.39366213  0.197048253 -0.014135627
## Snapchat.hrs.            -0.11762274 -0.691881725  0.031300220
## Telegram..hrs.           -0.11019464  0.062337339  0.010350919
## Facebook.Messenger..hrs. -0.49823309 -0.036967035  0.019070944
## BeReal..hrs.              0.06922897  0.374489650 -0.002068864
## TikTok..hrs.              0.07645893 -0.044651364 -0.694368827
## WeChat..hrs.              0.04413898  0.006023841  0.716628118
## Twitter..hrs.             0.51161801 -0.051282720  0.008142159
## Linkedin..hrs.            0.06526334  0.567599220 -0.009444762
## Messages..hrs.            0.02442628  0.040026662  0.007304666
```

```
plot(Students[,-1])
```




```
Students_pca$x
```

```
##                PC1           PC2          PC3         PC4          PC5
##   [1,] -0.416389889 -0.2965640115  0.256251509 -0.22115646  0.197705566
##   [2,] -0.972379460 -0.4534547890 -0.208196487 -0.54970124  0.511050897
##   [3,] -1.603608671 -1.1608229630 -0.942139583 -0.89353994  0.745355281
##   [4,] -1.383890607 -0.9926696594 -0.447019742 -0.74795734  0.630366509
##   [5,] -0.768091364 -0.6572135229 -0.220113513 -0.47442175  0.382717109
##   [6,] -0.754996653 -0.3748129436  0.002786294 -0.55409202  0.557704368
##   [7,] -0.657828390 -0.5382830720 -0.261863691 -0.44525877  0.319106416
##   [8,] -0.241218540 -0.2491805225  0.168869482  0.38661833  0.288527863
##   [9,]  0.181264122 -0.0311034891  0.897756127  0.43909203 -0.050468698
##  [10,]  0.035667587 -0.0653674965  1.060596899  0.91778417  0.149274460
##  [11,]  0.014725383 -0.0102237768  1.729244473  1.09805661  0.649976432
##  [12,]  0.371936274  0.6634589679  1.879305661  0.72004385  0.452513629
##  [13,]  0.062844523  0.6220812586  1.741575471  0.84096111  1.066546131
##  [14,]  0.075466200  0.1514879311  1.273592275  0.73738908  0.412912005
##  [15,] -2.120985868 -2.6571640142 -1.195287512  0.64677671  0.833500499
##  [16,] -0.276765699 -0.7054638643  0.063137968  0.40574054  0.098294777
##  [17,] -0.231228101 -1.9813994657 -0.166149448  6.25401279  0.016524790
##  [18,] -1.342560665 -4.5435864826 -0.149622042  9.37582774  0.630809870
##  [19,] -0.552670521 -2.1184306487  0.312007334  2.05837855 -0.779349285
##  [20,] -0.570577812 -1.5717901672 -0.256434873  0.68637631 -0.426218831
##  [21,] -0.255028051 -1.2123325065 -0.061977235  0.40863833 -0.726748853
##  [22,]  0.128428320  0.4819762509  0.456683538 -0.13079298 -0.033241419
##  [23,]  0.052474117  0.0937210477  0.023901062  0.01436224 -0.034840356
##  [24,]  0.221233179  0.0780742638  0.115194401  0.15083309 -0.112619988
##  [25,]  0.320153552  0.1769050486  0.586721646  0.22735908 -0.127680209
##  [26,]  0.181581063  0.0958082650  0.225850386  0.08703363 -0.080720299
##  [27,]  0.167648803  0.1358346473  0.407647495  0.10986330 -0.063654595
##  [28,] -0.002750549  0.2555529458  0.134842909 -0.12374179  0.005091954
##  [29,] -2.308434627 -3.8617659870  0.167455957 -0.02643501  1.227485170
##  [30,] -2.481920506 -3.7181082802 -0.147682230 -0.36008280  1.303155908
##  [31,] -1.022822818 -1.7174178610 -0.612183174 -0.45223175  0.497514289
##  [32,] -0.217306627 -0.5462724675  0.174095209 -0.38428482  0.161114976
##  [33,] -0.647016284 -0.7424294479 -0.158360354 -0.73419069  0.361232695
##  [34,] -0.723402376 -0.7377301123 -0.091679168 -0.79977142  0.405925950
##  [35,] -0.606515982 -0.4878696028 -0.292997209 -0.84153990 -0.068240313
##  [36,] -0.242835271  0.2159478970 -0.391753355 -0.26830800 -0.381368067
##  [37,] -0.152425215 -0.1198887459 -0.635112690 -0.21206882 -0.536476766
##  [38,] -0.414436644 -0.1767957614 -1.302541342 -0.43057201 -0.477531985
##  [39,] -0.021561562 -0.0008870563 -0.286423315 -0.01138847 -0.323866907
##  [40,] -0.143703910  0.2187825548 -0.474928361 -0.12557275 -0.194777160
##  [41,]  0.005800621  0.1047528800 -0.498637489 -0.07125657 -0.210875534
##  [42,] -0.362268779  0.0820879972 -0.563767216 -0.34580080  0.035505235
##  [43,]  0.002692584  0.4895491948  1.077027421  0.07478310  0.350384792
##  [44,] -0.038303371  0.3131580562  0.228094977 -0.28998546 -0.208072435
##  [45,]  0.128012345  0.6457829134  1.090491789  0.14597068  0.534489507
##  [46,]  0.106015509  0.4626686952  0.334452375 -0.10663156 -0.035459434
##  [47,] -0.029679656  0.3289331811  0.206289887 -0.11541655  0.018562354
##  [48,] -0.037752867  0.4298105942  0.208583172 -0.26482228  0.033041040
##  [49,] -0.263508663  0.5609455571  0.808003211 -0.12332750  0.584181064
##  [50,] -0.728057610  1.0305796946  0.352392800 -0.96021213  0.385124872
##  [51,] -0.065166189  0.6640205762  0.659064484 -0.36604519  0.082503255
```

```
##  [52,] -0.987588280  2.1608493413 -0.707612611 -0.82948716  0.284421196
##  [53,] -0.832751965  1.0432480987  0.286516894 -1.05107280  0.433109829
##  [54,] -0.307590359  1.2587406480  0.153139876 -0.41881900  0.094417690
##  [55,] -1.091430038  2.1901569567 -0.771481723 -0.92116812  0.331575970
##  [56,] -0.561785727  0.8686150351  0.330449015 -0.72867135  0.293475462
##  [57,]  1.285809880  0.3505735238  1.222315308  0.66706703 -0.479195377
##  [58,]  1.351592692  0.3358873736  1.198149777  0.66026821 -0.413413803
##  [59,]  1.402965111  0.3134333555  1.178691034  0.64618845 -0.403743157
##  [60,]  1.395135171  0.3106590865  1.152521141  0.62826658 -0.392454924
##  [61,]  1.402256016  0.3064565217  1.151691084  0.63474528 -0.396047689
##  [62,]  1.599320680  0.2336019436  1.088956070  0.58760318 -0.324540390
##  [63,]  1.255058882  0.3491519891  1.209955056  0.66015972 -0.510446229
##  [64,]  0.072727229 -0.2362413777  0.342478270  0.13374389 -0.685773044
##  [65,]  0.173390234 -0.6923652025  0.514151496  0.18981673 -0.756316636
##  [66,] -0.105161853 -0.8057329281 -0.120674265 -0.00612513 -0.519939026
##  [67,]  0.241315525 -0.1939011278  0.595811513  0.20286000 -0.661037349
##  [68,]  0.363304886 -0.2222312490  0.606657288  0.16401402 -0.847466504
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##  [86,] -1.16331579  0.969582509 -1.04842365 -0.851156690 -0.307182125
##  [87,] -0.49430803  0.593770376 -0.92844992 -0.146974395 -0.201614554
##  [88,] -4.10914502  1.076954431  0.38809875 -2.629813440 -0.177028833
##  [89,] -1.25806984  1.149711415 -0.88133082 -0.578906841 -0.303781139
##  [90,] -0.14097235  0.051239226 -0.57312116 -0.102039216 -0.046148562
##  [91,] -0.03950864  0.119291138  0.21158615 -0.181773706  0.018496721
##  [92,] -1.69727057  1.641133778 -1.36168347 -0.772986295  0.047253926
##  [93,] -1.62332024  1.979293240 -0.76841312 -0.447744548  0.216502672
##  [94,] -1.96010505  2.128545703 -0.33991978 -1.705626138  0.472253969
##  [95,] -0.60432662  0.816328256 -0.55351967  0.369885585  0.774673545
##  [96,] -0.26376127  0.934733486 -0.66802021  0.295517132  0.035887690
##  [97,]  0.11612440  0.585949582 -0.61010862 -0.239591877  0.014170412
##  [98,]  0.41733624  0.450348149 -0.30213804 -0.041465819  0.197218235
##  [99,] -3.12137394 -1.677531930  3.84783783 -0.063604798  0.339487319
## [100,] -0.48865321 -0.406729237 -0.04424487  0.372813797 -0.022535393
## [101,] -0.08932369 -0.186735324 -0.62732734  0.486174407 -0.086183138
## [102,] -0.20928015 -0.207284462 -0.62185509  0.686690545 -0.016590092
## [103,] -0.29963666  0.318859676 -0.60023229  1.172969254  0.013373201
## [104,] -1.24435927 -0.630291714  1.03184860  0.459601331  0.075841909
## [105,] -0.31281468  0.025859047 -0.29373943  0.771870975 -0.093539228
## [106,] -2.23672838 -0.202197742  0.01220140 -1.232468574 -0.302150081
## [107,] -1.75843141 -2.950446087  0.61669804  1.712865933 -0.166058554
## [108,] -0.06720614 -1.785491201  0.10466092  1.608015147 -0.443740287
## [109,]  0.48807347 -0.551389880 -0.23078746  0.902200001  0.205498928
## [110,]  0.01876960 -2.574893961  0.57973188  1.434611994  0.255438905
## [111,] -1.35951978 -1.383086421 -0.63537528  0.122070777 -0.068316577
## [112,]  0.07928259 -2.651097910  0.26313329  1.771040900 -0.116422947
## [113,]  0.47927718 -0.001509598 -0.36432249  0.604941818  0.323791959
## [114,] -0.03326624 -0.517155961  0.31080513  0.441540459  0.497809362
## [115,]  0.25981513 -0.498016746 -0.89483926  0.457910633  0.427020341
## [116,]  0.42391786 -0.764187064 -0.73124135  0.294130762  0.416937205
## [117,]  0.58597669 -0.609739051 -0.71027997  0.140795108  0.258457976
## [118,]  0.52267123 -0.713610198 -0.77753414  0.143401848  0.348791659
## [119,]  0.51741805 -0.406754731 -0.75698353  0.258617957  0.203894549
## [120,] -0.34637417  0.592053607 -0.43614455 -0.147389707  0.224098611
## [121,]  0.15774742  0.233705074  0.38692917  0.502221253  0.001687772
## [122,] -0.60762730 -0.236446256  0.69776946 -0.352855214  0.207155762
## [123,]  0.56094179 -0.378048981 -0.05819264 -0.261379332  0.742976412
## [124,] -0.44202055 -0.152376995 -0.87105332  0.522597899  0.436417435
## [125,]  0.56572981 -0.070248968 -0.16322013  0.069092069  0.339531209
## [126,] -0.42089881 -0.743896989 -0.13482816 -0.027789610  0.915497230
## [127,] -0.74639568 -0.088953029  0.73884114 -0.100350291  0.405319235
## [128,] -1.23152053  0.448555955  1.69970776  0.110835018  0.087429671
## [129,] -1.27007622  0.365674233  0.79618236  0.404403187  0.002874583
## [130,] -1.37280272  0.647892305  1.40483726  0.512722191  0.269480049
## [131,] -0.67681071 -0.058874209  0.57713648 -0.088675533  0.110308919
## [132,] -1.03220597  0.246418051  0.60458155  0.380003198  0.454136856
## [133,] -1.75836500  0.485068422  1.82440357  0.282636643  0.150147207
## [134,]  0.59767422 -0.480477488 -0.01141590 -0.392246318  0.254827329
## [135,]  0.37329773 -0.555635088 -0.45603531 -0.364177489 -0.128622517
```

```
## [136,]  0.63997656 -0.460991763 -0.13881943 -0.436821299 -0.180536427
## [137,]  0.39579504 -0.511090103 -0.44919241 -0.305108407 -0.326205541
## [138,]  0.23839898 -0.422472673 -0.64851229 -0.089897282 -0.437511659
## [139,]  0.31634919 -1.141187153  2.39144081 -1.211525397  0.451269200
## [140,]  1.16091615 -0.571090414  0.19899579 -0.775436974  0.121526340
## [141,]  1.68785284  1.345221708  2.17672590  0.580142935  0.378947460
## [142,]  1.20131756  1.127535172  1.43123408  0.615950914 -0.270984589
## [143,]  1.19252020  1.027194480  1.32345328  0.538735516 -0.270773123
## [144,]  1.23738645  1.191035559  1.44001026  0.700709945 -0.122118675
## [145,]  0.87978637  0.776012811  0.77093773  0.489110324 -0.363581605
## [146,]  1.18865690  0.381690083  0.64775446  0.045488199 -0.099131754
## [147,]  1.00518168  1.142150360  1.08593843  0.790003939 -0.377484371
## [148,]  1.22474362  0.303930828  1.34251970 -0.395007253 -0.098901827
## [149,]  0.96142393 -0.129036240  1.01182515 -0.433012235  0.213844802
## [150,]  1.59413646 -0.305167626  1.15699624 -0.935349733  0.426416139
## [151,]  1.08073021 -0.087912879  0.46034252 -0.332585797  0.285545647
## [152,]  1.20009252 -0.029060973  0.59406007 -0.367917385  0.164922318
## [153,]  1.31685186 -0.186412083  0.41499088 -0.518472329  0.235176435
## [154,]  1.22775223 -0.060846068  0.35632245 -0.335360207  0.182221629
## [155,] -0.90331196 -0.078183792  1.30501568  0.647620255 -0.146113104
## [156,] -0.04640023  0.126621602 -0.18953315  0.643417709 -0.106131452
## [157,]  0.19370594  0.517946552 -0.87041200  1.028462434 -0.275421759
## [158,]  0.28135013  0.677814338 -0.90144003  1.140894001 -0.355987696
## [159,] -1.41934808 -0.781444755  1.36026686  0.276795184  0.088610852
## [160,] -1.15293833 -0.737352643  1.30071791  0.624686406  0.236687055
## [161,]  0.49367809  0.038387022  1.36729598  0.051491097  0.525351081
## [162,]  1.01249897 -0.364714709 -0.10273079 -0.586739968 -0.515515530
## [163,]  0.86390894 -0.256355102 -0.17807802 -0.427283281 -0.718978246
## [164,]  1.16532111 -0.616735339 -0.22511114 -0.836057349 -0.219810672
## [165,]  1.05975260 -0.277052233 -0.11991510 -0.451164938 -0.249736180
## [166,]  0.98523231 -0.371975642 -0.56855321 -0.362849034 -0.099008080
## [167,] -1.18040226  1.110739361 -0.85423026 -2.390978274 -0.199638030
## [168,]  1.30541235 -0.341599237  0.25717130 -0.717824094 -0.210455496
## [169,]  0.29402341  0.010587165 -0.06114405 -0.449583412  0.159219546
## [170,] -1.34566640  1.161946282  0.21749121  0.701478642 -0.409478299
## [171,] -0.50867679  0.693123807  0.38324107  0.131796917 -0.104866563
## [172,] -0.63773688  0.537694869  0.85785579  0.155952577  0.049596197
## [173,] -0.40933043  0.457499668  0.40907092 -0.007234324  0.063814349
## [174,] -0.37521629  0.021231576 -0.19948386  0.192470094 -0.037217857
## [175,] -0.75683972  0.526705910  0.79170395  0.114418809  0.267120715
##                PC11
##   [1,] -0.0188736494
##   [2,]  0.0081155271
##   [3,] -0.0014659352
##   [4,]  0.0117896081
##   [5,] -0.0413045777
##   [6,] -0.0365117048
##   [7,] -0.0470660203
##   [8,] -0.0533181776
##   [9,] -0.0552382234
##  [10,] -0.0141991420
##  [11,]  0.0087169819
```

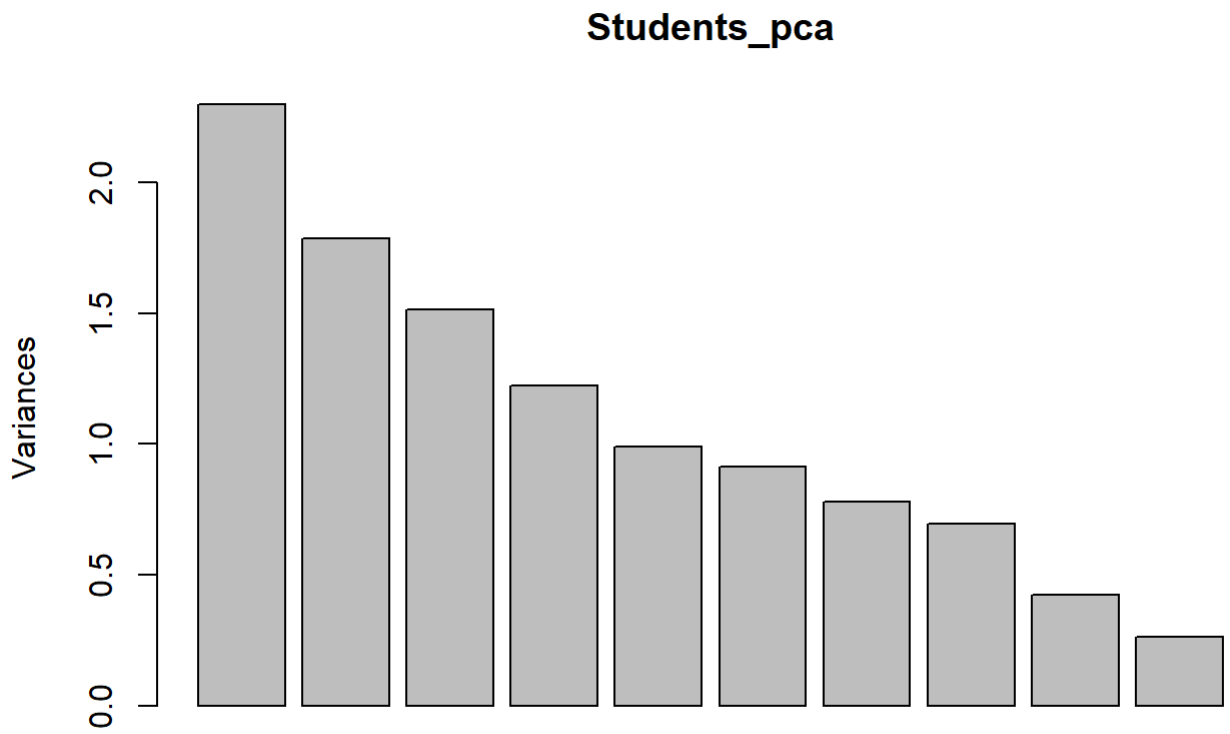
```
##  [12,] -0.0178917745
##  [13,]  0.0021597085
##  [14,] -0.0216510185
##  [15,]  0.1305694060
##  [16,] -0.0248955986
##  [17,] -0.0349873144
##  [18,]  0.0237650930
##  [19,]  0.0306468935
##  [20,] -0.0279345467
##  [21,] -0.0399419742
##  [22,] -0.0374566235
##  [23,] -0.0643527383
##  [24,] -0.0794625037
##  [25,] -0.0556420868
##  [26,] -0.0711725057
##  [27,] -0.0517730539
##  [28,] -0.0482387906
##  [29,]  0.0483836367
##  [30,]  0.0404019187
##  [31,] -0.1019556494
##  [32,] -0.1082361976
##  [33,] -0.0977206183
##  [34,] -0.0856366948
##  [35,] -0.0739485583
##  [36,] -0.0254701383
##  [37,] -0.0698707323
##  [38,] -0.0841366620
##  [39,] -0.0619927613
##  [40,] -0.0510672983
##  [41,] -0.0861998371
##  [42,] -0.0480595147
##  [43,] -0.0174615071
##  [44,] -0.0324853189
##  [45,] -0.0374329562
##  [46,] -0.0383960084
##  [47,] -0.0308086431
##  [48,] -0.0375691175
##  [49,] -0.0029773611
##  [50,]  0.0865052105
##  [51,]  0.0026500174
##  [52,]  0.1506231998
##  [53,]  0.0949014994
##  [54,]  0.0491646814
##  [55,]  0.1604167133
##  [56,]  0.0615617661
##  [57,]  0.0499974533
##  [58,]  0.1377475290
##  [59,]  0.2037672630
##  [60,]  0.2177110200
##  [61,]  0.2165705444
##  [62,]  0.4726451278
##  [63,]  0.0188000613
```

```
##  [64,] -0.0333869035
##  [65,] -0.0633837708
##  [66,] -0.0849417835
##  [67,] -0.0346487351
##  [68,] -0.0567820916
##  [69,] -0.0377923053
##  [70,] -0.0412174212
##  [71,]  0.0018935474
##  [72,] -0.0220524684
##  [73,] -0.0134063438
##  [74,] -0.0927704124
##  [75,] -0.0236558644
##  [76,] -0.0210104039
##  [77,] -0.0117773072
##  [78,]  0.0119036941
##  [79,]  0.0283151887
##  [80,]  0.0965948021
##  [81,]  0.0653918416
##  [82,]  0.0832160402
##  [83,]  0.0784705273
##  [84,]  0.0253598243
##  [85,]  0.0198707561
##  [86,]  0.0275346247
##  [87,] -0.0009682919
##  [88,]  0.1165314769
##  [89,]  0.0403847504
##  [90,] -0.0346363716
##  [91,] -0.0288749901
##  [92,]  0.0695935559
##  [93,]  0.1032214794
##  [94,]  0.1011233306
##  [95,]  0.0228207186
##  [96,]  0.0215124045
##  [97,] -0.0153943497
##  [98,] -0.0224604400
##  [99,]  0.0585426676
## [100,] -0.0286594843
## [101,] -0.0377916611
## [102,] -0.0286632948
## [103,]  0.0102530044
## [104,]  0.0097227483
## [105,] -0.0056198205
## [106,]  0.0903276401
## [107,]  0.0566941537
## [108,] -0.0029394027
## [109,] -0.0492205059
## [110,] -0.0402661622
## [111,]  0.0003350810
## [112,] -0.0414353090
## [113,] -0.0347499229
## [114,] -0.0335001643
## [115,] -0.0691065901
```

```
## [116,] -0.0839675594
## [117,] -0.0853635634
## [118,] -0.0900666401
## [119,] -0.0731721766
## [120,] -0.0015665960
## [121,]  0.0111530400
## [122,]  0.0007688892
## [123,] -0.0719346341
## [124,] -0.0231656894
## [125,] -0.0423423210
## [126,] -0.0610244377
## [127,] -0.0329767240
## [128,]  0.0039479633
## [129,]  0.0042588040
## [130,]  0.0084652840
## [131,] -0.0340426196
## [132,] -0.0192940102
## [133,]  0.0370833642
## [134,] -0.0714370791
## [135,] -0.0740095736
## [136,] -0.0691327730
## [137,] -0.0660981623
## [138,] -0.0598144376
## [139,] -0.0654736609
## [140,] -0.0981170632
## [141,]  0.0574161440
## [142,]  0.0639496382
## [143,]  0.0547229740
## [144,]  0.0619975135
## [145,]  0.0324292803
## [146,] -0.0128516759
## [147,]  0.0669531174
## [148,] -0.0052354267
## [149,] -0.0333836083
## [150,] -0.0750018279
## [151,] -0.0513143164
## [152,] -0.0469746995
## [153,] -0.0724880874
## [154,] -0.0604165040
## [155,]  0.0448229207
## [156,] -0.0073925794
## [157,] -0.0009251753
## [158,]  0.0073833739
## [159,]  0.0092130526
## [160,]  0.0160076861
## [161,] -0.0109158078
## [162,] -0.0632908346
## [163,] -0.0460524188
## [164,] -0.1001505656
## [165,] -0.0692812655
## [166,] -0.0902698956
## [167,] -0.6920773876
```

```
## [168,] -0.0742945703
## [169,]  2.0958195384
## [170,] -2.9423396624
## [171,] -0.3030793771
## [172,]  0.3119325072
## [173,]  2.2507222045
## [174,]  0.0975684772
## [175,]  0.2228110233
```

```
plot(Students_pca)
```




```
#get the original value of the data based on PCA
center <- Students_pca$center
scale <- Students_pca$scale
new_Students <- as.matrix(Students[,3:13])
new_Students
```

```
##        Whatsapp..hrs. Instagram..hrs. Snapchat.hrs. Telegram..hrs.
##   [1,]           8.90            7.10          1.90           0.02
##   [2,]          11.85           11.16          2.45           0.06
##   [3,]          12.25           16.75          3.25           0.01
##   [4,]          12.33           12.90          3.12           0.06
##   [5,]           8.50           11.90          1.90           0.05
##   [6,]           9.50           11.25          1.20           0.16
##   [7,]           8.25           11.75          1.67           0.00
##   [8,]           5.70           12.00          2.00           0.25
##   [9,]           4.50            7.25          1.40           0.35
##  [10,]           6.80            4.50          2.10           0.33
##  [11,]           5.90            3.50          3.25           0.72
##  [12,]           5.50            4.50          1.35           0.82
##  [13,]           6.20            7.00          2.50           0.96
##  [14,]           5.70            6.50          2.10           0.59
##  [15,]          10.50           14.80         12.10           0.00
##  [16,]           5.20            8.00          4.00           0.00
##  [17,]           3.30            4.00          4.30           0.00
##  [18,]           3.50            7.00         10.00           0.00
##  [19,]           5.23            6.30          7.12           0.00
##  [20,]           4.30           12.30          5.20           0.00
##  [21,]           3.70           11.20          4.30           0.00
##  [22,]           8.40            5.80          0.28           0.00
##  [23,]           5.73           10.25          1.20           0.00
##  [24,]           4.20            9.75          1.15           0.00
##  [25,]           5.25            5.00          1.15           0.00
##  [26,]           5.00            8.50          1.00           0.00
##  [27,]           6.00            6.50          1.20           0.00
##  [28,]           7.50            8.90          0.80           0.00
##  [29,]           7.50            4.90          9.50           0.06
##  [30,]           8.90            7.80          8.60           0.06
##  [31,]           3.90           15.10          2.70           0.00
##  [32,]           4.60            8.60          0.00           0.00
##  [33,]           6.70           11.10          0.00           0.00
##  [34,]           7.70           10.20          0.00           0.00
##  [35,]           8.40           12.70          0.00           0.00
##  [36,]           8.38           12.36          1.40           0.00
##  [37,]           5.42           16.25          1.50           0.00
##  [38,]           5.52           22.29          1.46           0.00
##  [39,]           5.25           12.59          1.59           0.00
##  [40,]           6.53           13.34          1.32           0.00
##  [41,]           4.52           14.90          1.01           0.00
##  [42,]           8.30           15.38          1.32           0.00
##  [43,]           8.00            7.00          1.00           0.50
##  [44,]           9.00            8.00          0.50           0.00
##  [45,]           7.00            7.00          0.50           0.50
##  [46,]           8.20            7.00          0.50           0.00
##  [47,]           8.50            8.00          1.00           0.00
##  [48,]           9.00            8.00          0.30           0.00
##  [49,]          10.00            9.00          1.00           0.50
##  [50,]          20.00            4.34          0.04           0.00
##  [51,]          12.00            3.10          0.00           0.00
```

```
##  [52,]         21.00           4.50         0.14          0.00
##  [53,]         20.93           4.75         0.04          0.00
##  [54,]         13.99           2.83         0.00          0.00
##  [55,]         22.03           4.88         0.14          0.00
##  [56,]         17.17           4.73         0.35          0.00
##  [57,]          0.00           0.13         0.00          0.00
##  [58,]          0.00           0.10         0.00          0.00
##  [59,]          0.00           0.13         0.00          0.00
##  [60,]          0.12           0.32         0.00          0.00
##  [61,]          0.02           0.35         0.00          0.00
##  [62,]          0.08           0.30         0.00          0.00
##  [63,]          0.00           0.35         0.00          0.00
##  [64,]          5.01           5.24         2.04          0.00
##  [65,]          3.22           6.24         2.31          0.00
##  [66,]          3.03          12.16         2.26          0.00
##  [67,]          5.46           5.17         2.10          0.00
##  [68,]          4.26           5.57         1.55          0.00
##  [69,]          4.32           4.05         2.48          0.00
##  [70,]          6.15           4.29         1.48          0.00
##  [71,]         11.50           6.70         0.01          0.01
##  [72,]         11.20           8.20         0.01          0.01
##  [73,]         10.00           8.10         0.01          0.02
##  [74,]          3.00           3.60         0.01          0.01
##  [75,]          9.00           8.00         0.01          0.02
##  [76,]         10.00          10.50         0.01          0.01
##  [77,]         12.00           9.50         0.00          0.00
##  [78,]          8.10          10.70         7.90          0.00
##  [79,]         10.30          10.50         7.30          0.00
##  [80,]         14.50          11.50         8.80          0.00
##  [81,]         13.40          11.30         7.40          0.00
##  [82,]         13.80          10.60         8.10          0.00
##  [83,]         12.70          10.40         8.30          0.00
##  [84,]         10.30           8.40         5.10          0.00
##  [85,]         11.07           2.50         0.28          0.06
##  [86,]          8.37           3.05         0.29          0.14
##  [87,]          8.13           2.43         0.23          0.09
##  [88,]          8.45           3.10         0.16          1.10
##  [89,]          9.52           2.54         0.23          0.11
##  [90,]          6.26           3.14         0.08          0.21
##  [91,]          7.17           6.41         0.09          0.24
##  [92,]         12.58           4.23         0.00          0.00
##  [93,]         16.98           7.58         0.00          0.00
##  [94,]         15.95          14.00         0.00          0.00
##  [95,]         14.20           8.00         0.00          0.00
##  [96,]         12.20           5.00         0.00          0.00
##  [97,]          9.10           7.00         0.00          0.00
##  [98,]         10.00           9.00         0.00          0.00
##  [99,]          8.43           0.00         0.00          2.39
## [100,]          6.20           0.00         0.00          0.56
## [101,]          6.28           0.00         0.00          0.29
## [102,]          7.19           0.00         0.00          0.29
## [103,]         11.34           0.00         0.00          0.21
```

```
## [104,]          8.30           0.00          0.00          1.05
## [105,]          9.05           0.00          0.00          0.39
## [106,]          9.34          18.50          1.20          0.00
## [107,]          7.49          18.58          0.52          0.00
## [108,]          7.22          10.33          1.12          0.00
## [109,]          5.46           7.35          0.42          0.00
## [110,]          5.47          16.43          0.49          0.00
## [111,]          4.40          10.48          0.42          0.00
## [112,]          4.34          12.43          0.53          0.00
## [113,]          9.63           7.35          0.00          0.00
## [114,]          8.73           7.80          0.00          0.34
## [115,]          5.80           4.75          0.00          0.00
## [116,]          4.48           6.38          0.00          0.00
## [117,]          4.20           6.15          0.00          0.00
## [118,]          3.87           6.13          0.00          0.00
## [119,]          5.18           5.19          0.00          0.00
## [120,]         10.00           7.50          0.50          0.00
## [121,]         12.25           8.20          1.00          0.25
## [122,]          9.00           9.70          0.30          0.50
## [123,]          7.25          12.67          0.80          0.00
## [124,]          8.84           4.77          1.82          0.00
## [125,]          9.00          10.50          1.00          0.00
## [126,]          6.43           7.16          0.62          0.35
## [127,]          6.00           9.00          2.00          0.00
## [128,]          7.00           8.00          2.00          0.00
## [129,]          7.00           4.00          2.00          0.00
## [130,]          8.00           5.00          1.00          0.00
## [131,]          5.00           7.00          2.00          0.00
## [132,]          7.00           5.00          1.00          0.00
## [133,]          9.25           9.00          3.30          0.00
## [134,]          5.50          10.40          1.00          0.12
## [135,]          3.22           6.28          1.49          0.10
## [136,]          4.20           8.45          1.40          0.11
## [137,]          3.40           5.25          1.50          0.15
## [138,]          3.32           2.28          1.20          0.18
## [139,]          5.30          16.70          0.45          0.90
## [140,]          3.59          12.28          0.51          0.11
## [141,]         22.50          24.00          0.00          0.00
## [142,]         19.50          18.00          1.50          0.00
## [143,]         18.50          17.50          1.50          0.00
## [144,]         20.00          18.00          1.00          0.00
## [145,]         15.00          13.00          1.50          0.00
## [146,]         12.00          14.50          1.00          0.00
## [147,]         19.00          15.00          1.50          0.00
## [148,]         12.55          19.12          1.56          0.09
## [149,]         10.13          17.35          1.52          0.13
## [150,]          8.12          21.53          1.04          0.02
## [151,]          9.01          15.35          1.02          0.00
## [152,]          9.30          16.01          1.11          0.00
## [153,]          7.20          15.04          0.56          0.00
## [154,]          8.10          14.03          0.54          0.00
## [155,]         12.13           3.00          0.50          0.90
```

```
## [156,]          9.50           2.30          0.20          0.30
## [157,]         10.50           0.00          0.00          0.06
## [158,]         11.36           0.00          0.00          0.01
## [159,]          7.70           0.00          0.00          1.22
## [160,]          9.70           3.00          0.00          1.00
## [161,]         12.50          14.30          0.00          0.40
## [162,]          4.52          10.60          2.19          0.00
## [163,]          5.21           9.28          2.60          0.00
## [164,]          2.14          10.80          1.40          0.00
## [165,]          5.10          10.35          1.29          0.00
## [166,]          3.40           7.20          0.46          0.00
## [167,]          5.20          11.00          0.57          0.00
## [168,]          5.23          13.80          1.50          0.00
## [169,]          0.04           7.60          0.00          0.00
## [170,]          0.00           1.80          0.00          0.00
## [171,]          0.73           6.33          0.00          0.00
## [172,]          0.15           9.30          0.00          0.00
## [173,]          0.03           7.20          0.00          0.00
## [174,]          0.05           3.60          0.00          0.00
## [175,]          0.01          10.00          0.00          0.00
##       Facebook.Messenger..hrs. BeReal..hrs. TikTok..hrs. WeChat..hrs.
##   [1,]                     0.00         0.00         0.00         0.00
##   [2,]                     0.00         0.00         0.00         0.00
##   [3,]                     0.00         0.00         0.00         0.00
##   [4,]                     0.00         0.00         0.00         0.00
##   [5,]                     0.00         0.00         0.00         0.00
##   [6,]                     0.00         0.00         0.00         0.00
##   [7,]                     0.00         0.00         0.00         0.00
##   [8,]                     0.00         0.35         0.00         0.00
##   [9,]                     0.00         0.21         0.00         0.00
##  [10,]                     0.00         0.65         0.00         0.00
##  [11,]                     0.00         0.42         0.00         0.00
##  [12,]                     0.00         0.15         0.00         0.00
##  [13,]                     0.00         0.14         0.00         0.00
##  [14,]                     0.00         0.32         0.00         0.00
##  [15,]                     0.00         0.00         0.00         0.00
##  [16,]                     0.00         0.00         0.00         0.00
##  [17,]                     0.00         5.40         0.00         0.00
##  [18,]                     0.00         8.60         0.00         0.00
##  [19,]                     0.00         1.57         0.00         0.00
##  [20,]                     0.00         0.50         0.00         0.00
##  [21,]                     0.00         0.20         0.00         0.00
##  [22,]                     0.00         0.00         0.00         0.00
##  [23,]                     0.00         0.00         0.00         0.00
##  [24,]                     0.00         0.00         0.00         0.00
##  [25,]                     0.00         0.00         0.00         0.00
##  [26,]                     0.00         0.00         0.00         0.00
##  [27,]                     0.00         0.00         0.00         0.00
##  [28,]                     0.00         0.00         0.00         0.00
##  [29,]                     0.00         0.00         0.00         0.00
##  [30,]                     0.00         0.00         0.00         0.00
##  [31,]                     0.00         0.00         0.00         0.00
```

```
##  [32,]                0.00         0.00         0.00         0.00
##  [33,]                0.00         0.00         0.00         0.00
##  [34,]                0.00         0.00         0.00         0.00
##  [35,]                0.00         0.00         0.00         0.00
##  [36,]                0.20         0.00         0.00         0.00
##  [37,]                0.10         0.00         0.00         0.00
##  [38,]                0.14         0.00         0.00         0.00
##  [39,]                0.11         0.00         0.00         0.00
##  [40,]                0.20         0.00         0.00         0.00
##  [41,]                0.10         0.00         0.00         0.00
##  [42,]                0.00         0.00         0.00         0.00
##  [43,]                0.00         0.00         0.00         0.00
##  [44,]                0.00         0.00         0.00         0.00
##  [45,]                0.00         0.00         0.00         0.00
##  [46,]                0.00         0.00         0.00         0.00
##  [47,]                0.00         0.00         0.00         0.00
##  [48,]                0.00         0.00         0.00         0.00
##  [49,]                0.00         0.00         0.00         0.00
##  [50,]                0.00         0.00         0.00         0.00
##  [51,]                0.00         0.00         0.00         0.00
##  [52,]                1.15         0.00         0.00         0.00
##  [53,]                0.00         0.00         0.00         0.00
##  [54,]                0.55         0.00         0.00         0.00
##  [55,]                1.15         0.00         0.00         0.00
##  [56,]                0.04         0.00         0.00         0.00
##  [57,]                0.00         0.00         0.00         0.37
##  [58,]                0.00         0.00         0.00         0.57
##  [59,]                0.00         0.00         0.00         0.72
##  [60,]                0.00         0.00         0.00         0.75
##  [61,]                0.00         0.00         0.00         0.75
##  [62,]                0.00         0.00         0.00         1.33
##  [63,]                0.00         0.00         0.00         0.30
##  [64,]                0.27         0.00         0.00         0.00
##  [65,]                0.00         0.00         0.00         0.00
##  [66,]                0.00         0.00         0.00         0.00
##  [67,]                0.00         0.00         0.00         0.00
##  [68,]                0.00         0.00         0.00         0.00
##  [69,]                0.00         0.00         0.00         0.00
##  [70,]                0.00         0.00         0.00         0.00
##  [71,]                0.50         0.00         0.00         0.00
##  [72,]                0.10         0.00         0.00         0.00
##  [73,]                0.60         0.00         0.00         0.00
##  [74,]                0.30         0.00         0.00         0.00
##  [75,]                0.60         0.00         0.00         0.00
##  [76,]                0.50         0.00         0.00         0.00
##  [77,]                0.10         0.00         0.00         0.00
##  [78,]                0.00         0.00         0.00         0.00
##  [79,]                0.00         0.00         0.00         0.00
##  [80,]                0.00         0.00         0.00         0.00
##  [81,]                0.00         0.00         0.00         0.00
##  [82,]                0.00         0.00         0.00         0.00
##  [83,]                0.00         0.00         0.00         0.00
```

```
##  [84,]                0.00         0.00         0.00         0.00
##  [85,]                0.39         0.00         0.00         0.00
##  [86,]                1.14         0.00         0.00         0.00
##  [87,]                0.59         0.00         0.00         0.00
##  [88,]                2.35         0.00         0.00         0.00
##  [89,]                1.08         0.00         0.00         0.00
##  [90,]                0.29         0.00         0.00         0.00
##  [91,]                0.23         0.00         0.00         0.00
##  [92,]                1.50         0.00         0.00         0.00
##  [93,]                1.45         0.00         0.00         0.00
##  [94,]                2.00         0.00         0.00         0.00
##  [95,]                0.50         0.00         0.00         0.00
##  [96,]                0.50         0.00         0.00         0.00
##  [97,]                0.50         0.00         0.00         0.00
##  [98,]                0.30         0.00         0.00         0.00
##  [99,]                0.00         0.00         0.00         0.00
## [100,]                0.00         0.00         0.00         0.00
## [101,]                0.00         0.00         0.00         0.00
## [102,]                0.00         0.00         0.00         0.00
## [103,]                0.00         0.00         0.00         0.00
## [104,]                0.00         0.00         0.00         0.00
## [105,]                0.00         0.00         0.00         0.00
## [106,]                2.34         0.19         0.00         0.00
## [107,]                1.50         0.28         0.00         0.00
## [108,]                0.28         0.10         0.00         0.00
## [109,]                0.12         0.90         0.00         0.00
## [110,]                0.35         0.21         0.00         0.00
## [111,]                1.30         0.16         0.00         0.00
## [112,]                0.23         0.20         0.00         0.00
## [113,]                0.00         0.00         0.00         0.00
## [114,]                0.00         0.00         0.00         0.00
## [115,]                0.00         0.00         0.00         0.00
## [116,]                0.00         0.00         0.00         0.00
## [117,]                0.00         0.00         0.00         0.00
## [118,]                0.00         0.00         0.00         0.00
## [119,]                0.00         0.00         0.00         0.00
## [120,]                0.50         0.00         0.00         0.00
## [121,]                0.00         0.00         0.00         0.00
## [122,]                0.50         0.00         0.00         0.00
## [123,]                0.00         0.00         0.00         0.00
## [124,]                0.00         0.00         0.00         0.00
## [125,]                0.00         0.00         0.00         0.00
## [126,]                0.00         0.00         0.00         0.00
## [127,]                0.00         0.00         0.00         0.00
## [128,]                0.00         0.00         0.00         0.00
## [129,]                0.00         0.00         0.00         0.00
## [130,]                0.00         0.00         0.00         0.00
## [131,]                0.00         0.00         0.00         0.00
## [132,]                0.00         0.00         0.00         0.00
## [133,]                0.00         0.00         0.00         0.00
## [134,]                0.00         0.00         0.00         0.00
## [135,]                0.00         0.00         0.00         0.00
```

```
## [136,]                    0.00         0.00         0.00         0.00
## [137,]                    0.00         0.00         0.00         0.00
## [138,]                    0.00         0.00         0.00         0.00
## [139,]                    0.00         0.00         0.00         0.00
## [140,]                    0.00         0.00         0.00         0.00
## [141,]                    0.00         0.00         0.00         0.00
## [142,]                    0.00         0.00         0.00         0.00
## [143,]                    0.00         0.00         0.00         0.00
## [144,]                    0.00         0.00         0.00         0.00
## [145,]                    0.00         0.00         0.00         0.00
## [146,]                    0.00         0.00         0.00         0.00
## [147,]                    0.00         0.00         0.00         0.00
## [148,]                    0.07         0.00         0.00         0.00
## [149,]                    0.00         0.00         0.00         0.00
## [150,]                    0.00         0.00         0.00         0.00
## [151,]                    0.00         0.00         0.00         0.00
## [152,]                    0.00         0.00         0.00         0.00
## [153,]                    0.00         0.00         0.00         0.00
## [154,]                    0.00         0.00         0.00         0.00
## [155,]                    0.00         0.00         0.00         0.00
## [156,]                    0.00         0.00         0.00         0.00
## [157,]                    0.00         0.00         0.00         0.00
## [158,]                    0.00         0.00         0.00         0.00
## [159,]                    0.00         0.00         0.00         0.00
## [160,]                    0.00         0.00         0.00         0.00
## [161,]                    0.00         0.00         0.00         0.00
## [162,]                    0.00         0.00         0.00         0.00
## [163,]                    0.00         0.00         0.00         0.00
## [164,]                    0.00         0.00         0.00         0.00
## [165,]                    0.00         0.00         0.00         0.00
## [166,]                    0.00         0.00         0.00         0.00
## [167,]                    1.70         0.00         0.46         0.00
## [168,]                    0.00         0.00         0.00         0.00
## [169,]                    0.00         0.00         0.60         7.10
## [170,]                    0.00         0.00         3.90         6.83
## [171,]                    0.00         0.00         2.33         7.50
## [172,]                    0.00         0.00         2.50         9.50
## [173,]                    0.00         0.00         1.50        10.50
## [174,]                    0.00         0.00         1.33         5.00
## [175,]                    0.00         0.00         2.70        10.00
##       Twitter..hrs. Linkedin..hrs. Messages..hrs.
##   [1,]          0.00           4.50           0.10
##   [2,]          0.00           5.50           0.04
##   [3,]          0.00           9.50           0.01
##   [4,]          0.00           9.00           0.20
##   [5,]          0.00           7.50           0.10
##   [6,]          0.00           8.00           0.01
##   [7,]          0.00           6.50           0.00
##   [8,]          0.00           2.50           0.20
##   [9,]          0.00           2.67           0.80
##  [10,]          0.00           1.55           0.50
##  [11,]          0.00           1.95           0.40
```

```
##  [12,]         0.00          0.85          0.70
##  [13,]         0.00          0.25          0.00
##  [14,]         0.00          1.70          0.50
##  [15,]         0.50          2.30          0.00
##  [16,]         0.20          2.00          0.00
##  [17,]         1.20          1.50          0.00
##  [18,]         0.00          1.00          0.00
##  [19,]         0.00          1.00          2.13
##  [20,]         0.00          3.00          1.37
##  [21,]         0.00          2.00          1.70
##  [22,]         0.00          0.68          0.00
##  [23,]         0.00          0.45          0.00
##  [24,]         0.00          0.25          0.00
##  [25,]         0.00          0.49          0.00
##  [26,]         0.00          1.00          0.00
##  [27,]         0.00          0.80          0.00
##  [28,]         0.00          0.75          0.00
##  [29,]         0.00         21.90          0.00
##  [30,]         0.00         22.80          0.00
##  [31,]         0.00         13.80          0.00
##  [32,]         0.00         10.20          0.00
##  [33,]         0.00         12.60          0.00
##  [34,]         0.00         13.10          0.00
##  [35,]         0.00          9.20          0.80
##  [36,]         0.00          0.04          0.90
##  [37,]         0.00          0.13          1.12
##  [38,]         0.00          0.11          1.16
##  [39,]         0.00          0.08          0.59
##  [40,]         0.00          0.02          0.40
##  [41,]         0.00          0.10          0.31
##  [42,]         0.00          0.04          0.19
##  [43,]         0.00          2.00          0.50
##  [44,]         0.00          1.00          0.50
##  [45,]         0.00          2.00          0.00
##  [46,]         0.00          0.00          0.00
##  [47,]         0.00          0.00          0.00
##  [48,]         0.00          1.00          0.00
##  [49,]         0.00          2.00          0.25
##  [50,]         0.00          0.31          0.00
##  [51,]         0.00          1.40          0.00
##  [52,]         0.00          0.11          0.00
##  [53,]         0.00          0.46          0.00
##  [54,]         0.00          1.51          0.00
##  [55,]         0.00          0.13          0.00
##  [56,]         0.00          0.42          0.00
##  [57,]         0.00          0.00          0.08
##  [58,]         0.00          0.00          0.00
##  [59,]         0.00          0.00          0.02
##  [60,]         0.00          0.00          0.02
##  [61,]         0.00          0.00          0.02
##  [62,]         0.00          0.00          0.03
##  [63,]         0.00          0.00          0.13
```

```
##  [64,]         0.00          3.21          1.31
##  [65,]         0.00          3.49          1.45
##  [66,]         0.00          4.05          1.16
##  [67,]         0.00          0.28          1.17
##  [68,]         0.00          1.12          1.45
##  [69,]         0.00          0.56          1.37
##  [70,]         0.00          2.30          0.40
##  [71,]         0.00          6.00          0.10
##  [72,]         0.00          5.00          0.00
##  [73,]         0.00          6.00          0.00
##  [74,]         0.00          8.00          0.01
##  [75,]         0.00          6.00          0.01
##  [76,]         0.00          4.00          0.00
##  [77,]         0.00          2.00          0.00
##  [78,]         0.00         22.70          0.00
##  [79,]         0.00         22.30          0.10
##  [80,]         0.00         20.40          0.40
##  [81,]         0.00         19.50          0.00
##  [82,]         0.00         18.70          0.00
##  [83,]         0.00         17.40          0.20
##  [84,]         0.00         10.50          0.00
##  [85,]         0.00          1.55          0.42
##  [86,]         0.00          0.54          0.14
##  [87,]         0.00          1.07          0.35
##  [88,]         0.00          0.41          0.42
##  [89,]         0.00          0.59          1.05
##  [90,]         0.00          1.02          0.24
##  [91,]         0.00          0.33          1.46
##  [92,]         0.00          3.60          0.06
##  [93,]         0.00          4.60          0.21
##  [94,]         0.00          4.80          0.68
##  [95,]         0.00          8.00          0.20
##  [96,]         0.00          2.40          0.30
##  [97,]         0.00          1.10          0.04
##  [98,]         0.00          2.00          0.00
##  [99,]         0.02          1.36          0.15
## [100,]         0.04          1.20          0.22
## [101,]         0.05          1.19          0.09
## [102,]         0.22          2.01          0.04
## [103,]         0.14          3.04          0.16
## [104,]         0.09          1.56          0.05
## [105,]         0.05          1.42          0.05
## [106,]         4.23          0.32          0.00
## [107,]         8.50          0.12          0.00
## [108,]         4.27          0.08          0.00
## [109,]         2.20          0.12          0.00
## [110,]         5.30          2.04          0.00
## [111,]         4.27          1.36          0.00
## [112,]         5.39          0.12          0.00
## [113,]         0.37          3.45          0.13
## [114,]         0.56          4.10          0.09
## [115,]         0.53          4.60          0.11
```

```
## [116,]         0.78          3.86          0.15
## [117,]         0.54          2.45          0.16
## [118,]         0.60          3.20          0.10
## [119,]         0.40          2.40          0.20
## [120,]         0.00          4.00          1.00
## [121,]         0.00          3.00          0.00
## [122,]         0.60          2.00          0.00
## [123,]         0.00          6.80          0.31
## [124,]         0.00          9.74          0.57
## [125,]         0.00          5.00          0.00
## [126,]         0.00          8.87          0.00
## [127,]         0.00          7.00          6.00
## [128,]         0.00          4.00         10.00
## [129,]         0.00          5.00          8.00
## [130,]         0.00          4.00         10.00
## [131,]         0.00          5.00          6.00
## [132,]         0.00          6.00          7.00
## [133,]         0.00          8.00         10.30
## [134,]         0.00          3.50          0.10
## [135,]         0.00          2.50          0.50
## [136,]         0.00          1.30          0.30
## [137,]         0.00          1.20          0.20
## [138,]         0.00          0.34          0.30
## [139,]         0.00          0.22          0.00
## [140,]         0.00          0.17          0.00
## [141,]         0.00          0.50          0.01
## [142,]         0.00          0.50          0.01
## [143,]         0.00          0.50          0.00
## [144,]         0.00          0.50          0.00
## [145,]         0.00          0.50          0.50
## [146,]         0.00          0.50          0.00
## [147,]         0.00          0.50          0.00
## [148,]         0.00          0.47          0.04
## [149,]         0.00          3.05          0.03
## [150,]         0.00          2.05          0.04
## [151,]         0.00          3.01          0.04
## [152,]         0.00          2.07          0.03
## [153,]         0.00          1.15          0.05
## [154,]         0.00          1.13          0.05
## [155,]         0.00          0.90          0.15
## [156,]         0.00          1.30          0.12
## [157,]         0.00          0.70          0.04
## [158,]         0.00          0.25          0.06
## [159,]         0.00          1.23          0.03
## [160,]         0.50          2.43          0.06
## [161,]         0.00          2.50          0.08
## [162,]         0.00          0.20          0.02
## [163,]         0.00          0.12          0.07
## [164,]         0.00          0.11          0.03
## [165,]         0.00          0.20          0.05
## [166,]         0.00          0.00          0.00
## [167,]         0.00          0.14          0.00
```

```
## [168,]         0.00          0.00          0.00
## [169,]         0.00          0.35          0.82
## [170,]         0.33          0.15          1.40
## [171,]         0.21          0.04          1.28
## [172,]         0.67          0.50          1.50
## [173,]         0.33          0.33          1.35
## [174,]         0.50          0.67          1.80
## [175,]         0.60          2.30          1.00
```

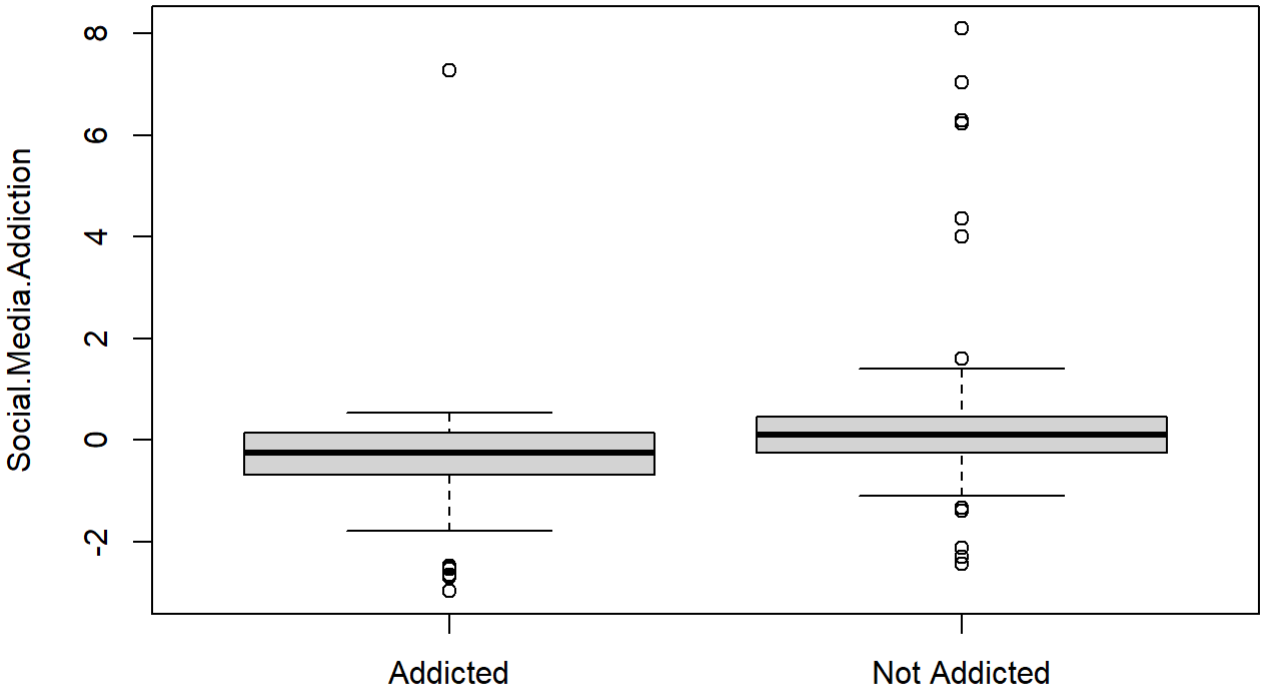
```
drop(scale(new_Students,center=center, scale=scale)%*%Students_pca$rotation[,1])
```

```
##   [1] -0.416389889 -0.972379460 -1.603608671 -1.383890607 -0.768091364
##   [6] -0.754996653 -0.657828390 -0.241218540  0.181264122  0.035667587
##  [11]  0.014725383  0.371936274  0.062844523  0.075466200 -2.120985868
##  [16] -0.276765699 -0.231228101 -1.342560665 -0.552670521 -0.570577812
##  [21] -0.255028051  0.128428320  0.052474117  0.221233179  0.320153552
##  [26]  0.181581063  0.167648803 -0.002750549 -2.308434627 -2.481920506
##  [31] -1.022822818 -0.217306627 -0.647016284 -0.723402376 -0.606515982
##  [36] -0.242835271 -0.152425215 -0.414436644 -0.021561562 -0.143703910
##  [41]  0.005800621 -0.362268779  0.002692584 -0.038303371  0.128012345
##  [46]  0.106015509 -0.029679656 -0.037752867 -0.263508663 -0.728057610
##  [51] -0.065166189 -0.987588280 -0.832751965 -0.307590359 -1.091430038
##  [56] -0.561785727  1.285809880  1.351592692  1.402965111  1.395135171
##  [61]  1.402256016  1.599320680  1.255058882  0.072727229  0.173390234
##  [66] -0.105161853  0.241315525  0.363304886  0.326392566  0.140173840
##  [71] -0.526214261 -0.450509165 -0.478773642  0.220736240 -0.390039030
##  [76] -0.444381338 -0.388414206 -2.441856538 -2.506559138 -2.973194236
##  [81] -2.648001614 -2.698015408 -2.533982662 -1.399616970 -0.038014900
##  [86]  0.108776834  0.217806803  0.048677748  0.093615640  0.416467823
##  [91]  0.318535349 -0.512002416 -1.069768418 -1.323320744 -0.924969118
##  [96] -0.280812196 -0.039651072 -0.228386981  0.587307419  0.627986437
## [101]  0.591569214  0.467904863  0.053016965  0.465257385  0.351563537
## [106] -0.802964190 -0.286084958  0.054101688  0.329698286 -0.074581531
## [111]  0.149279673  0.323589741 -0.153159965 -0.102489844  0.212592390
## [116]  0.310056526  0.422311469  0.403675129  0.381331583 -0.331158400
## [121] -0.515042335 -0.180093329 -0.496463285 -0.599571704 -0.484533082
## [126] -0.281800116 -0.107749282  0.248064230  0.250018774  0.427611892
## [131]  0.183837022  0.228935392 -0.389523057 -0.078574328  0.302105595
## [136]  0.203704849  0.397520783  0.631940565  0.009768048  0.266607898
## [141] -1.778822656 -1.476149198 -1.371488034 -1.450632171 -0.859820925
## [146] -0.630318428 -1.307258618 -0.947264811 -0.808531691 -0.699851842
## [151] -0.569945513 -0.577454229 -0.227621308 -0.256324179 -0.022135058
## [156]  0.190376617  0.242796303  0.194871226  0.546722439  0.176786440
## [161] -0.611010506  0.020895467 -0.029164684  0.325743174  0.106871110
## [166]  0.505936380  0.463130719 -0.069577533  4.002758103  8.093698041
## [171]  6.220852426  7.029901559  6.288409090  4.357348282  7.279584804
```

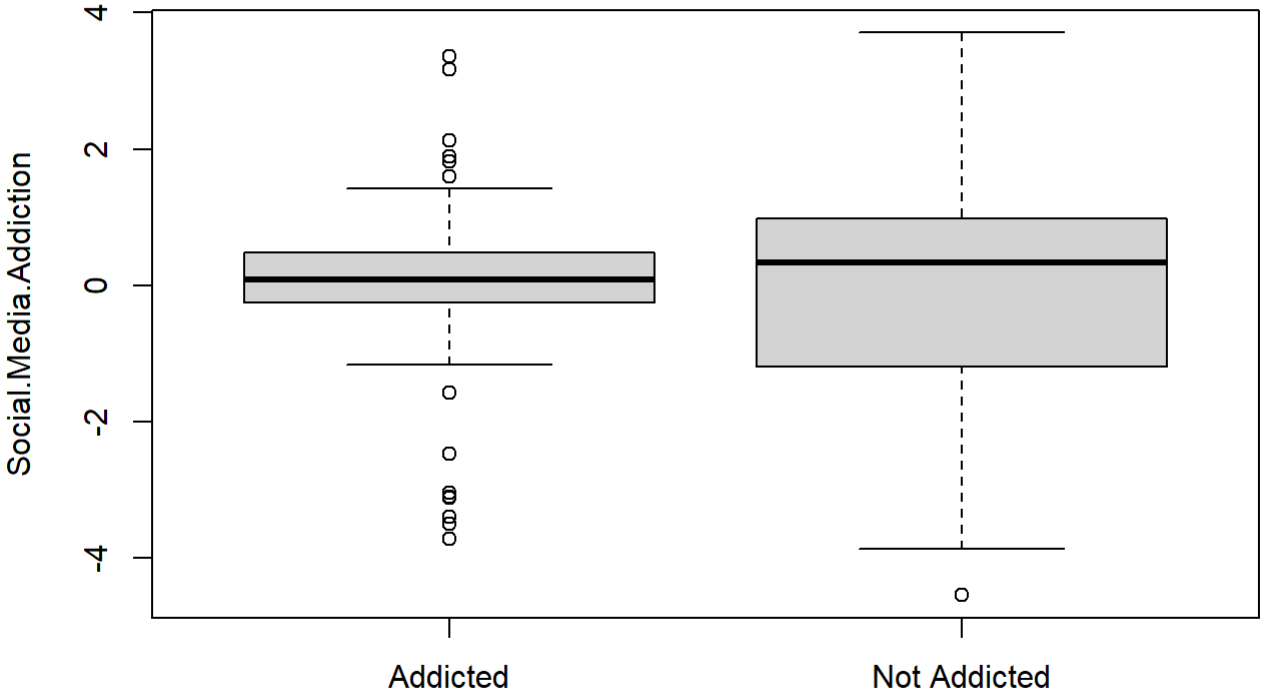
```
predict(Students_pca)[,1]
```

```
##   [1] -0.416389889 -0.972379460 -1.603608671 -1.383890607 -0.768091364
##   [6] -0.754996653 -0.657828390 -0.241218540  0.181264122  0.035667587
##  [11]  0.014725383  0.371936274  0.062844523  0.075466200 -2.120985868
##  [16] -0.276765699 -0.231228101 -1.342560665 -0.552670521 -0.570577812
##  [21] -0.255028051  0.128428320  0.052474117  0.221233179  0.320153552
##  [26]  0.181581063  0.167648803 -0.002750549 -2.308434627 -2.481920506
##  [31] -1.022822818 -0.217306627 -0.647016284 -0.723402376 -0.606515982
##  [36] -0.242835271 -0.152425215 -0.414436644 -0.021561562 -0.143703910
##  [41]  0.005800621 -0.362268779  0.002692584 -0.038303371  0.128012345
##  [46]  0.106015509 -0.029679656 -0.037752867 -0.263508663 -0.728057610
##  [51] -0.065166189 -0.987588280 -0.832751965 -0.307590359 -1.091430038
##  [56] -0.561785727  1.285809880  1.351592692  1.402965111  1.395135171
##  [61]  1.402256016  1.599320680  1.255058882  0.072727229  0.173390234
##  [66] -0.105161853  0.241315525  0.363304886  0.326392566  0.140173840
##  [71] -0.526214261 -0.450509165 -0.478773642  0.220736240 -0.390039030
##  [76] -0.444381338 -0.388414206 -2.441856538 -2.506559138 -2.973194236
##  [81] -2.648001614 -2.698015408 -2.533982662 -1.399616970 -0.038014900
##  [86]  0.108776834  0.217806803  0.048677748  0.093615640  0.416467823
##  [91]  0.318535349 -0.512002416 -1.069768418 -1.323320744 -0.924969118
##  [96] -0.280812196 -0.039651072 -0.228386981  0.587307419  0.627986437
## [101]  0.591569214  0.467904863  0.053016965  0.465257385  0.351563537
## [106] -0.802964190 -0.286084958  0.054101688  0.329698286 -0.074581531
## [111]  0.149279673  0.323589741 -0.153159965 -0.102489844  0.212592390
## [116]  0.310056526  0.422311469  0.403675129  0.381331583 -0.331158400
## [121] -0.515042335 -0.180093329 -0.496463285 -0.599571704 -0.484533082
## [126] -0.281800116 -0.107749282  0.248064230  0.250018774  0.427611892
## [131]  0.183837022  0.228935392 -0.389523057 -0.078574328  0.302105595
## [136]  0.203704849  0.397520783  0.631940565  0.009768048  0.266607898
## [141] -1.778822656 -1.476149198 -1.371488034 -1.450632171 -0.859820925
## [146] -0.630318428 -1.307258618 -0.947264811 -0.808531691 -0.699851842
## [151] -0.569945513 -0.577454229 -0.227621308 -0.256324179 -0.022135058
## [156]  0.190376617  0.242796303  0.194871226  0.546722439  0.176786440
## [161] -0.611010506  0.020895467 -0.029164684  0.325743174  0.106871110
## [166]  0.505936380  0.463130719 -0.069577533  4.002758103  8.093698041
## [171]  6.220852426  7.029901559  6.288409090  4.357348282  7.279584804
```

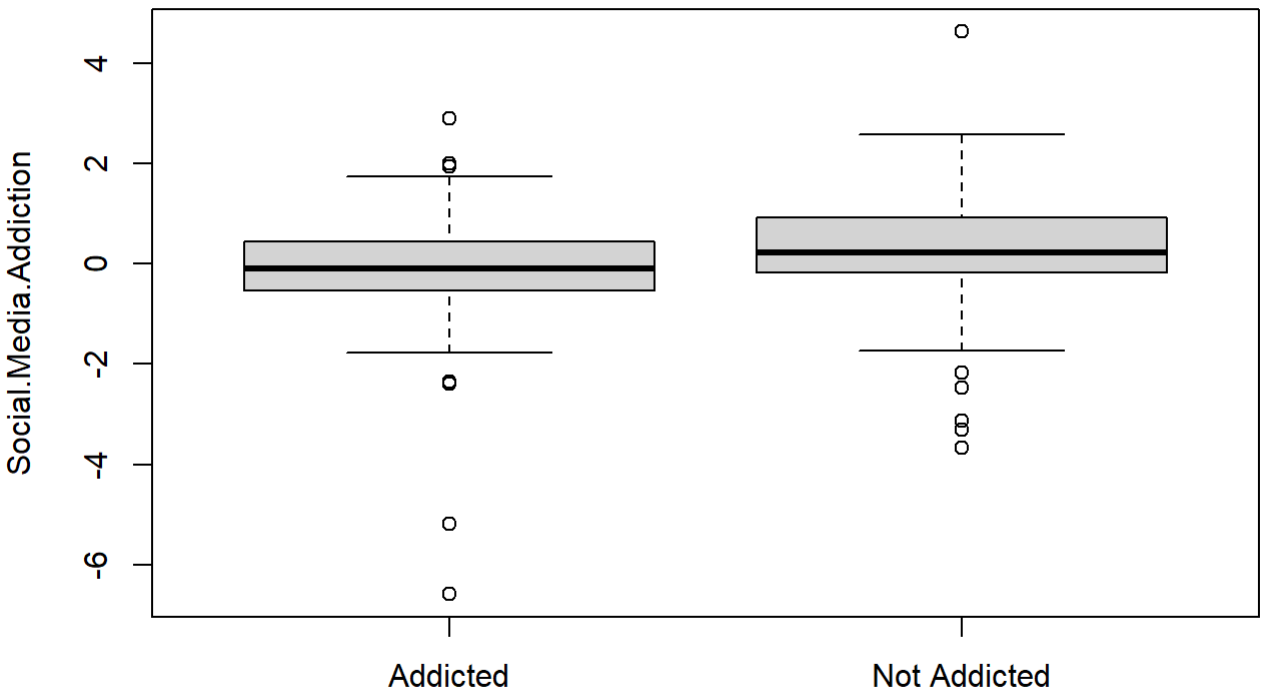
```
#The aboved two gives us the same thing. predict is a good function to know.
Students$Social.Media.Addiction <- as.factor(Students$Social.Media.Addiction)
out <- sapply(1:11, function(i){plot(Students$Social.Media.Addiction,Students_pca$x[,i],xlab=pas
te("PC",i,sep=""),ylab="Social.Media.Addiction")})
```


Social.Media.Addiction
8
6
4
2
0
-2
Addicted
Not Addicted

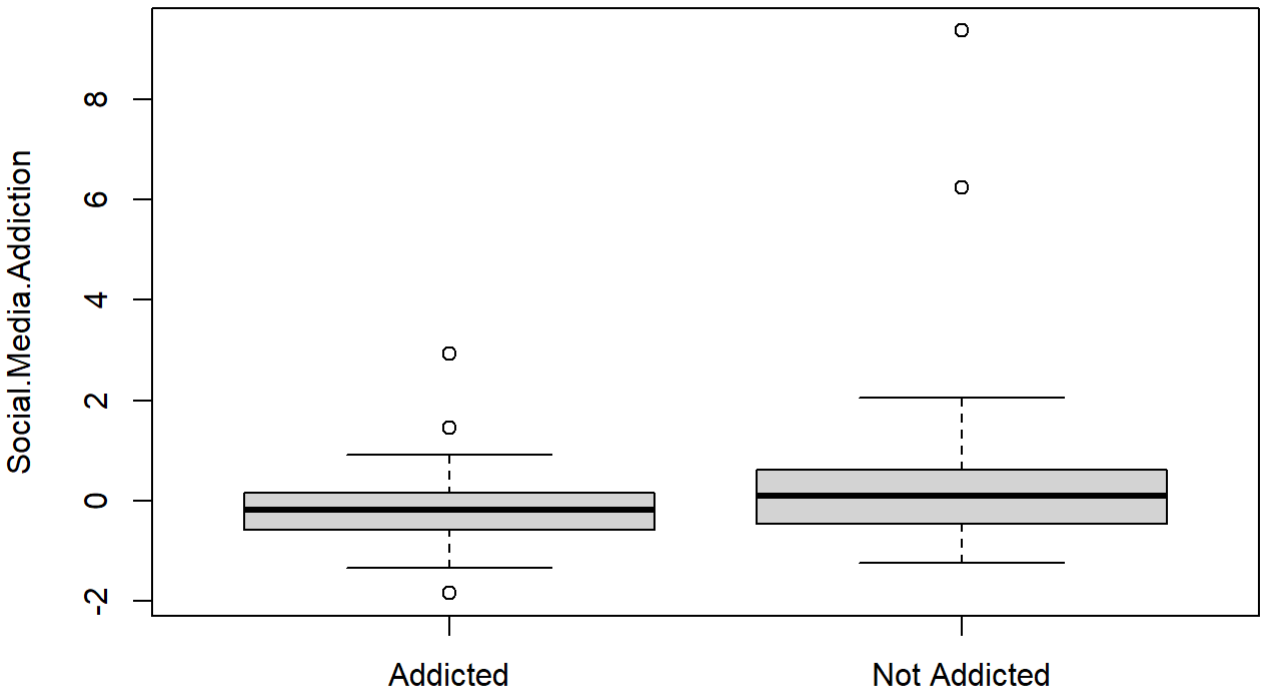
PC1


Social.Media.Addiction
4
2
0
-2
-4
Addicted
Not Addicted

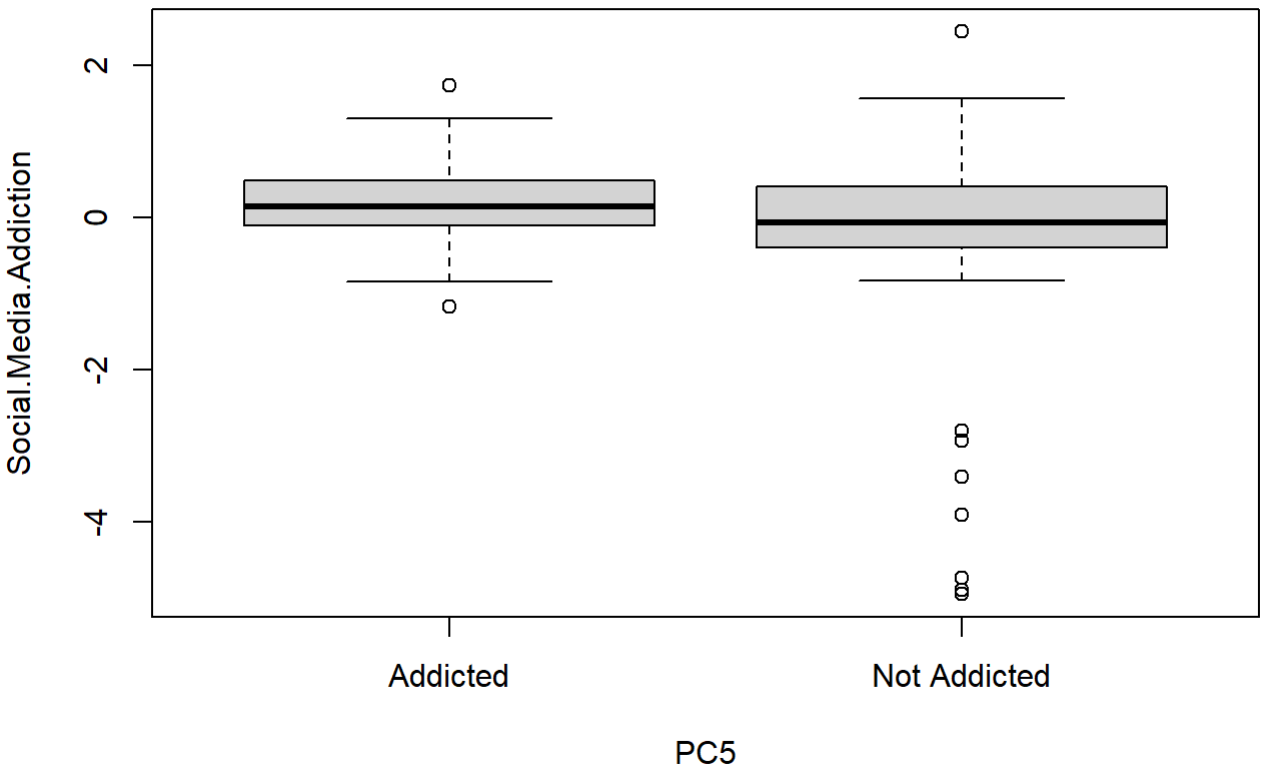
PC2


Social.Media.Addiction
4
2
0
-2
-4
-6
Addicted
Not Addicted

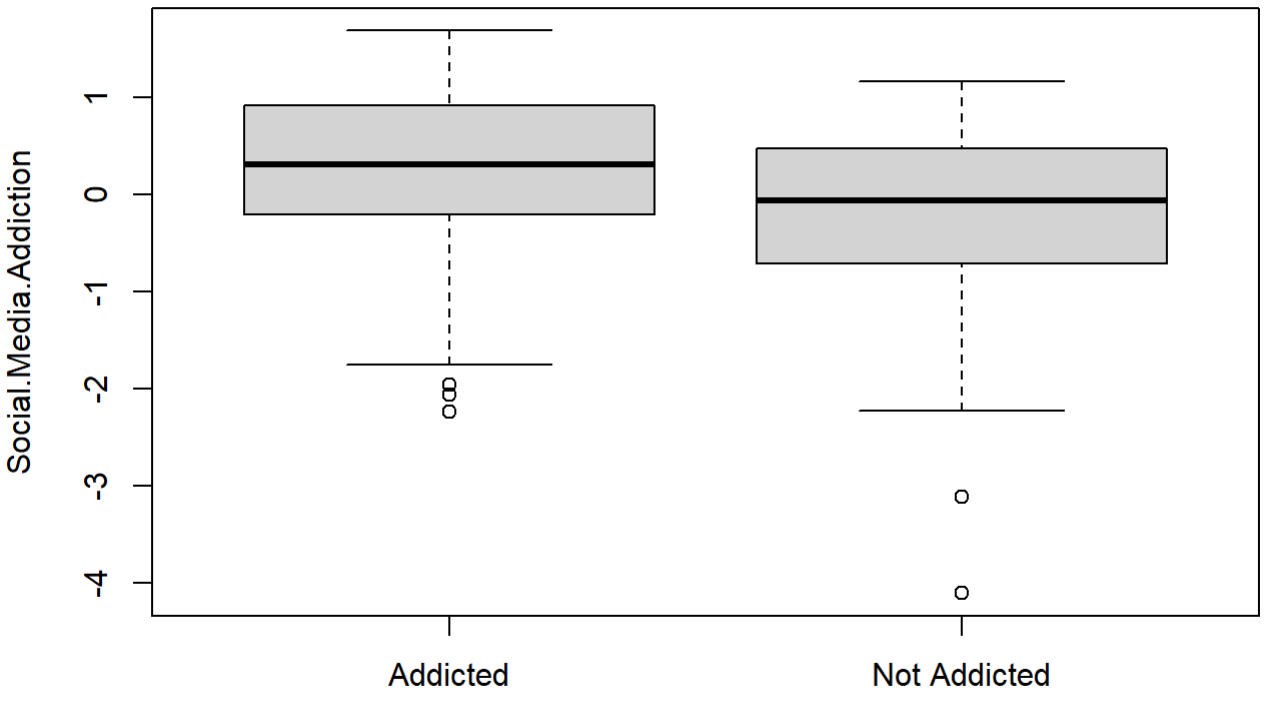
PC3


Social.Media.Addiction
8
6
4
2
0
-2
Addicted
Not Addicted

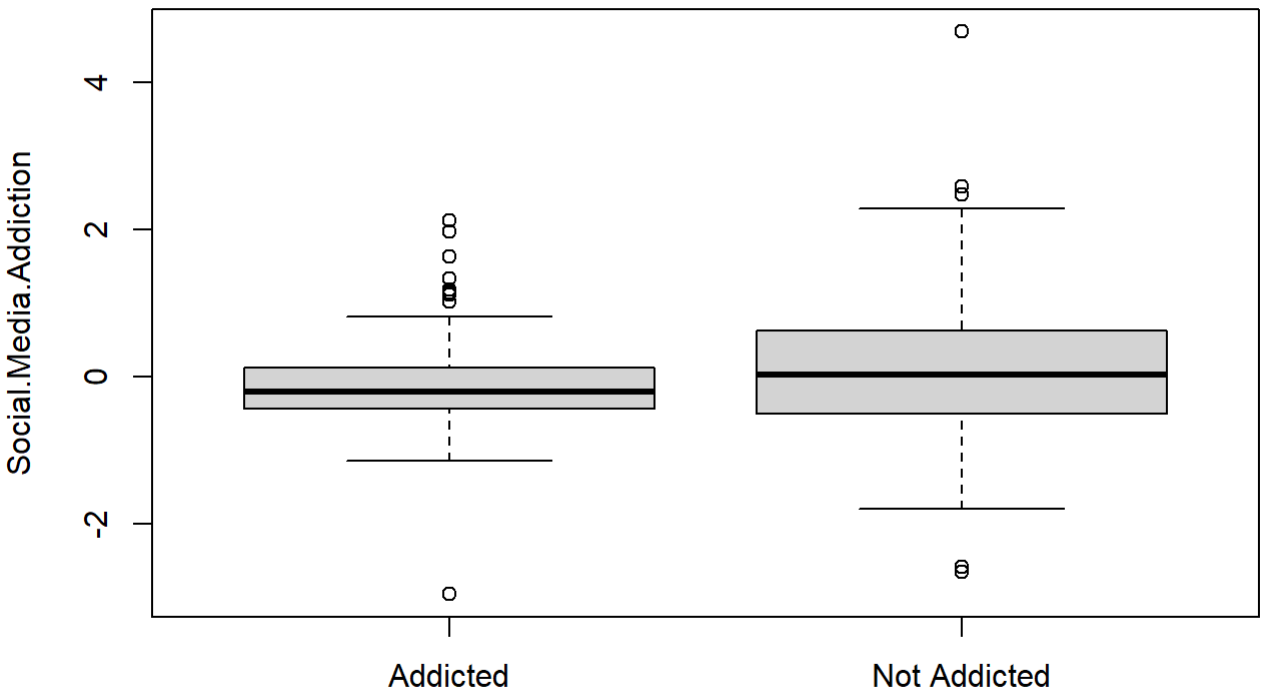
PC4


Social.Media.Addiction
2
0
-2
-4
Addicted
Not Addicted

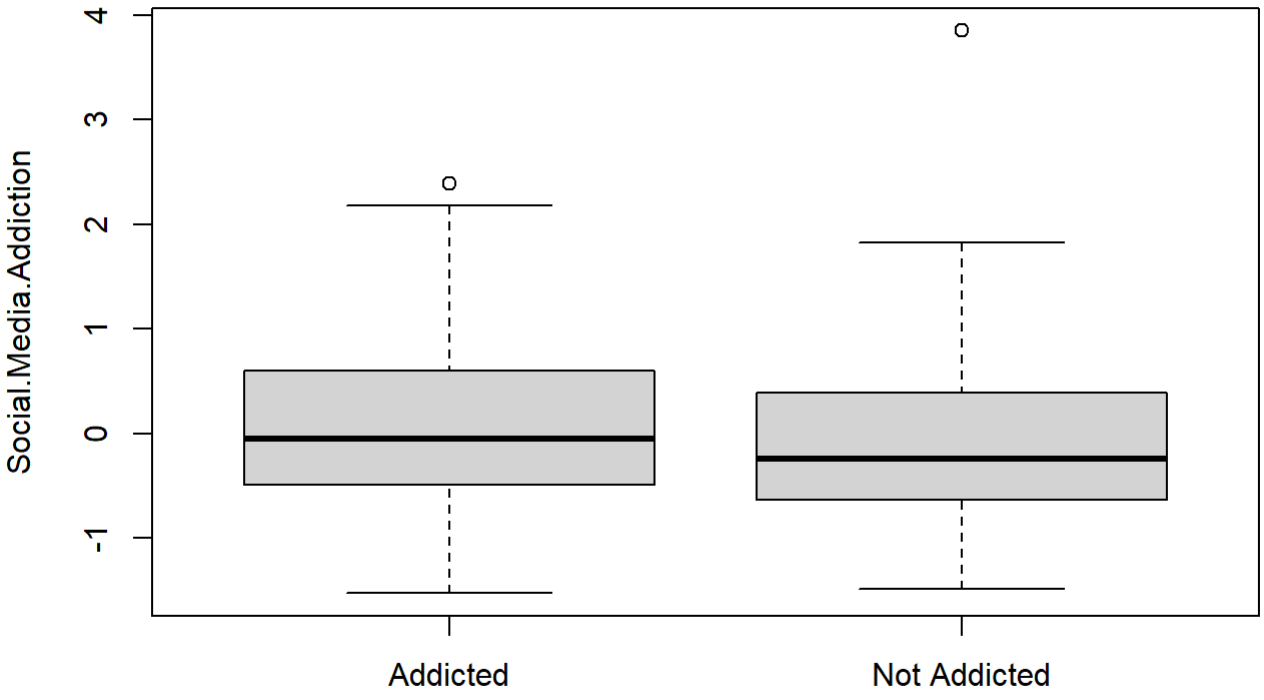
PC5


Social.Media.Addiction
1
0
-1
-2
-3
-4
Addicted
Not Addicted

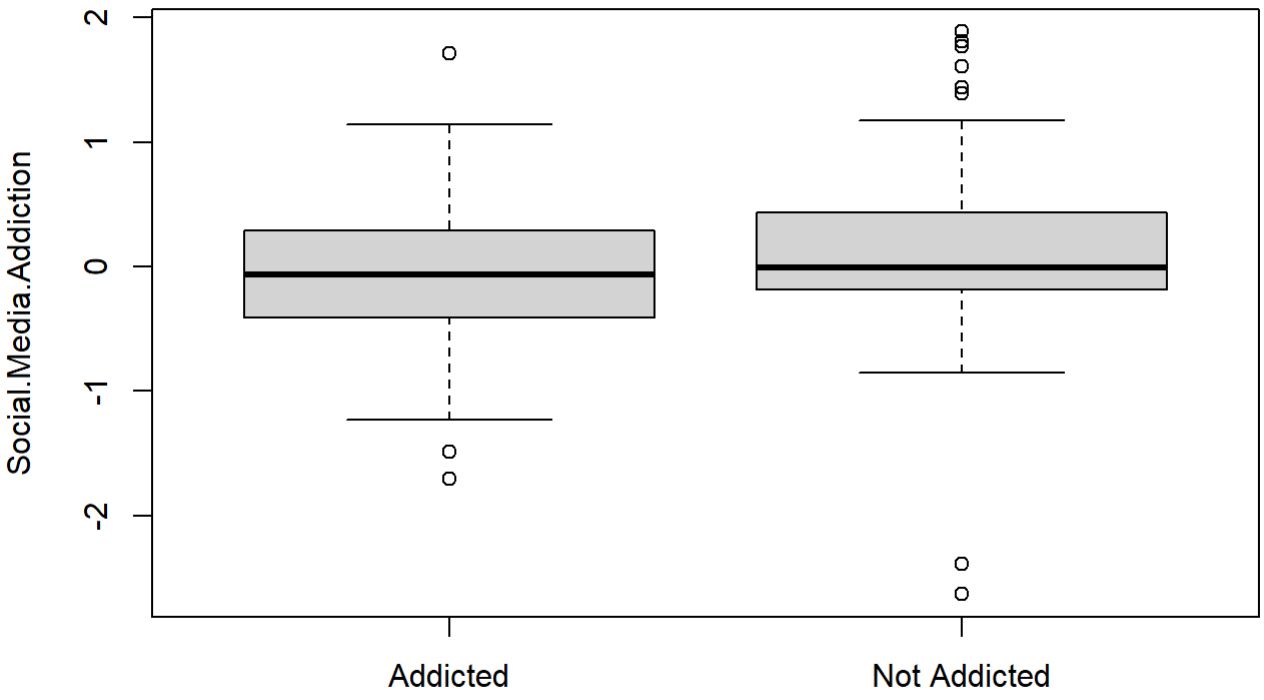
PC6


Social.Media.Addiction
4
2
0
-2
Addicted
Not Addicted

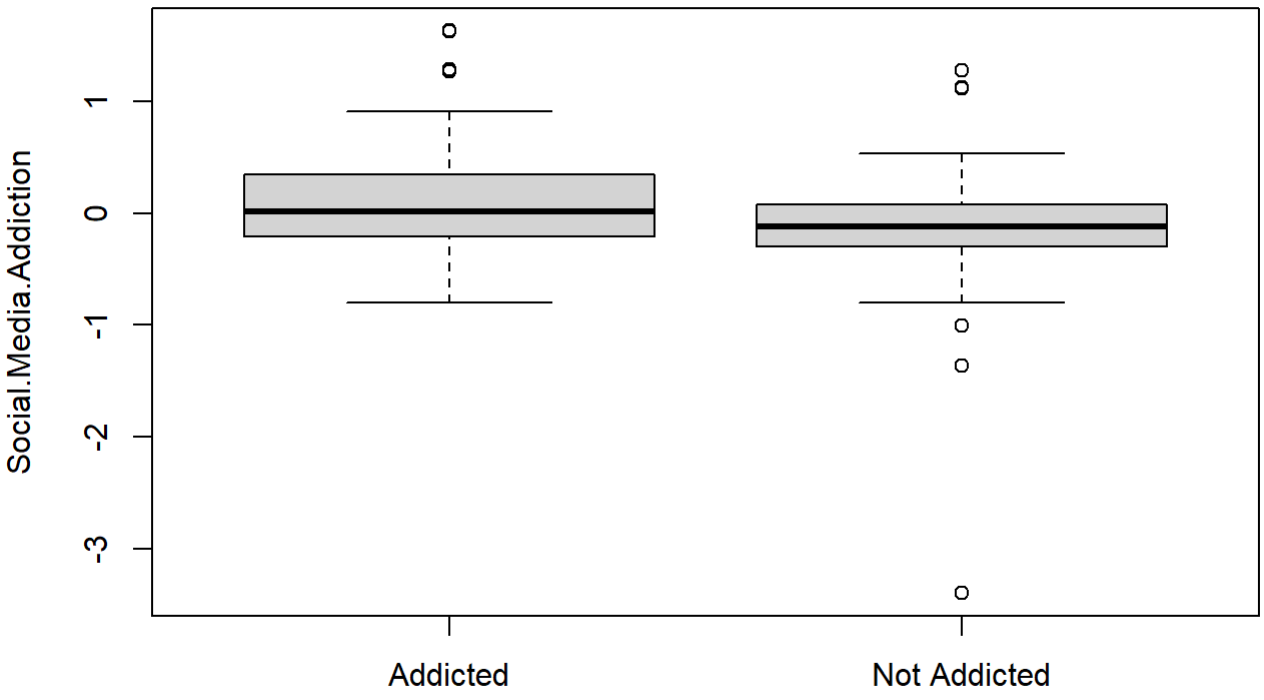
PC7


Social.Media.Addiction
4
3
2
1
0
-1
Addicted
Not Addicted

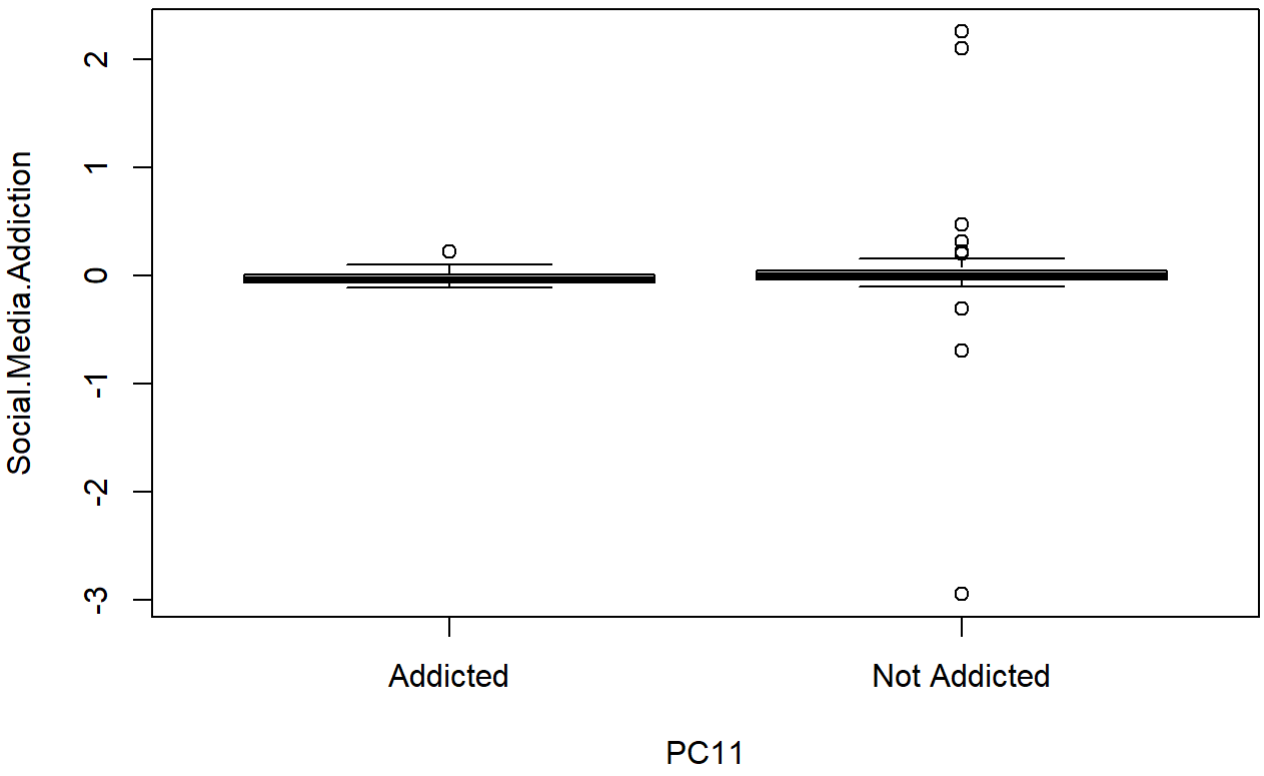
PC8


Social.Media.Addiction
2
1
0
-1
-2
Addicted
Not Addicted

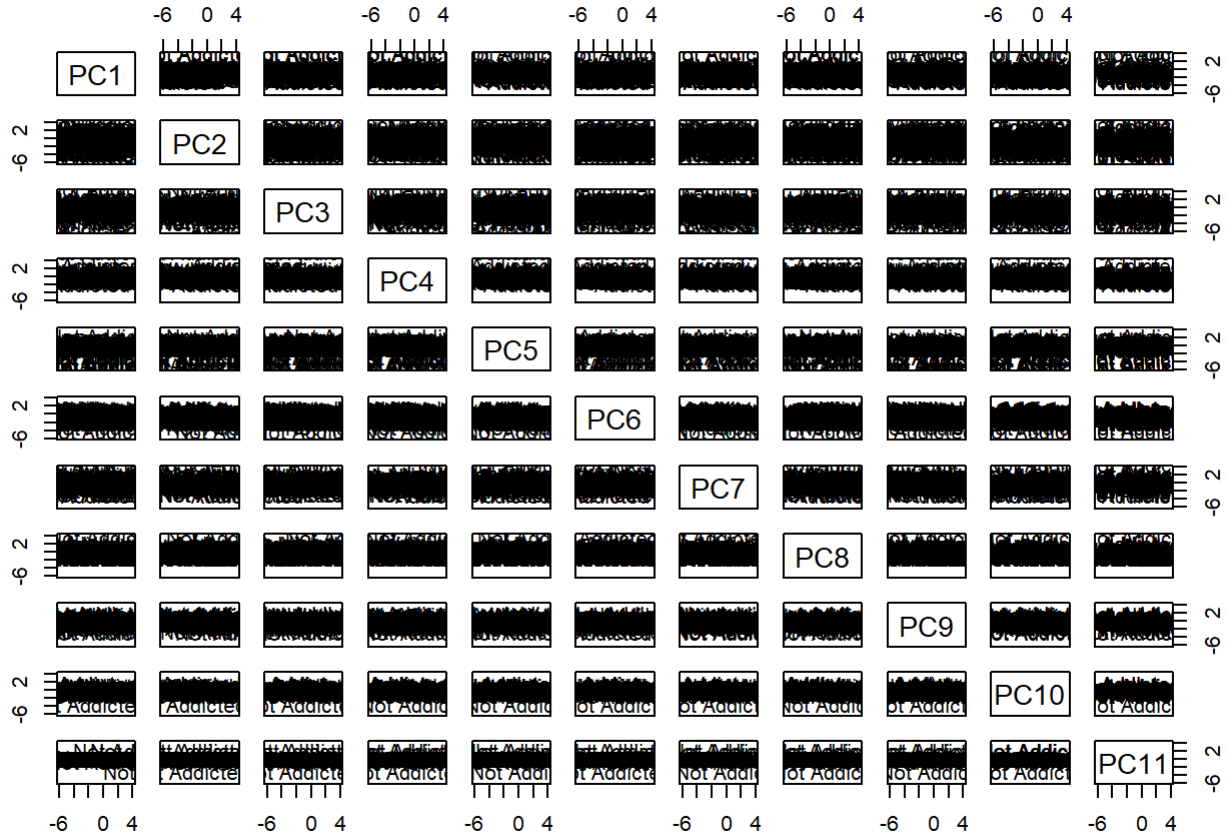
PC9


Social.Media.Addiction
1
0
-1
-2
-3
Addicted
Not Addicted

PC10



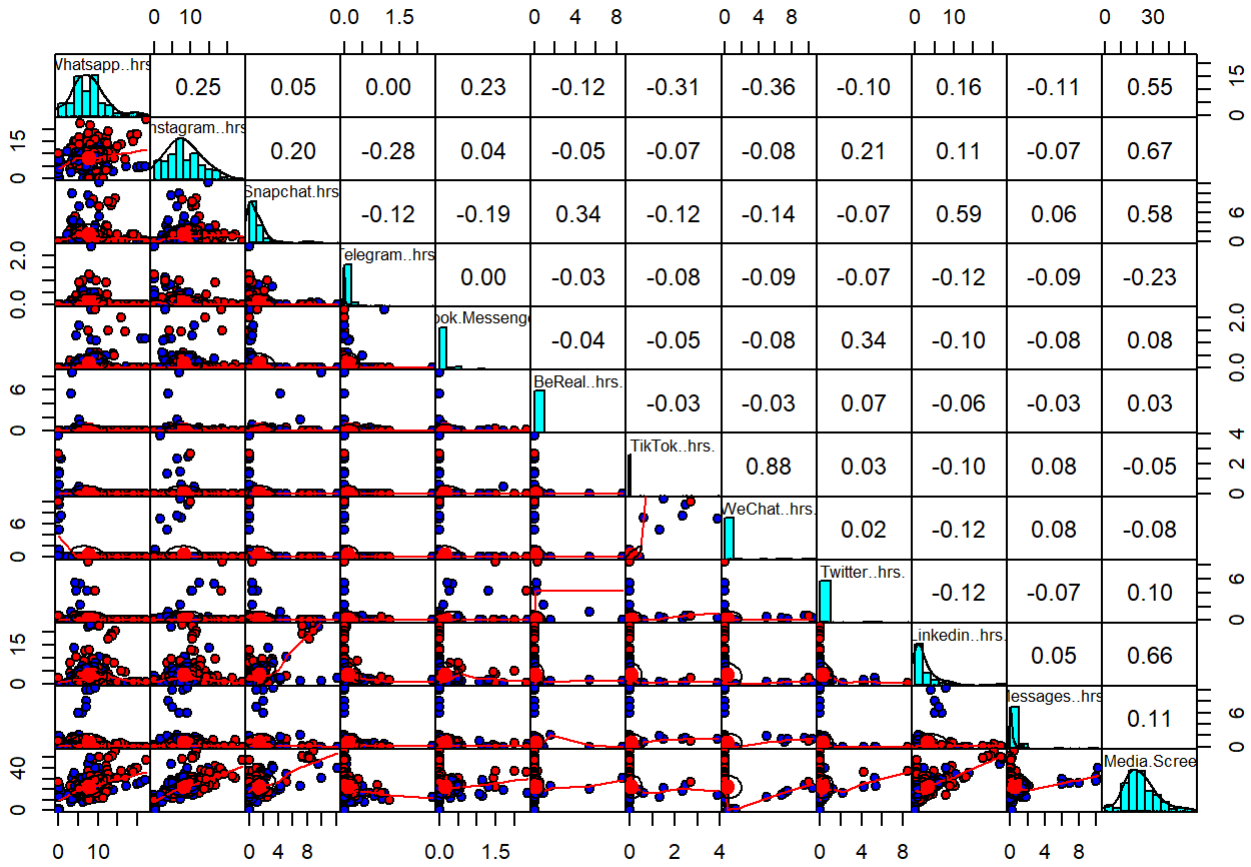

```
pairs(Students_pca$x[,1:11], ylim = c(-6,4),xlim = c(-6,4),panel=function(x,y,...){text(x,y,Stud
ents$Social.Media.Addiction)})
```



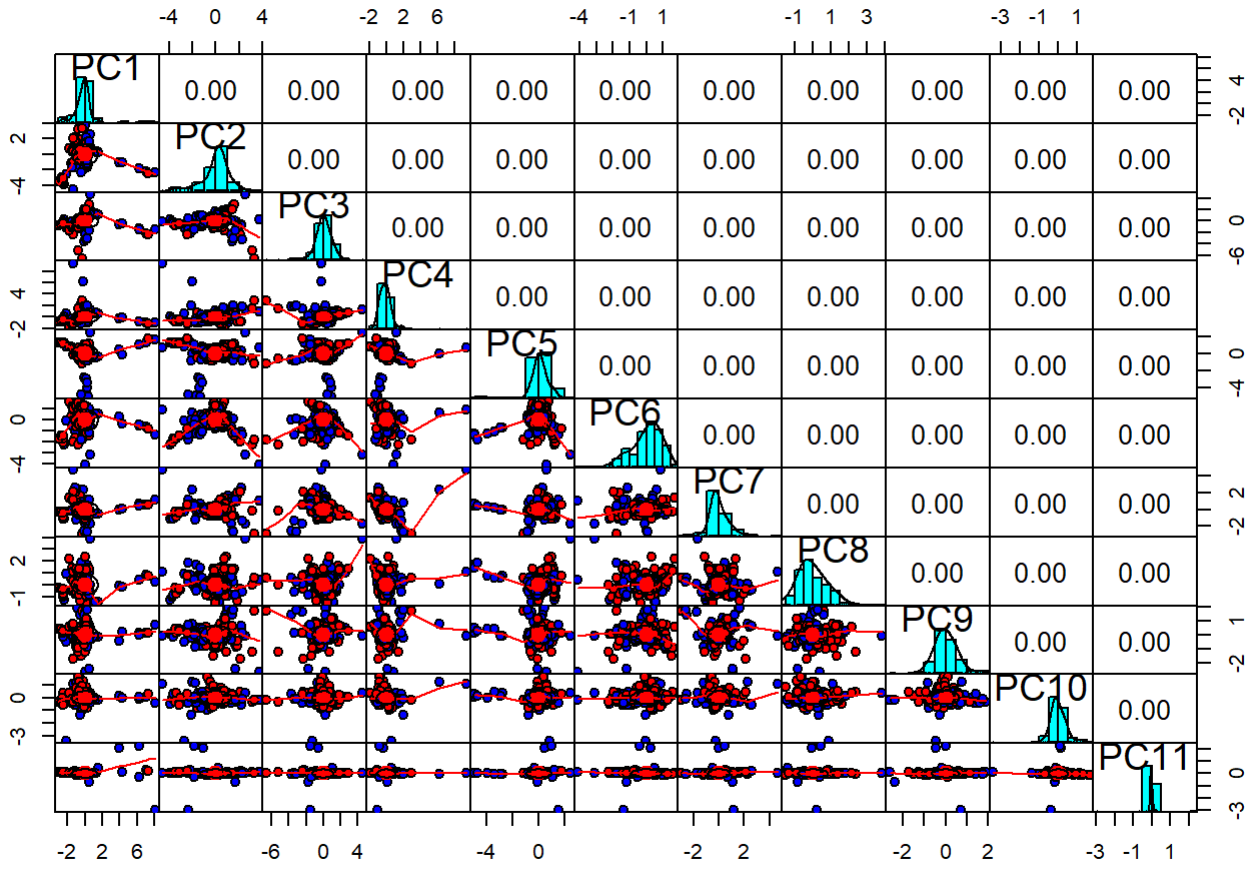

```
# Better Ways to Visualize

library(factoextra)
library(psych)
library(ggplot2)
library(corrplot)

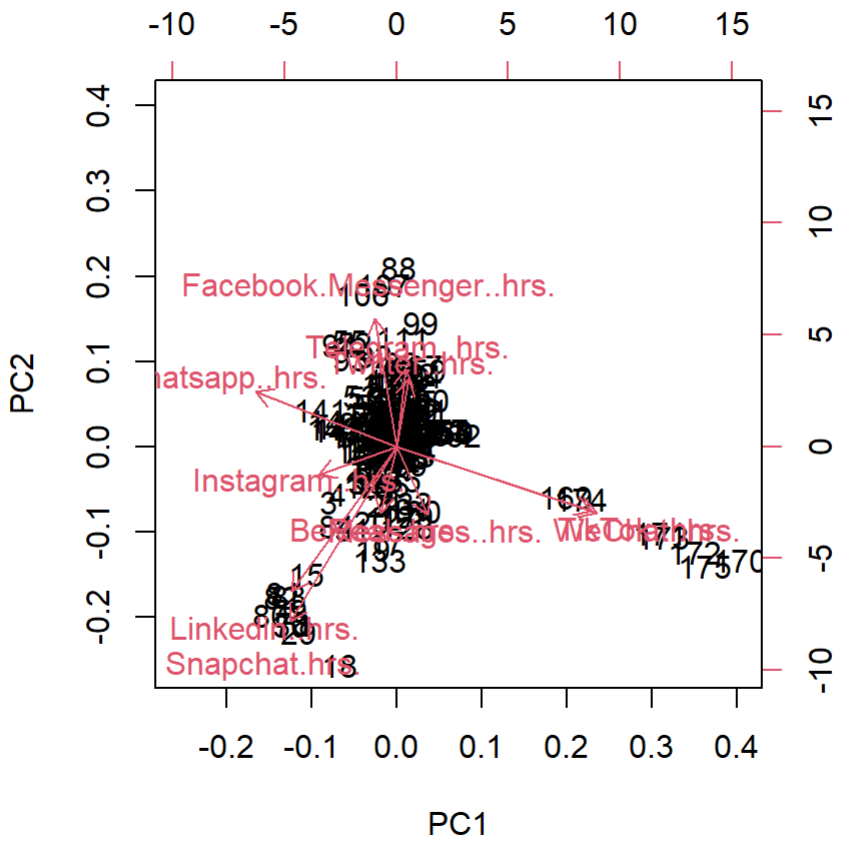
# Correlation
pairs.panels(Students[,3:14],
             gap = 0,
             bg = c("red", "blue")[Students$Social.Media.Addiction],
             pch=21)
```




```
pairs.panels(Students_pca$x,
             gap=0,
             bg = c("red", "blue")[Students$Social.Media.Addiction],
             pch=21)
```




```
biplot(Students_pca)
```




```
summary(Students_pca)
```

```
## Importance of components:
##                           PC1    PC2    PC3    PC4     PC5     PC6     PC7
## Standard deviation     1.5160 1.3363 1.2300 1.1060 0.99514 0.95540 0.88333
## Proportion of Variance 0.2089 0.1623 0.1375 0.1112 0.09003 0.08298 0.07093
## Cumulative Proportion  0.2089 0.3713 0.5088 0.6200 0.71004 0.79302 0.86395
##                            PC8     PC9    PC10    PC11
## Standard deviation     0.83449 0.65128 0.51242 0.33676
## Proportion of Variance 0.06331 0.03856 0.02387 0.01031
## Cumulative Proportion  0.92726 0.96582 0.98969 1.00000
```

It represnts the relationship between the original variables in the dataset and the principal components.The closer the arrows are to each other, the higher the correlation between those var iables. The plot also shows the scores for each observation on denoted by points.The variables "Facebook", "Instagram", and "Twitter" are highly correlated with each other and are positively associated with the , which is associated with social media use.

```
#####  EFA

library(psych)
attach(Students)
fit.pc <- principal(Students[3:13], nfactors=5, rotate="varimax")
fit.pc
```

```
## Principal Components Analysis
## Call: principal(r = Students[3:13], nfactors = 5, rotate = "varimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##                             RC1   RC2   RC3   RC4   RC5   h2    u2 com
## Whatsapp..hrs.            -0.45  0.30  0.12 -0.48 -0.26 0.61 0.392 3.4
## Instagram..hrs.           -0.02  0.59  0.45 -0.20 -0.03 0.60 0.404 2.1
## Snapchat.hrs.             -0.13  0.74 -0.22  0.45  0.00 0.83 0.174 1.9
## Telegram..hrs.            -0.17 -0.47 -0.32  0.06 -0.42 0.53 0.469 3.1
## Facebook.Messenger..hrs. -0.14 -0.15  0.66 -0.15 -0.11 0.52 0.483 1.4
## BeReal..hrs.              -0.06  0.07  0.08  0.86 -0.07 0.77 0.234 1.1
## TikTok..hrs.               0.94 -0.03 -0.01 -0.03  0.00 0.89 0.108 1.0
## WeChat..hrs.               0.95 -0.05 -0.03 -0.02  0.02 0.91 0.085 1.0
## Twitter..hrs.              0.06 -0.03  0.79  0.22  0.01 0.67 0.327 1.2
## Linkedin..hrs.            -0.11  0.74 -0.30 -0.02 -0.01 0.65 0.346 1.4
## Messages..hrs.             0.00 -0.03 -0.14 -0.01  0.90 0.83 0.168 1.0
##
##                        RC1  RC2  RC3  RC4  RC5
## SS loadings           2.09 1.80 1.54 1.30 1.08
## Proportion Var        0.19 0.16 0.14 0.12 0.10
## Cumulative Var        0.19 0.35 0.49 0.61 0.71
## Proportion Explained  0.27 0.23 0.20 0.17 0.14
## Cumulative Proportion 0.27 0.50 0.70 0.86 1.00
##
## Mean item complexity =  1.7
## Test of the hypothesis that 5 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.1
##  with the empirical chi square  185.55  with prob <  1.6e-34
##
## Fit based upon off diagonal values = 0.76
```

```
round(fit.pc$values, 3)
```

```
##  [1] 2.298 1.786 1.513 1.223 0.990 0.913 0.780 0.696 0.424 0.263 0.113
```

```
fit.pc$loadings
```

```
##
## Loadings:
##                           RC1    RC2    RC3    RC4    RC5
## Whatsapp..hrs.           -0.452  0.304  0.118 -0.480 -0.260
## Instagram..hrs.                  0.594  0.450 -0.197
## Snapchat.hrs.            -0.128  0.745 -0.222  0.454
## Telegram..hrs.           -0.167 -0.469 -0.315        -0.424
## Facebook.Messenger..hrs. -0.142 -0.145  0.664 -0.149 -0.115
## BeReal..hrs.                                    0.863
## TikTok..hrs.              0.943
## WeChat..hrs.              0.954
## Twitter..hrs.                           0.787  0.219
## Linkedin..hrs.           -0.106  0.741 -0.304
## Messages..hrs.                         -0.136         0.902
##
##                  RC1   RC2   RC3   RC4   RC5
## SS loadings    2.088 1.801 1.544 1.296 1.081
## Proportion Var 0.190 0.164 0.140 0.118 0.098
## Cumulative Var 0.190 0.354 0.494 0.612 0.710
```

```
for (i in c(1,3,2,4,5)) { print(fit.pc$loadings[[1,i]])}
```

```
## [1] -0.4517488
## [1] 0.1181015
## [1] 0.3038819
## [1] -0.4800097
## [1] -0.2597205
```

```
fit.pc$communality
```

```
##           Whatsapp..hrs.          Instagram..hrs.            Snapchat.hrs.
##                0.6082332                0.5958063                0.8264784
##           Telegram..hrs. Facebook.Messenger..hrs.             BeReal..hrs.
##                0.5312401                0.5175000                0.7661189
##             TikTok..hrs.             WeChat..hrs.            Twitter..hrs.
##                0.8918356                0.9145874                0.6729125
##           Linkedin..hrs.           Messages..hrs.
##                0.6535130                0.8321743
```

```
fit.pc$scores
```

```
##                 RC1          RC2          RC3          RC4          RC5
##   [1,] -0.152497279  0.269471923 -0.346721165 -0.111360004 -0.138069301
##   [2,] -0.209122368  0.818932656 -0.190203052 -0.394725499 -0.399504825
##   [3,] -0.133149986  1.766817917 -0.030185704 -0.558044893 -0.471424074
##   [4,] -0.208031386  1.377823262 -0.266103225 -0.445192856 -0.406380311
##   [5,] -0.082007735  0.826497106 -0.221229331 -0.268506842 -0.227291039
##   [6,] -0.141322755  0.639391419 -0.319636866 -0.404600649 -0.443973764
##   [7,] -0.056640889  0.727984603 -0.137537975 -0.272773057 -0.185174630
##   [8,] -0.091239037  0.123553245 -0.162219028  0.384764210 -0.295383274
##   [9,] -0.161153898 -0.465690211 -0.528682428  0.430560889 -0.003406124
##  [10,] -0.279737931 -0.515289982 -0.580929099  0.840913775 -0.262997873
##  [11,] -0.358504793 -0.728881064 -1.059411663  0.995218466 -0.785052823
##  [12,] -0.354685604 -1.213441120 -0.982362131  0.521342999 -0.660757247
##  [13,] -0.352286350 -0.954429141 -0.967850589  0.598739217 -1.272680799
##  [14,] -0.272836680 -0.638546210 -0.730744984  0.634531501 -0.534145124
##  [15,] -0.169356844  2.530945141 -0.061116453  1.107453450 -0.484389590
##  [16,] -0.027601089  0.373341743 -0.214020563  0.521981982 -0.024430756
##  [17,] -0.336792097 -0.002997790  0.724936633  5.778445803 -0.432158876
##  [18,] -0.573868591  1.203462578  0.396815050  9.040243252 -0.983216689
##  [19,] -0.312099224  0.636809403 -0.388626434  2.324352900  0.854983030
##  [20,] -0.075736075  0.889266442 -0.150224247  0.982083396  0.594678064
##  [21,] -0.068285157  0.527537310 -0.174881641  0.680749846  0.864174956
##  [22,] -0.140419837 -0.442023980 -0.168934096 -0.210175255 -0.049009823
##  [23,] -0.008067969 -0.083271171  0.023652491 -0.009059712  0.015756621
##  [24,]  0.035673771 -0.202579260 -0.007009437  0.121540124  0.088063254
##  [25,] -0.053642949 -0.477266499 -0.278512589  0.187044780  0.071819288
##  [26,] -0.001700719 -0.222388531 -0.093892943  0.066747673  0.056943616
##  [27,] -0.059837298 -0.307236964 -0.201830668  0.083812318  0.024918789
##  [28,] -0.077974197 -0.157652067 -0.029701868 -0.165303051 -0.044684792
##  [29,] -0.134518008  2.908319836 -1.608727721  0.912297614 -0.560443543
##  [30,] -0.137063229  3.082105561 -1.421149938  0.570074950 -0.628076440
##  [31,]  0.140766057  1.620229891 -0.330269310  0.001035008 -0.133308147
##  [32,]  0.048632975  0.389614777 -0.409547537 -0.180601008 -0.011168947
##  [33,]  0.017139508  0.853775446 -0.346034774 -0.457800628 -0.145953726
##  [34,] -0.024470321  0.871430594 -0.409047384 -0.514242573 -0.188659271
##  [35,] -0.081447243  0.701663855 -0.121137938 -0.607220152  0.226731764
##  [36,] -0.160495301  0.092809291  0.351875104 -0.296636615  0.335777548
##  [37,] -0.017385368  0.289961423  0.435597984 -0.165267524  0.557419800
##  [38,]  0.041879017  0.702196141  0.822430752 -0.377091458  0.531063584
##  [39,] -0.023289791  0.057581699  0.244349771 -0.013749447  0.310956911
##  [40,] -0.056186937  0.097033681  0.407964516 -0.185283506  0.150785933
##  [41,]  0.051143696  0.103986524  0.395298607 -0.106267019  0.196394144
##  [42,] -0.045881669  0.353485504  0.343631018 -0.352262545 -0.027458184
##  [43,] -0.287798257 -0.605103900 -0.605176184 -0.023078740 -0.462282733
##  [44,] -0.166584437 -0.217747136 -0.073651262 -0.309502071  0.161338143
##  [45,] -0.219788510 -0.711763028 -0.576764724 -0.006966818 -0.667034809
##  [46,] -0.123463976 -0.384461301 -0.086329257 -0.191484035 -0.045752098
##  [47,] -0.124930615 -0.212708829 -0.052843217 -0.175192329 -0.077477587
##  [48,] -0.133256036 -0.232785320 -0.052465842 -0.328363525 -0.093520383
##  [49,] -0.313557258 -0.378174190 -0.469073685 -0.237213324 -0.690903844
##  [50,] -0.535515158 -0.183218887 -0.127583564 -1.094967610 -0.524848943
##  [51,] -0.285378794 -0.484600573 -0.307012010 -0.454869732 -0.186646973
```

```
##  [52,] -0.743436790 -0.336642528  1.037700509 -1.342354141 -0.685270907
##  [53,] -0.560557461 -0.106206846 -0.102464513 -1.182461568 -0.569094031
##  [54,] -0.437225162 -0.516177455  0.237434072 -0.689558899 -0.326951679
##  [55,] -0.772507041 -0.269280409  1.067176365 -1.434800270 -0.732049669
##  [56,] -0.446508843 -0.204109575 -0.109792581 -0.850910835 -0.419445613
##  [57,]  0.170020348 -1.257918907 -0.525325696  0.579835520  0.384602702
##  [58,]  0.233381870 -1.249403052 -0.527008651  0.576170856  0.332703359
##  [59,]  0.276407237 -1.242659443 -0.527004834  0.570209918  0.334993932
##  [60,]  0.283515956 -1.223639890 -0.515428544  0.553927353  0.327025542
##  [61,]  0.287130684 -1.225291680 -0.514556914  0.560753463  0.331100816
##  [62,]  0.453890426 -1.205849679 -0.522045764  0.539604640  0.303511178
##  [63,]  0.148900063 -1.247039415 -0.513274182  0.574049101  0.412808864
##  [64,] -0.165469355 -0.175365481 -0.181971185  0.217868423  0.679614074
##  [65,] -0.063946954 -0.057581005 -0.437125349  0.399807289  0.839639872
##  [66,]  0.032486674  0.404752242 -0.115073414  0.217259392  0.652447452
##  [67,] -0.140461093 -0.353766760 -0.333264200  0.281251207  0.648742371
##  [68,] -0.108062390 -0.408340661 -0.331741976  0.265902362  0.846393418
##  [69,] -0.130937547 -0.391448374 -0.441968456  0.451739818  0.796147284
##  [70,] -0.113423627 -0.293493228 -0.410013740  0.152814721  0.216307095
##  [71,] -0.297891797  0.050689281  0.196042647 -0.673553225 -0.255621168
##  [72,] -0.206095220  0.133063495 -0.076870428 -0.618242060 -0.252300604
##  [73,] -0.244243008  0.070350222  0.356964847 -0.612751164 -0.275852602
##  [74,] -0.014351648 -0.275388370 -0.329413756  0.090342630  0.078013886
##  [75,] -0.213436063  0.025193333  0.342674177 -0.531999104 -0.227253528
##  [76,] -0.204264236  0.092571370  0.482588341 -0.646629157 -0.244930636
##  [77,] -0.223543904  0.001439477  0.133078235 -0.682268225 -0.246310970
##  [78,] -0.055374120  3.176724601 -1.174191920  0.427502792 -0.516868501
##  [79,] -0.133034194  3.098683898 -1.122020503  0.180970686 -0.538144997
##  [80,] -0.293803159  3.419462396 -1.037928580  0.058197106 -0.582719473
##  [81,] -0.227953681  3.050685158 -0.940900633 -0.028935510 -0.697149119
##  [82,] -0.256578919  3.072677880 -0.981667067  0.073553452 -0.717305710
##  [83,] -0.241333594  2.931689104 -0.964708727  0.208851893 -0.554551965
##  [84,] -0.173725644  1.533319670 -0.650513607  0.105720135 -0.382237819
##  [85,] -0.367039130 -0.639721369 -0.038350337 -0.381066399 -0.050752730
##  [86,] -0.395264126 -0.982291058  0.699222517 -0.266403715 -0.252555512
##  [87,] -0.307757462 -0.865898525  0.131572078 -0.173446959 -0.013277018
##  [88,] -0.872043749 -2.111148723  1.145481735 -0.257034674 -1.474521122
##  [89,] -0.478675199 -0.981504083  0.625541835 -0.364278360  0.220343335
##  [90,] -0.218672124 -0.969463837 -0.226122727  0.007125777 -0.116254535
##  [91,] -0.289491669 -0.830468765 -0.114994112 -0.162891597  0.432101375
##  [92,] -0.517240363 -0.459037624  1.165867035 -0.805670678 -0.365847007
##  [93,] -0.620163380  0.032602177  1.300369722 -1.263527203 -0.504969934
##  [94,] -0.624616795  0.347370151  2.186945264 -1.485873963 -0.317418678
##  [95,] -0.367819025  0.421160818  0.218657666 -0.959359865 -0.338177893
##  [96,] -0.362026801 -0.356887296  0.254036762 -0.629888952 -0.114452671
##  [97,] -0.224909980 -0.434741334  0.399915657 -0.428441206 -0.114874269
##  [98,] -0.194761804 -0.144505046  0.286956091 -0.542461869 -0.177782692
##  [99,] -0.892611486 -3.027338624 -2.416622665  0.496582634 -3.035701126
## [100,] -0.305367770 -1.459702937 -0.956284574  0.235840617 -0.526377368
## [101,] -0.222918074 -1.206045243 -0.731291196  0.169535004 -0.246367620
## [102,] -0.243468051 -1.100790174 -0.668072553  0.123044851 -0.312995242
## [103,] -0.362118246 -0.785790974 -0.654504064 -0.252625879 -0.340172521
```

```
## [104,] -0.499873985 -1.789703881 -1.315717172  0.198565635 -1.342258303
## [105,] -0.338357218 -1.171184285 -0.796463135 -0.024438182 -0.518040018
## [106,] -0.316136969  0.149689008  5.059378776  0.121296103 -0.250285384
## [107,] -0.044299768  0.033231613  6.464305244  1.262545328  0.123221042
## [108,] -0.021747066 -0.178496812  2.548497865  0.792277205  0.119257487
## [109,] -0.060934730 -0.522557164  1.272373213  1.220662576  0.067048294
## [110,]  0.120154451  0.215667595  3.448678830  0.914895618  0.175606757
## [111,] -0.078874453 -0.469006682  3.541240617  0.779876198  0.131204847
## [112,]  0.124371718 -0.248909615  3.212059095  1.191818976  0.289616889
## [113,] -0.152652489 -0.106545792  0.020473030 -0.360905874 -0.052946253
## [114,] -0.206098831 -0.363280144 -0.160878463 -0.192891319 -0.478267755
## [115,] -0.050199720 -0.335767651 -0.123225635  0.036299144  0.111453631
## [116,]  0.012011615 -0.340070920  0.116161466  0.148838471  0.198342705
## [117,]  0.008615342 -0.486436056  0.033679213  0.148434493  0.222502081
## [118,]  0.026540418 -0.433422860  0.031786223  0.177485271  0.199485086
## [119,] -0.040097113 -0.521266145 -0.083717889  0.073668303  0.201791211
## [120,] -0.303961748 -0.063706282  0.272600688 -0.503333221  0.295436018
## [121,] -0.306287942 -0.024454376 -0.330662023 -0.456424438 -0.599084513
## [122,] -0.316619468 -0.578649981  0.410847365 -0.231649533 -0.788048167
## [123,] -0.026091280  0.611899896 -0.066997075 -0.358617249  0.030328210
## [124,] -0.185084121  0.542561776 -0.680706849 -0.133647549  0.089899674
## [125,] -0.095965530  0.417192752 -0.107302627 -0.365431679 -0.174708832
## [126,] -0.135752582  0.033659060 -0.734983509 -0.085624563 -0.533490188
## [127,] -0.399701384  0.300937435 -0.479749012 -0.086772446  3.032412800
## [128,] -0.709252232 -0.160101195 -0.493960100 -0.166971616  5.110025435
## [129,] -0.625265682 -0.271689916 -0.718958736 -0.015852167  4.085601095
## [130,] -0.770266210 -0.513864259 -0.604506946 -0.292283059  5.111718263
## [131,] -0.396943421 -0.051721330 -0.521645243  0.083253845  3.112125449
## [132,] -0.539557202 -0.252153780 -0.628621932 -0.185303081  3.572129179
## [133,] -0.786282433  0.564160273 -0.653092012 -0.251667130  5.083741233
## [134,] -0.028163594  0.034228487 -0.180136041 -0.041558021 -0.110436460
## [135,] -0.028643847 -0.339697718 -0.411881741  0.338201558  0.247915186
## [136,] -0.028359429 -0.270927154 -0.230771461  0.203896686  0.091202785
## [137,] -0.045831924 -0.549845220 -0.450821787  0.394835928  0.041471696
## [138,] -0.093703153 -0.922641808 -0.596679424  0.470101972  0.095160543
## [139,] -0.169103756 -0.619975029 -0.284083339 -0.067808004 -1.155409108
## [140,]  0.058246446 -0.269402617  0.080551837  0.025001854 -0.028718404
## [141,] -0.385763354  1.306939004  1.007775016 -1.921481462 -0.758071365
## [142,] -0.368717769  1.040268241  0.562757875 -1.283886929 -0.626911642
## [143,] -0.341333856  0.967727576  0.526107235 -1.190063556 -0.586052368
## [144,] -0.380956026  0.969632307  0.593167495 -1.393915735 -0.641201680
## [145,] -0.312003076  0.497434094  0.229601703 -0.784826082 -0.146866933
## [146,] -0.161120988  0.421235483  0.326726182 -0.660731878 -0.276078167
## [147,] -0.387027251  0.810190590  0.387850196 -1.149673200 -0.590854389
## [148,] -0.167493904  0.769883397  0.563493341 -0.759914928 -0.446703315
## [149,] -0.100880377  0.747215286  0.239212744 -0.537615471 -0.411162697
## [150,]  0.044496751  0.893031992  0.613499904 -0.594505084 -0.181369122
## [151,] -0.048308441  0.588663258  0.247258053 -0.489242610 -0.163390238
## [152,] -0.052978386  0.581035001  0.320633383 -0.506142682 -0.176417260
## [153,]  0.003700094  0.253761303  0.312948201 -0.377650467 -0.045428746
## [154,] -0.037455983  0.211084766  0.264784217 -0.418184405 -0.076473750
## [155,] -0.560693306 -1.267322671 -1.040653506 -0.170136592 -1.287895382
```

```
## [156,] -0.307684708 -0.886578697 -0.622473058 -0.135400136 -0.405185589
## [157,] -0.294682048 -0.877078613 -0.516913360 -0.216185175 -0.150770808
## [158,] -0.311262253 -0.839033642 -0.452047351 -0.288973133 -0.106915477
## [159,] -0.530058008 -1.993911142 -1.489343048  0.272577921 -1.547919943
## [160,] -0.485936002 -1.410309337 -0.917244963  0.054555648 -1.342998115
## [161,] -0.285133140  0.051936733 -0.030589244 -0.770310220 -0.772809391
## [162,]  0.026646624  0.051248226 -0.008408780  0.218408696  0.054202847
## [163,] -0.017641304  0.048789604 -0.097025047  0.265283587  0.050319123
## [164,]  0.111135535 -0.174606187  0.027541681  0.285564092  0.180259283
## [165,]  0.009050637 -0.107601331  0.028368082  0.052243845  0.068752540
## [166,]  0.035743812 -0.558422713 -0.113063637  0.169784119  0.159061093
## [167,]  0.233279175 -0.419758538  1.793403430 -0.405129372 -0.219510511
## [168,]  0.046475802  0.163161142  0.224231902 -0.033458900  0.011570706
## [169,]  2.797742561 -0.392356604 -0.194796782  0.035454825  0.228985403
## [170,]  6.005667620 -0.350911021 -0.403189739 -0.136241612 -0.113578472
## [171,]  4.625873928 -0.224077898 -0.177872296 -0.175099921  0.063933843
## [172,]  5.436521591  0.086889020  0.180683332 -0.223610340  0.057201009
## [173,]  4.685342613 -0.187075277 -0.099676856 -0.114054391  0.148723428
## [174,]  2.832112270 -0.658522090 -0.191461762  0.211573144  0.736061543
## [175,]  5.837282505  0.358420793  0.114766643 -0.306945467 -0.295587382
```

```
fa.parallel(Students[3:13])
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.
```

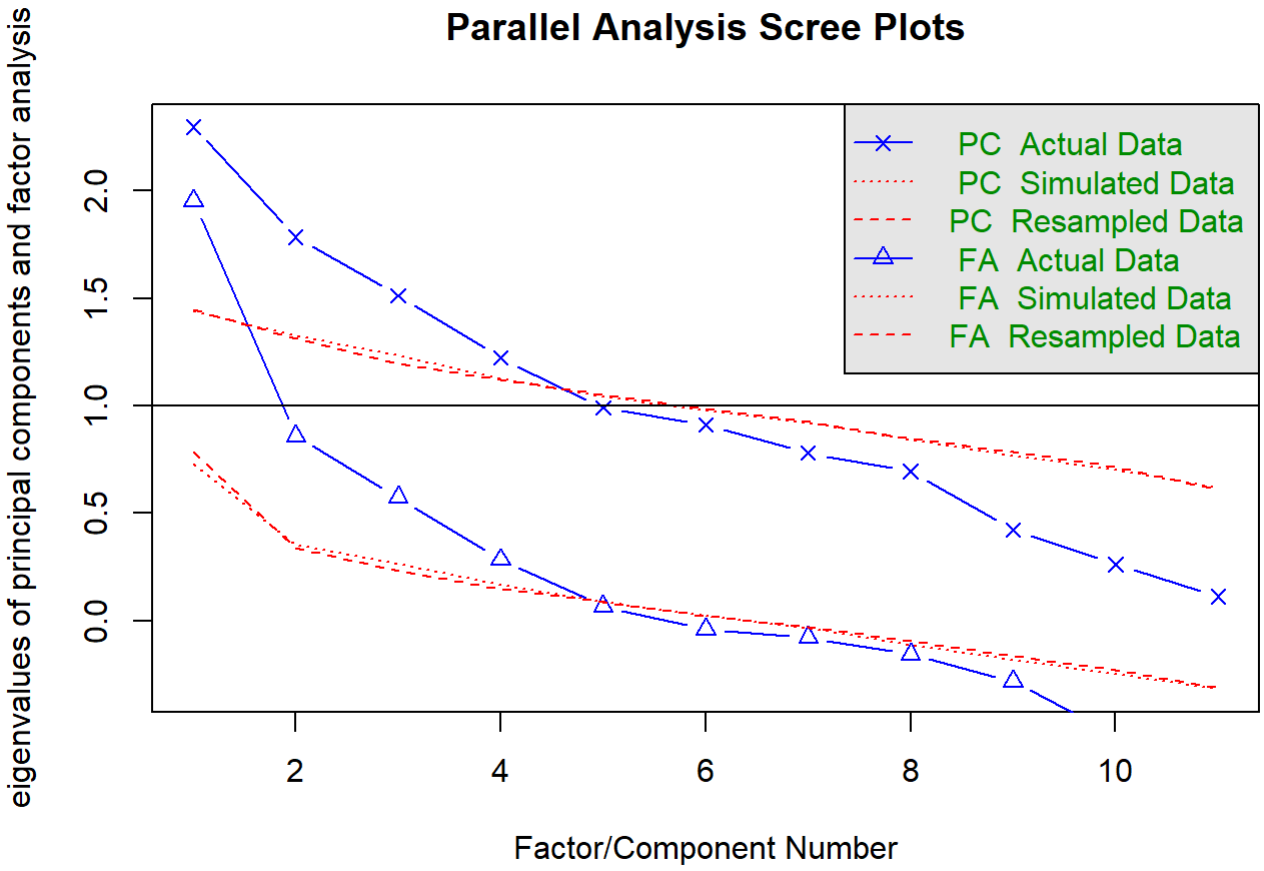
```
## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected.  Examine the results carefully
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.

## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.

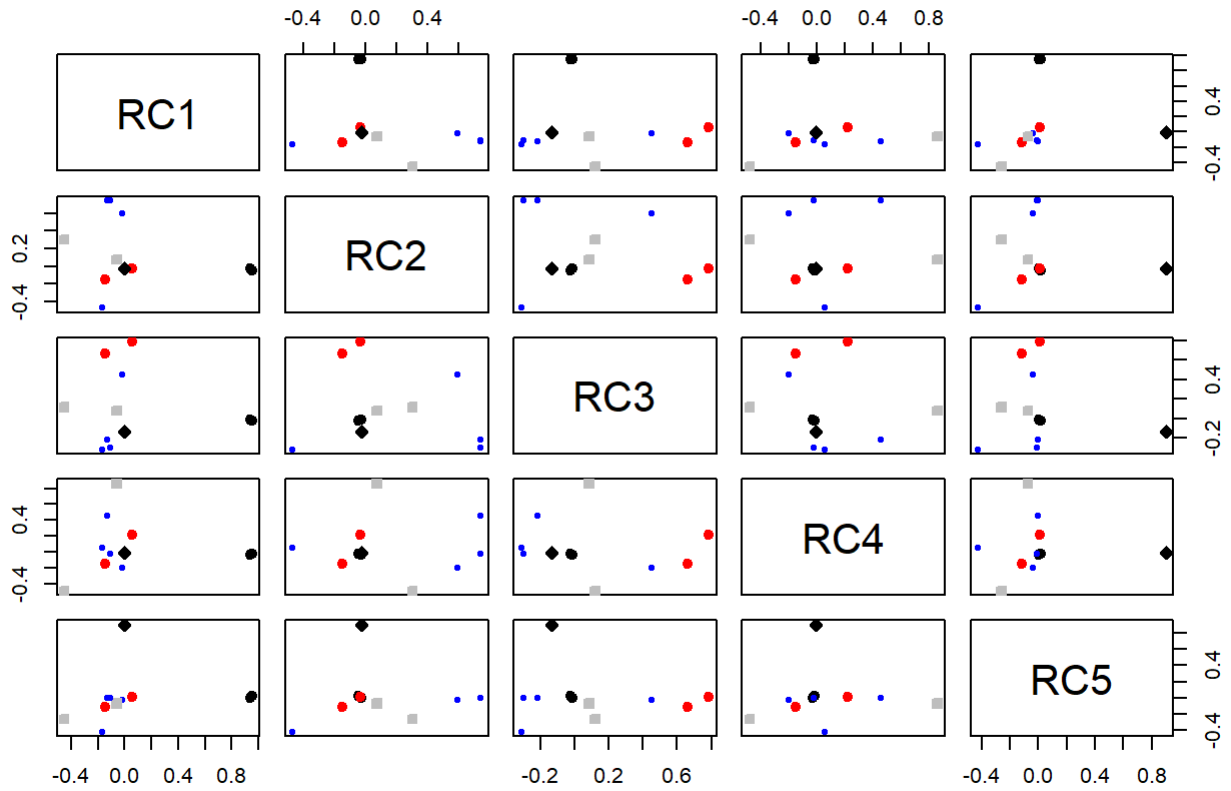
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.

## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.
```



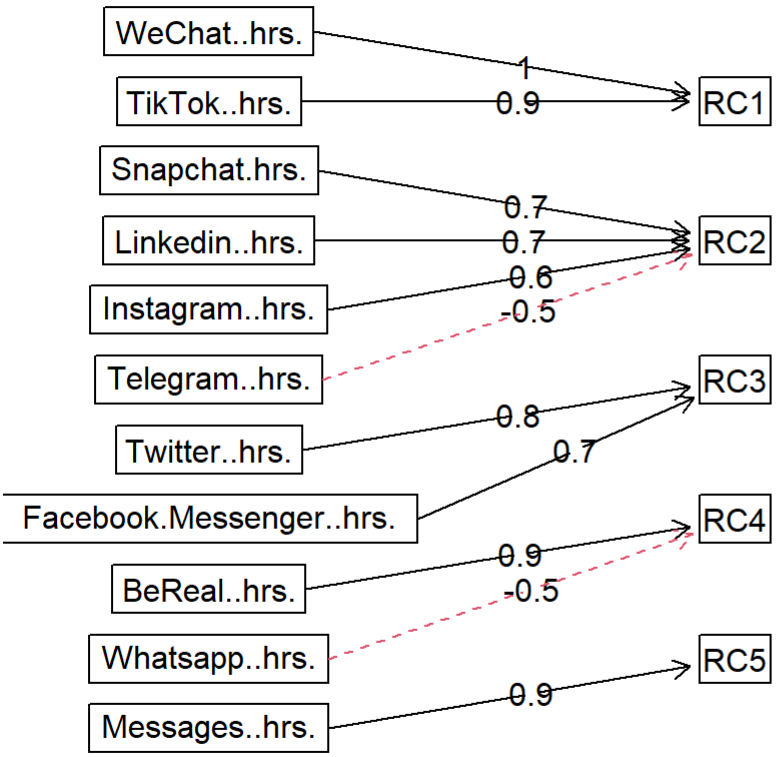

```
## Parallel analysis suggests that the number of factors =  4  and the number of components =  4
```

```
#From this plot we can see that between 5 and 6 there is a dip so have took 5 factors
fa.plot(fit.pc)
```




```
fa.diagram(fit.pc)
```

Components Analysis




```
vss(Students[3:13])
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.
```

```
## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected.  Examine the results carefully
```

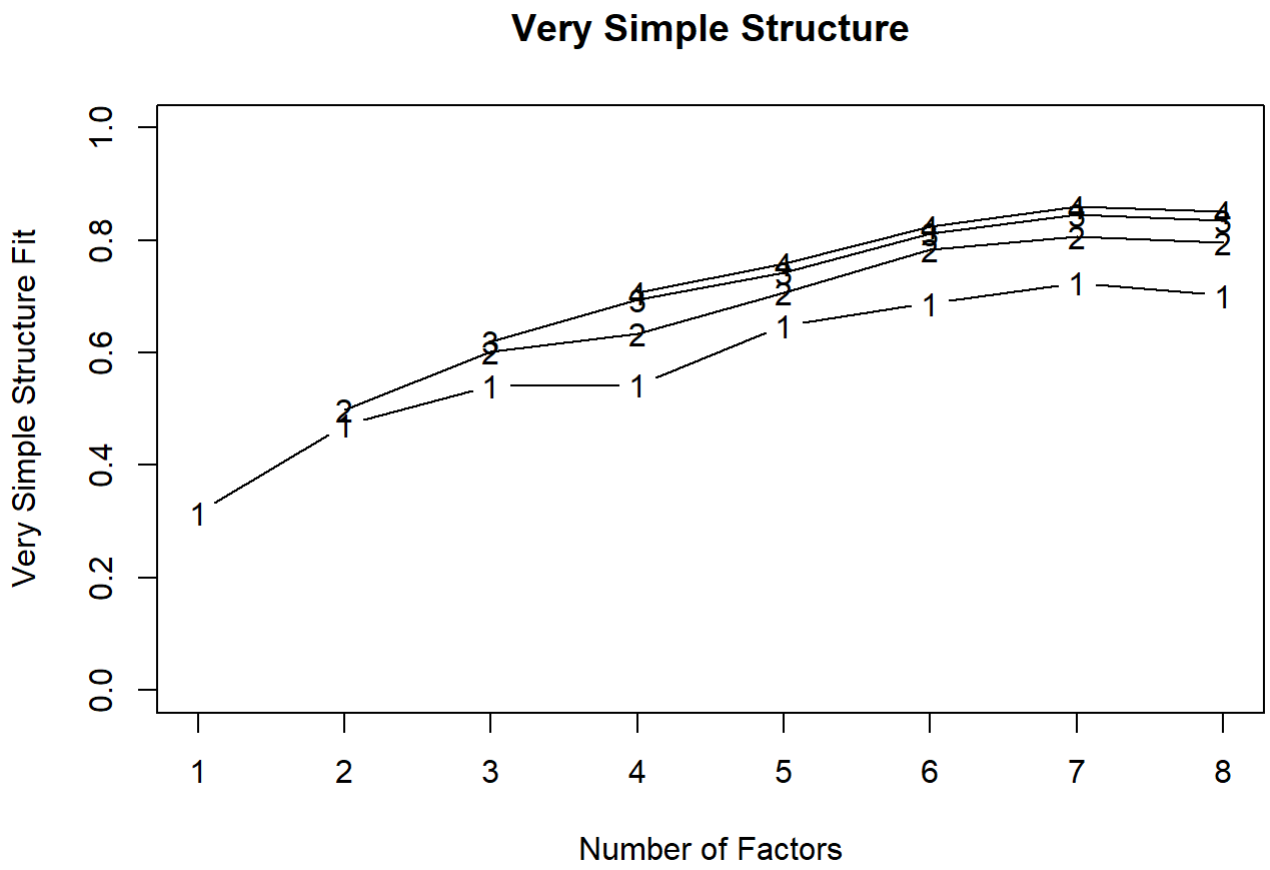
```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.
```

```
## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected.  Examine the results carefully

## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected.  Examine the results carefully
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :
## The estimated weights for the factor scores are probably incorrect.  Try a
## different factor score estimation method.
```

```
## Warning in fac(r = r, nfactors = nfactors, n.obs = n.obs, rotate = rotate, : An
## ultra-Heywood case was detected.  Examine the results carefully
```



```
##
## Very Simple Structure
## Call: vss(x = Students[3:13])
## VSS complexity 1 achieves a maximimum of 0.72  with  7  factors
## VSS complexity 2 achieves a maximimum of 0.81  with  7  factors
##
## The Velicer MAP achieves a minimum of 0.06  with  1  factors
## BIC achieves a minimum of  -50.92  with  2  factors
## Sample Size adjusted BIC achieves a minimum of  -5.02  with  6  factors
##
## Statistics by number of factors
##   vss1 vss2   map dof   chisq    prob sqresid  fit RMSEA BIC SABIC complex
## 1 0.32 0.00 0.059  44 2.4e+02 7.5e-29    10.6 0.32 0.160  13 152.4     1.0
## 2 0.47 0.50 0.062  34 1.2e+02 2.8e-12     7.7 0.50 0.123 -51  56.7     1.2
## 3 0.54 0.60 0.072  25 8.8e+01 5.8e-09     5.9 0.62 0.120 -41  38.1     1.5
## 4 0.54 0.63 0.092  17 4.6e+01 1.9e-04     4.5 0.71 0.098 -42  11.7     1.6
## 5 0.65 0.71 0.119  10 1.5e+01 1.3e-01     3.6 0.77 0.054 -37  -4.9     1.7
## 6 0.69 0.78 0.154   4 3.0e+00 5.6e-01     2.6 0.83 0.000 -18  -5.0     1.5
## 7 0.72 0.81 0.207  -1 4.3e-02      NA     1.9 0.87    NA  NA    NA     1.6
## 8 0.70 0.80 0.316  -5 4.7e-06      NA     2.0 0.87    NA  NA    NA     1.3
##    eChisq    SRMR eCRMS eBIC
## 1 3.6e+02 1.4e-01 0.152  129
## 2 1.6e+02 9.2e-02 0.117  -13
## 3 8.1e+01 6.5e-02 0.096  -48
## 4 3.4e+01 4.2e-02 0.075  -54
## 5 1.2e+01 2.5e-02 0.059  -40
## 6 3.1e+00 1.3e-02 0.047  -18
## 7 8.5e-03 6.6e-04    NA   NA
## 8 6.2e-07 5.7e-06    NA   NA
```

We chat and tik tok are in RC1 values of 1 and 0.9. Snapchat ,Linkedin, insta and telegram a re in RC2 values of 0.7,0.7,0.6 and 0.5 respectively.Twitter and Facebook messenger are in RC3 o f 0.8 and 0.7 respectively.Be real and whatsapp are in 0.9 and 0.5 in RC4 and messages are in RC 5 of 0.9.

```
str(Students)
```

```
## 'data.frame':    175 obs. of  16 variables:
##  $ Student                                  : chr  "AJAY ADDALA" "AJAY ADDALA" "AJAY ADDALA"
"AJAY ADDALA" ...
##  $ Week                                     : chr  "Feb 26 - Mar 4" "Mar 5 - Mar 11" "Mar 12
- Mar 18" "Mar 19 - Mar 25" ...
##  $ Whatsapp..hrs.                           : num  8.9 11.8 12.2 12.3 8.5 ...
##  $ Instagram..hrs.                          : num  7.1 11.2 16.8 12.9 11.9 ...
##  $ Snapchat.hrs.                            : num  1.9 2.45 3.25 3.12 1.9 1.2 1.67 2 1.4 2.1
...
##  $ Telegram..hrs.                           : num  0.02 0.06 0.01 0.06 0.05 0.16 0 0.25 0.35
0.33 ...
##  $ Facebook.Messenger..hrs.                 : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ BeReal..hrs.                             : num  0 0 0 0 0 0 0 0.35 0.21 0.65 ...
##  $ TikTok..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ WeChat..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Twitter..hrs.                            : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Linkedin..hrs.                           : num  4.5 5.5 9.5 9 7.5 8 6.5 2.5 2.67 1.55 ...
##  $ Messages..hrs.                           : num  0.1 0.04 0.01 0.2 0.1 0.01 0 0.2 0.8 0.5
...
##  $ Total.Social.Media.Screen.Time..hrs.     : num  22.5 31.1 41.8 37.6 29.9 ...
##  $ Number.of.times.opened..hourly.intervals.: int  111 119 124 121 116 115 113 150 121 110
...
##  $ Social.Media.Addiction                   : Factor w/ 2 levels "Addicted","Not Addicted": 1
1 1 1 1 1 1 1 1 ...
```

```
Students$Student <- as.factor(Students$Student)
Students$Week <- as.factor(Students$Week)
```

###Logistic regression

Exploratory Analysis

```
xtabs(~ Social.Media.Addiction + Student, data=Students)
```

```
##                         Student
## Social.Media.Addiction AJAY ADDALA AKASH SHANMUGAM ANUSHKA CHAUBE
##           Addicted               7               7              6
##           Not Addicted           0               0              1
##                         Student
## Social.Media.Addiction BATUL KHAMBATA CHENHAO ZHOU JIAYUE GAO KIREETI MANTRALA
##           Addicted                  5            1          0                2
##           Not Addicted              2            6          7                5
##                         Student
## Social.Media.Addiction MUSKAN CHOWATIA NAGA ASRITHA NARRA NAMRATA RATH
##           Addicted                   2                  0            7
##           Not Addicted               5                  7            0
##                         Student
## Social.Media.Addiction PARTHVI KALPESH SONI POOJA BYLAPLAR JAYANNA
##           Addicted                         7                      5
##           Not Addicted                     0                      2
##                         Student
## Social.Media.Addiction PRINCE RAMESHBHAI KHENI PRIYAM KUMARI RUCHIT JATIN MODY
##           Addicted                           1             4                 6
##           Not Addicted                       6             3                 1
##                         Student
## Social.Media.Addiction RUTWIK SANJAY GUNTOORKAR SAILESH POTTURI
##           Addicted                           7               5
##           Not Addicted                       0               2
##                         Student
## Social.Media.Addiction SARJAK ATUL MANIAR SHREYASH MEHTA
##           Addicted                      1              7
##           Not Addicted                  6              0
##                         Student
## Social.Media.Addiction SHRUTI SANJIVAN SONTAKKE TANAY RAJESH DANGAICH
##           Addicted                           4                     0
##           Not Addicted                       3                     7
##                         Student
## Social.Media.Addiction TARUN KAUSHIK TEJESH ALAPARTHI VEDA ALLOORI
##           Addicted                5                5            1
##           Not Addicted            2                2            6
##                         Student
## Social.Media.Addiction VIDHI AMBWANI
##           Addicted                5
##           Not Addicted            2
```

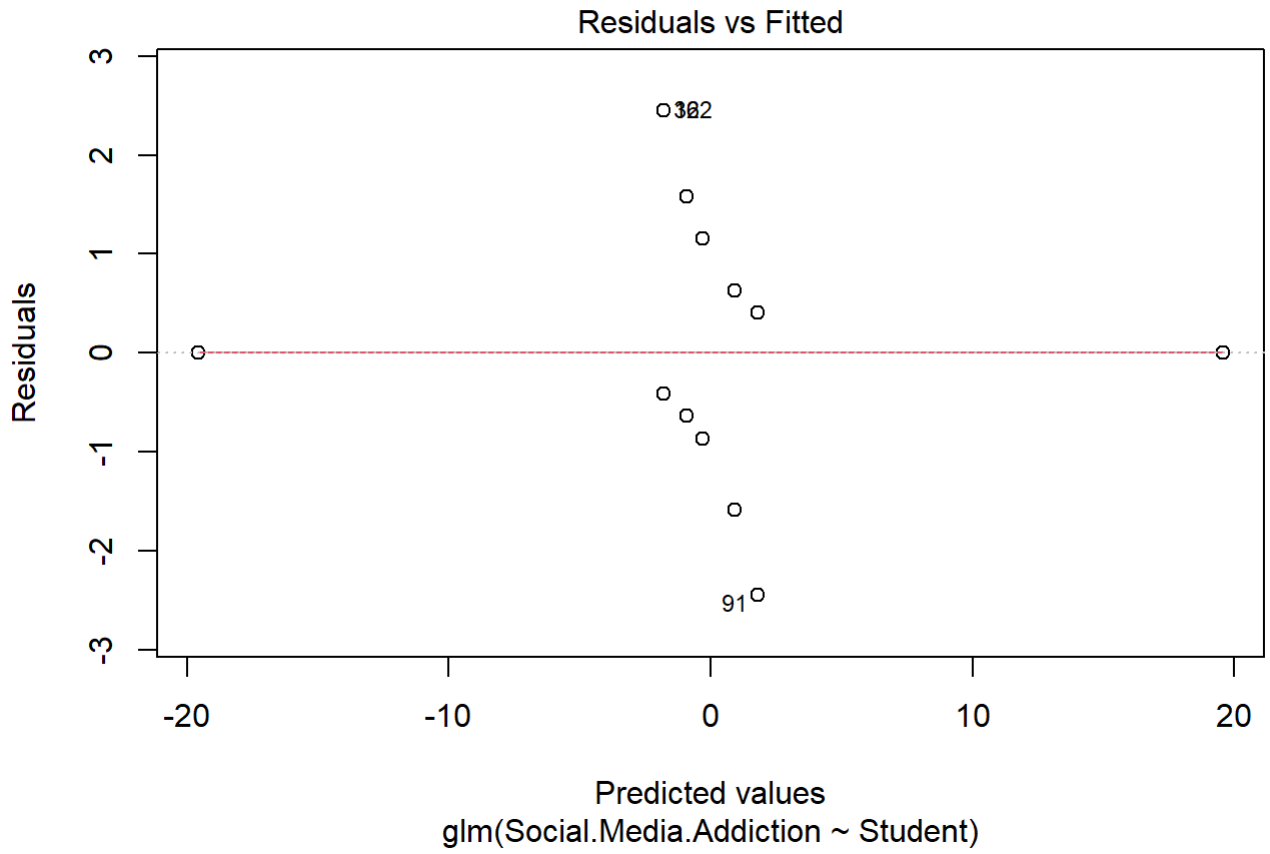
```
xtabs(~ Social.Media.Addiction + Week, data=Students)
```

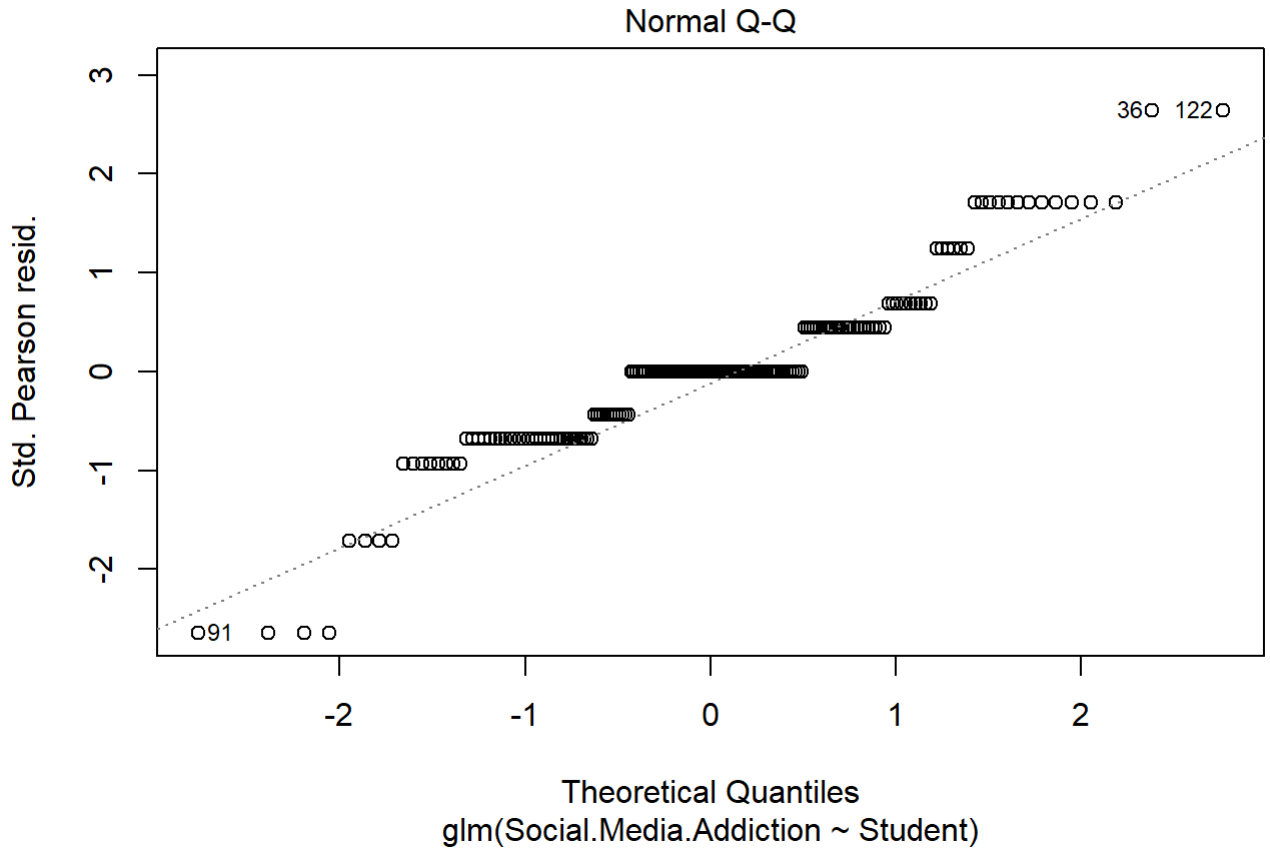
```
##                       Week
## Social.Media.Addiction Apr 2 - Apr 8 Apr 9 - Apr 15 Feb 26 - Mar 4
##           Addicted                14             17             14
##           Not Addicted            11              8             11
##                       Week
## Social.Media.Addiction Mar 12 - Mar 18 Mar 19 - Mar 25 Mar 26 - Apr 1
##           Addicted                  13              16             11
##           Not Addicted              12               9             14
##                       Week
## Social.Media.Addiction Mar 5 - Mar 11
##           Addicted                15
##           Not Addicted            10
```

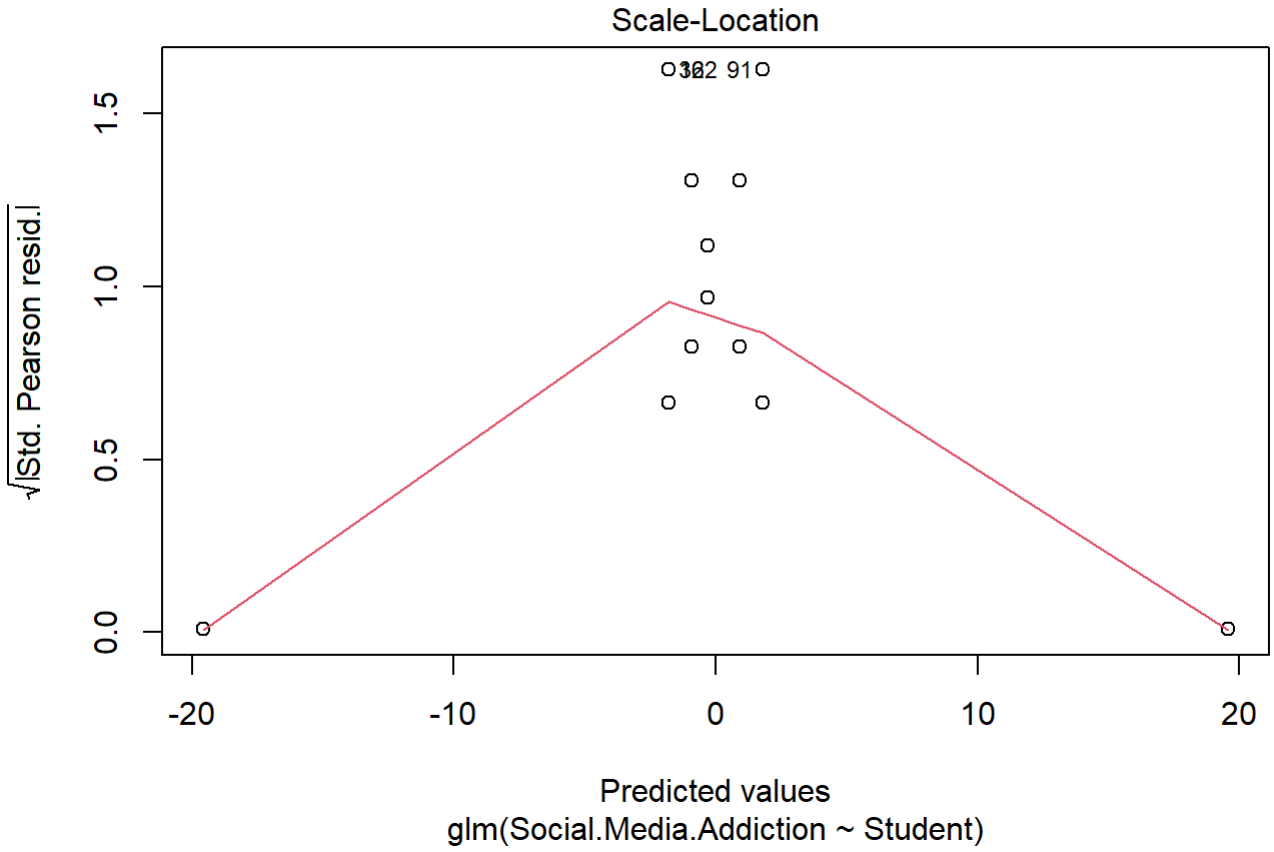
```
logistic_simple <- glm(Social.Media.Addiction ~ Student, data=Students, family="binomial")
summary(logistic_simple)
```

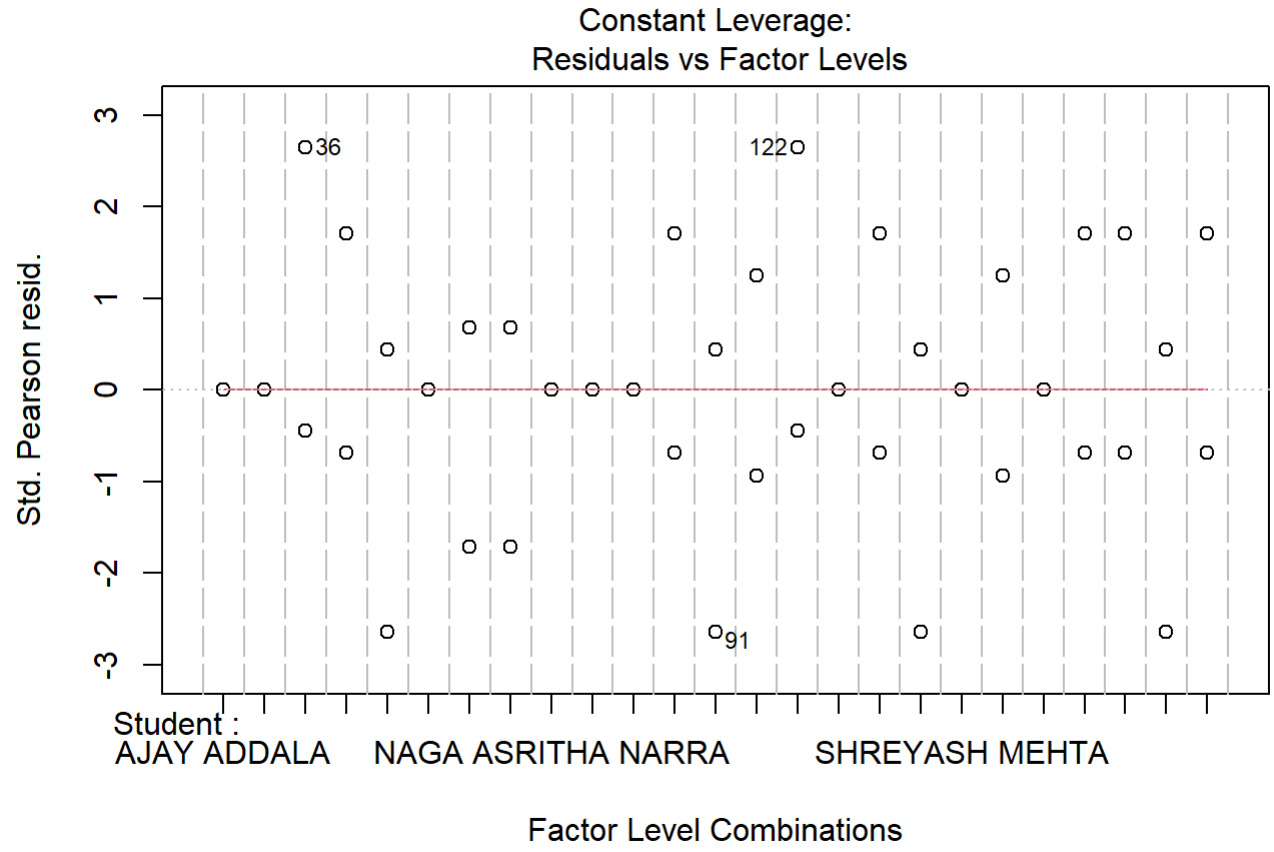
```
##
## Call:
## glm(formula = Social.Media.Addiction ~ Student, family = "binomial",
##     data = Students)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.97277  -0.82033  -0.00008   0.55525   1.97277
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                   -1.957e+01  4.065e+03  -0.005    0.996
## StudentAKASH SHANMUGAM         3.060e-08  5.748e+03   0.000    1.000
## StudentANUSHKA CHAUBE          1.777e+01  4.065e+03   0.004    0.997
## StudentBATUL KHAMBATA          1.865e+01  4.065e+03   0.005    0.996
## StudentCHENHAO ZHOU            2.136e+01  4.065e+03   0.005    0.996
## StudentJIAYUE GAO              3.913e+01  5.748e+03   0.007    0.995
## StudentKIREETI MANTRALA        2.048e+01  4.065e+03   0.005    0.996
## StudentMUSKAN CHOWATIA         2.048e+01  4.065e+03   0.005    0.996
## StudentNAGA ASRITHA NARRA      3.913e+01  5.748e+03   0.007    0.995
## StudentNAMRATA RATH            3.073e-08  5.748e+03   0.000    1.000
## StudentPARTHVI KALPESH SONI    3.058e-08  5.748e+03   0.000    1.000
## StudentPOOJA BYLAPLAR JAYANNA  1.865e+01  4.065e+03   0.005    0.996
## StudentPRINCE RAMESHBHAI KHENI 2.136e+01  4.065e+03   0.005    0.996
## StudentPRIYAM KUMARI           1.928e+01  4.065e+03   0.005    0.996
## StudentRUCHIT JATIN MODY       1.777e+01  4.065e+03   0.004    0.997
## StudentRUTWIK SANJAY GUNTOORKAR 3.077e-08  5.748e+03   0.000    1.000
## StudentSAILESH POTTURI         1.865e+01  4.065e+03   0.005    0.996
## StudentSARJAK ATUL MANIAR      2.136e+01  4.065e+03   0.005    0.996
## StudentSHREYASH MEHTA          3.061e-08  5.748e+03   0.000    1.000
## StudentSHRUTI SANJIVAN SONTAKKE 1.928e+01  4.065e+03   0.005    0.996
## StudentTANAY RAJESH DANGAICH   3.913e+01  5.748e+03   0.007    0.995
## StudentTARUN KAUSHIK           1.865e+01  4.065e+03   0.005    0.996
## StudentTEJESH ALAPARTHI        1.865e+01  4.065e+03   0.005    0.996
## StudentVEDA ALLOORI            2.136e+01  4.065e+03   0.005    0.996
## StudentVIDHI AMBWANI           1.865e+01  4.065e+03   0.005    0.996
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 239.02  on 174  degrees of freedom
## Residual deviance: 120.58  on 150  degrees of freedom
## AIC: 170.58
##
## Number of Fisher Scoring iterations: 18
```

```
plot(logistic_simple)
```


Residuals vs Fitted
Residuals
Predicted values
glm(Social.Media.Addiction ~ Student)
91


Normal Q-Q
Std. Pearson resid.
Theoretical Quantiles
glm(Social.Media.Addiction ~ Student)
36
122
91

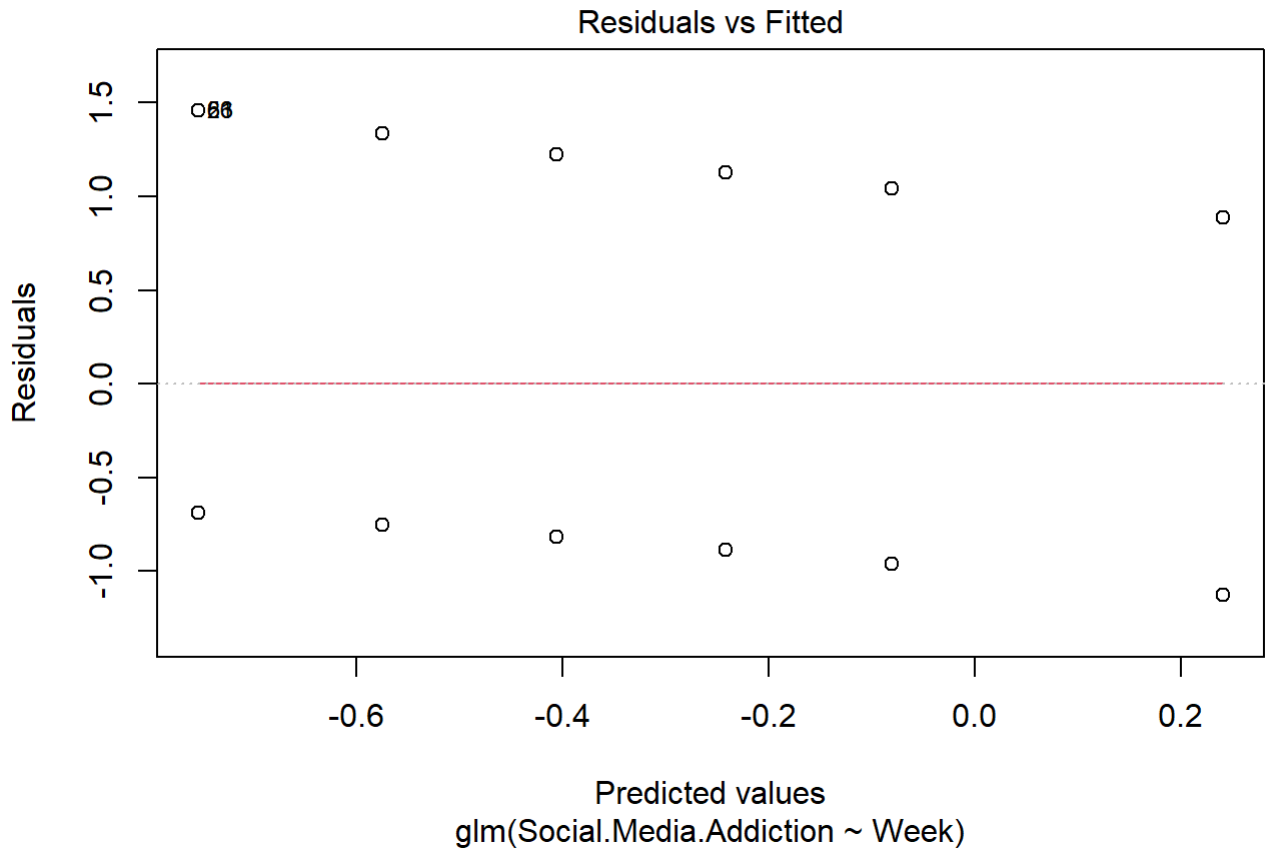

Scale-Location
√|Std. Pearson resid.|
0.0
0.5
1.0
1.5
-20
-10
0
10
20
Predicted values
glm(Social.Media.Addiction ~ Student)

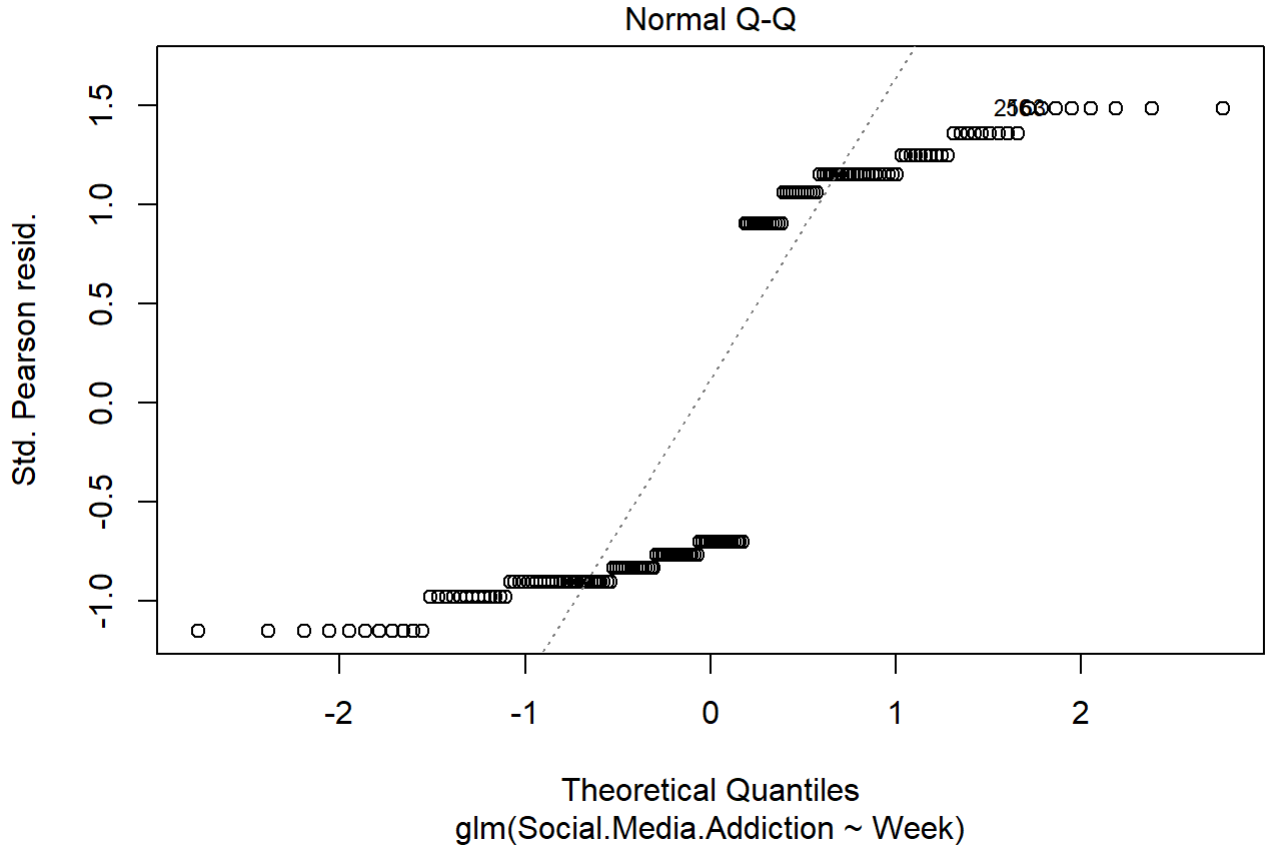

Constant Leverage:
Residuals vs Factor Levels
Std. Pearson resid.
3
2
1
0
-1
-2
-3
36
122
91
Student :
AJAY ADDALA
NAGA ASRITHA NARRA
SHREYASH MEHTA
Factor Level Combinations

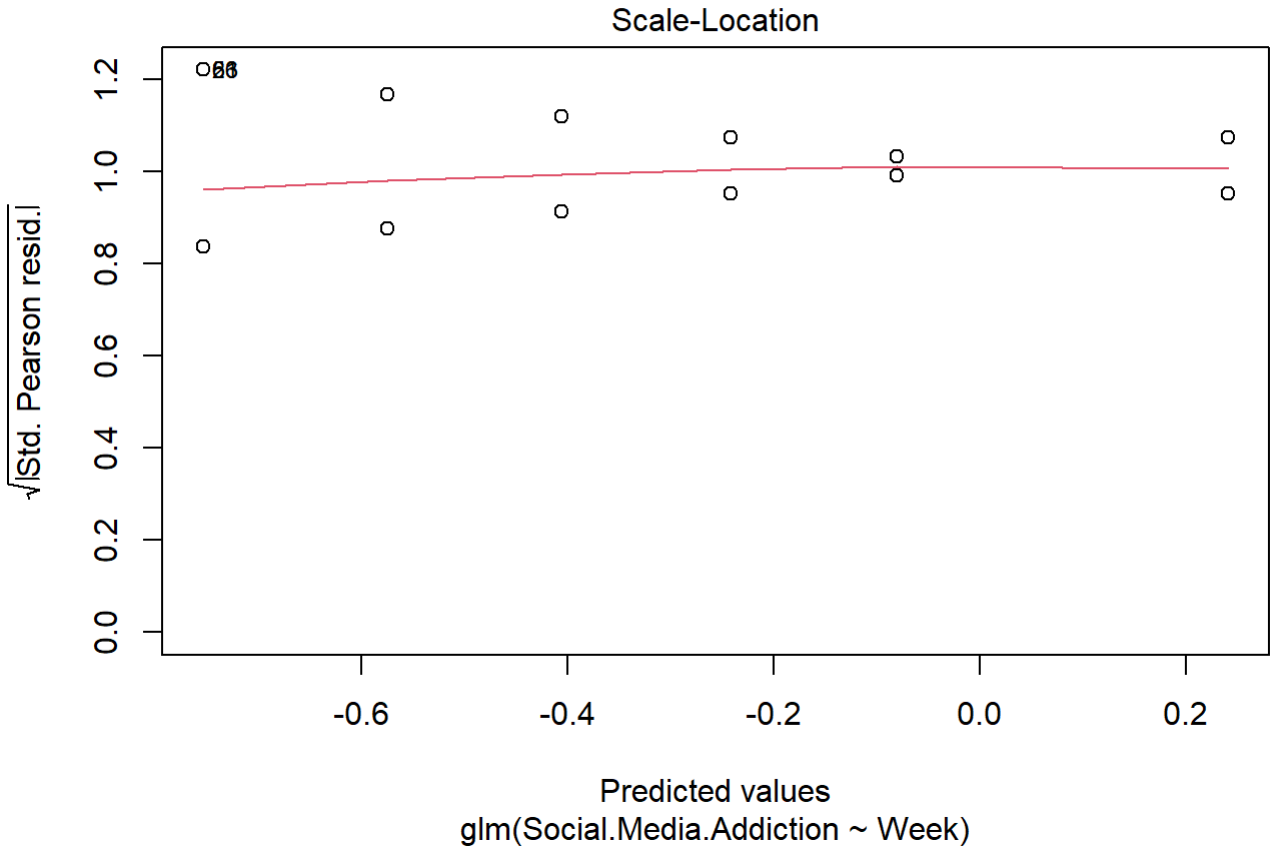
```
logistic_simple1 <- glm(Social.Media.Addiction ~ Week, data=Students, family="binomial")
summary(logistic_simple1)
```

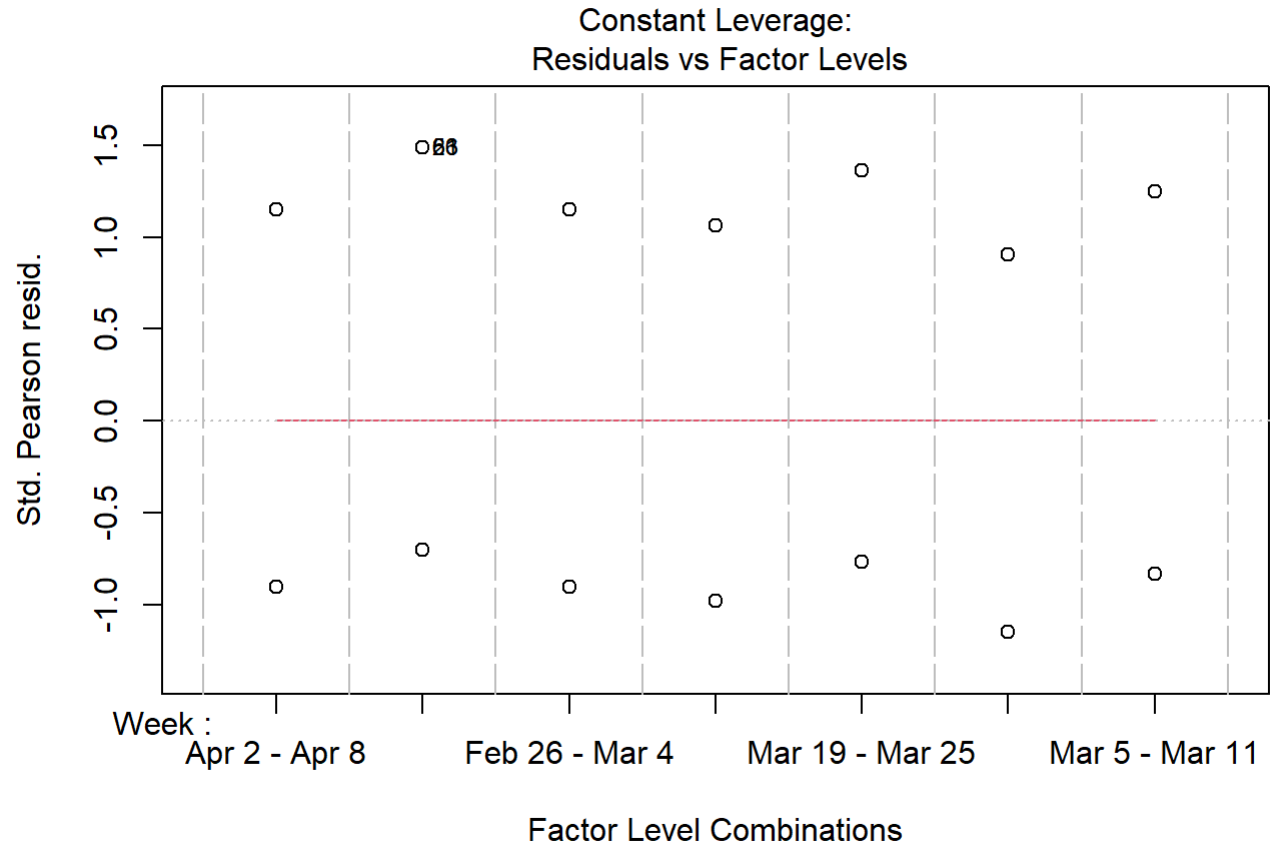
```
##
## Call:
## glm(formula = Social.Media.Addiction ~ Week, family = "binomial",
##     data = Students)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.2814  -1.0769  -0.8782   1.2814   1.5096
##
## Coefficients:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -2.412e-01  4.029e-01  -0.599    0.549
## WeekApr 9 - Apr 15  -5.126e-01  5.884e-01  -0.871    0.384
## WeekFeb 26 - Mar 4  -2.392e-15  5.698e-01   0.000    1.000
## WeekMar 12 - Mar 18  1.611e-01  5.680e-01   0.284    0.777
## WeekMar 19 - Mar 25 -3.342e-01  5.796e-01  -0.577    0.564
## WeekMar 26 - Apr 1   4.823e-01  5.698e-01   0.846    0.397
## WeekMar 5 - Mar 11  -1.643e-01  5.736e-01  -0.286    0.775
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 239.02  on 174  degrees of freedom
## Residual deviance: 235.17  on 168  degrees of freedom
## AIC: 249.17
##
## Number of Fisher Scoring iterations: 4
```

```
plot(logistic_simple1)
```


Residuals vs Fitted
Residuals
1.5
1.0
0.5
0.0
-0.5
-1.0
-0.6
-0.4
-0.2
0.0
0.2
Predicted values
glm(Social.Media.Addiction ~ Week)


Normal Q-Q
Std. Pearson resid.
1.5
1.0
0.5
0.0
-0.5
-1.0
-2
-1
0
1
2
Theoretical Quantiles
glm(Social.Media.Addiction ~ Week)


Scale-Location
√|Std. Pearson resid.|
0.0
0.2
0.4
0.6
0.8
1.0
1.2
-0.6
-0.4
-0.2
0.0
0.2
Predicted values
glm(Social.Media.Addiction ~ Week)


Constant Leverage:
Residuals vs Factor Levels
Std. Pearson resid.
-1.0
-0.5
0.0
0.5
1.0
1.5
Week :
Apr 2 - Apr 8
Feb 26 - Mar 4
Mar 19 - Mar 25
Mar 5 - Mar 11
Factor Level Combinations

```
predicted.data <- data.frame(probability.of.Social.Media.Addiction=logistic_simple$fitted.value
s,Week=Students$Week)
predicted.data
```

```
##     probability.of.Social.Media.Addiction            Week
## 1                            3.181005e-09  Feb 26 - Mar 4
## 2                            3.181005e-09  Mar 5 - Mar 11
## 3                            3.181005e-09 Mar 12 - Mar 18
## 4                            3.181005e-09 Mar 19 - Mar 25
## 5                            3.181005e-09  Mar 26 - Apr 1
## 6                            3.181005e-09   Apr 2 - Apr 8
## 7                            3.181005e-09  Apr 9 - Apr 15
## 8                            2.857143e-01  Feb 26 - Mar 4
## 9                            2.857143e-01  Mar 5 - Mar 11
## 10                           2.857143e-01 Mar 12 - Mar 18
## 11                           2.857143e-01 Mar 19 - Mar 25
## 12                           2.857143e-01  Mar 26 - Apr 1
## 13                           2.857143e-01   Apr 2 - Apr 8
## 14                           2.857143e-01  Apr 9 - Apr 15
## 15                           8.571429e-01  Feb 26 - Mar 4
## 16                           8.571429e-01  Mar 5 - Mar 11
## 17                           8.571429e-01 Mar 12 - Mar 18
## 18                           8.571429e-01 Mar 19 - Mar 25
## 19                           8.571429e-01  Mar 26 - Apr 1
## 20                           8.571429e-01   Apr 2 - Apr 8
## 21                           8.571429e-01  Apr 9 - Apr 15
## 22                           2.857143e-01  Feb 26 - Mar 4
## 23                           2.857143e-01  Mar 5 - Mar 11
## 24                           2.857143e-01 Mar 12 - Mar 18
## 25                           2.857143e-01 Mar 19 - Mar 25
## 26                           2.857143e-01  Mar 26 - Apr 1
## 27                           2.857143e-01   Apr 2 - Apr 8
## 28                           2.857143e-01  Apr 9 - Apr 15
## 29                           2.857143e-01  Feb 26 - Mar 4
## 30                           2.857143e-01  Mar 5 - Mar 11
## 31                           2.857143e-01 Mar 12 - Mar 18
## 32                           2.857143e-01 Mar 19 - Mar 25
## 33                           2.857143e-01  Mar 26 - Apr 1
## 34                           2.857143e-01   Apr 2 - Apr 8
## 35                           2.857143e-01  Apr 9 - Apr 15
## 36                           1.428571e-01  Feb 26 - Mar 4
## 37                           1.428571e-01  Mar 5 - Mar 11
## 38                           1.428571e-01 Mar 12 - Mar 18
## 39                           1.428571e-01 Mar 19 - Mar 25
## 40                           1.428571e-01  Mar 26 - Apr 1
## 41                           1.428571e-01   Apr 2 - Apr 8
## 42                           1.428571e-01  Apr 9 - Apr 15
## 43                           7.142857e-01  Feb 26 - Mar 4
## 44                           7.142857e-01  Mar 5 - Mar 11
## 45                           7.142857e-01 Mar 12 - Mar 18
## 46                           7.142857e-01 Mar 19 - Mar 25
## 47                           7.142857e-01  Mar 26 - Apr 1
## 48                           7.142857e-01   Apr 2 - Apr 8
## 49                           7.142857e-01  Apr 9 - Apr 15
## 50                           1.000000e+00  Feb 26 - Mar 4
## 51                           1.000000e+00  Mar 5 - Mar 11
```

```
## 52                          1.000000e+00 Mar 12 - Mar 18
## 53                          1.000000e+00 Mar 19 - Mar 25
## 54                          1.000000e+00  Mar 26 - Apr 1
## 55                          1.000000e+00   Apr 2 - Apr 8
## 56                          1.000000e+00  Apr 9 - Apr 15
## 57                          1.000000e+00  Feb 26 - Mar 4
## 58                          1.000000e+00  Mar 5 - Mar 11
## 59                          1.000000e+00 Mar 12 - Mar 18
## 60                          1.000000e+00 Mar 19 - Mar 25
## 61                          1.000000e+00  Mar 26 - Apr 1
## 62                          1.000000e+00   Apr 2 - Apr 8
## 63                          1.000000e+00  Apr 9 - Apr 15
## 64                          3.181005e-09  Feb 26 - Mar 4
## 65                          3.181005e-09  Mar 5 - Mar 11
## 66                          3.181005e-09 Mar 12 - Mar 18
## 67                          3.181005e-09 Mar 19 - Mar 25
## 68                          3.181005e-09  Mar 26 - Apr 1
## 69                          3.181005e-09   Apr 2 - Apr 8
## 70                          3.181005e-09  Apr 9 - Apr 15
## 71                          2.857143e-01  Feb 26 - Mar 4
## 72                          2.857143e-01  Mar 5 - Mar 11
## 73                          2.857143e-01 Mar 12 - Mar 18
## 74                          2.857143e-01 Mar 19 - Mar 25
## 75                          2.857143e-01  Mar 26 - Apr 1
## 76                          2.857143e-01   Apr 2 - Apr 8
## 77                          2.857143e-01  Apr 9 - Apr 15
## 78                          2.857143e-01  Feb 26 - Mar 4
## 79                          2.857143e-01  Mar 5 - Mar 11
## 80                          2.857143e-01 Mar 12 - Mar 18
## 81                          2.857143e-01 Mar 19 - Mar 25
## 82                          2.857143e-01  Mar 26 - Apr 1
## 83                          2.857143e-01   Apr 2 - Apr 8
## 84                          2.857143e-01  Apr 9 - Apr 15
## 85                          8.571429e-01  Feb 26 - Mar 4
## 86                          8.571429e-01  Mar 5 - Mar 11
## 87                          8.571429e-01 Mar 12 - Mar 18
## 88                          8.571429e-01 Mar 19 - Mar 25
## 89                          8.571429e-01  Mar 26 - Apr 1
## 90                          8.571429e-01   Apr 2 - Apr 8
## 91                          8.571429e-01  Apr 9 - Apr 15
## 92                          4.285714e-01  Feb 26 - Mar 4
## 93                          4.285714e-01  Mar 5 - Mar 11
## 94                          4.285714e-01 Mar 12 - Mar 18
## 95                          4.285714e-01 Mar 19 - Mar 25
## 96                          4.285714e-01  Mar 26 - Apr 1
## 97                          4.285714e-01   Apr 2 - Apr 8
## 98                          4.285714e-01  Apr 9 - Apr 15
## 99                          8.571429e-01  Feb 26 - Mar 4
## 100                         8.571429e-01  Mar 5 - Mar 11
## 101                         8.571429e-01 Mar 12 - Mar 18
## 102                         8.571429e-01 Mar 19 - Mar 25
## 103                         8.571429e-01  Mar 26 - Apr 1
```

```
## 104                          8.571429e-01   Apr 2 - Apr 8
## 105                          8.571429e-01  Apr 9 - Apr 15
## 106                          7.142857e-01  Feb 26 - Mar 4
## 107                          7.142857e-01  Mar 5 - Mar 11
## 108                          7.142857e-01 Mar 12 - Mar 18
## 109                          7.142857e-01 Mar 19 - Mar 25
## 110                          7.142857e-01  Mar 26 - Apr 1
## 111                          7.142857e-01   Apr 2 - Apr 8
## 112                          7.142857e-01  Apr 9 - Apr 15
## 113                          3.181005e-09  Feb 26 - Mar 4
## 114                          3.181005e-09  Mar 5 - Mar 11
## 115                          3.181005e-09 Mar 12 - Mar 18
## 116                          3.181005e-09 Mar 19 - Mar 25
## 117                          3.181005e-09  Mar 26 - Apr 1
## 118                          3.181005e-09   Apr 2 - Apr 8
## 119                          3.181005e-09  Apr 9 - Apr 15
## 120                          1.428571e-01  Feb 26 - Mar 4
## 121                          1.428571e-01  Mar 5 - Mar 11
## 122                          1.428571e-01 Mar 12 - Mar 18
## 123                          1.428571e-01 Mar 19 - Mar 25
## 124                          1.428571e-01  Mar 26 - Apr 1
## 125                          1.428571e-01   Apr 2 - Apr 8
## 126                          1.428571e-01  Apr 9 - Apr 15
## 127                          1.000000e+00  Feb 26 - Mar 4
## 128                          1.000000e+00  Mar 5 - Mar 11
## 129                          1.000000e+00 Mar 12 - Mar 18
## 130                          1.000000e+00 Mar 19 - Mar 25
## 131                          1.000000e+00  Mar 26 - Apr 1
## 132                          1.000000e+00   Apr 2 - Apr 8
## 133                          1.000000e+00  Apr 9 - Apr 15
## 134                          2.857143e-01  Feb 26 - Mar 4
## 135                          2.857143e-01  Mar 5 - Mar 11
## 136                          2.857143e-01 Mar 12 - Mar 18
## 137                          2.857143e-01 Mar 19 - Mar 25
## 138                          2.857143e-01  Mar 26 - Apr 1
## 139                          2.857143e-01   Apr 2 - Apr 8
## 140                          2.857143e-01  Apr 9 - Apr 15
## 141                          3.181005e-09  Feb 26 - Mar 4
## 142                          3.181005e-09  Mar 5 - Mar 11
## 143                          3.181005e-09 Mar 12 - Mar 18
## 144                          3.181005e-09 Mar 19 - Mar 25
## 145                          3.181005e-09  Mar 26 - Apr 1
## 146                          3.181005e-09   Apr 2 - Apr 8
## 147                          3.181005e-09  Apr 9 - Apr 15
## 148                          3.181005e-09  Feb 26 - Mar 4
## 149                          3.181005e-09  Mar 5 - Mar 11
## 150                          3.181005e-09 Mar 12 - Mar 18
## 151                          3.181005e-09 Mar 19 - Mar 25
## 152                          3.181005e-09  Mar 26 - Apr 1
## 153                          3.181005e-09   Apr 2 - Apr 8
## 154                          3.181005e-09  Apr 9 - Apr 15
## 155                          3.181005e-09  Feb 26 - Mar 4
```

```
## 156                          3.181005e-09  Mar 5 - Mar 11
## 157                          3.181005e-09 Mar 12 - Mar 18
## 158                          3.181005e-09 Mar 19 - Mar 25
## 159                          3.181005e-09  Mar 26 - Apr 1
## 160                          3.181005e-09   Apr 2 - Apr 8
## 161                          3.181005e-09  Apr 9 - Apr 15
## 162                          4.285714e-01  Feb 26 - Mar 4
## 163                          4.285714e-01  Mar 5 - Mar 11
## 164                          4.285714e-01 Mar 12 - Mar 18
## 165                          4.285714e-01 Mar 19 - Mar 25
## 166                          4.285714e-01  Mar 26 - Apr 1
## 167                          4.285714e-01   Apr 2 - Apr 8
## 168                          4.285714e-01  Apr 9 - Apr 15
## 169                          8.571429e-01  Feb 26 - Mar 4
## 170                          8.571429e-01  Mar 5 - Mar 11
## 171                          8.571429e-01 Mar 12 - Mar 18
## 172                          8.571429e-01 Mar 19 - Mar 25
## 173                          8.571429e-01  Mar 26 - Apr 1
## 174                          8.571429e-01   Apr 2 - Apr 8
## 175                          8.571429e-01  Apr 9 - Apr 15
```

```
xtabs(~ probability.of.Social.Media.Addiction + Student, data=predicted.data)
```

```
##                                     Student
## probability.of.Social.Media.Addiction AJAY ADDALA AKASH SHANMUGAM
##                   3.18100531826685e-09           7               0
##                   3.18100541552969e-09           0               0
##                   3.18100541561804e-09           0               7
##                   3.18100541563938e-09           0               0
##                   3.18100541601663e-09           0               0
##                   3.18100541614883e-09           0               0
##                   0.14285714285714               0               0
##                   0.142857142857142              0               0
##                   0.285714285714279              0               0
##                   0.285714285714281              0               0
##                   0.285714285714283              0               0
##                   0.285714285714286              0               0
##                   0.285714285714287              0               0
##                   0.285714285714288              0               0
##                   0.428571428571426              0               0
##                   0.71428571428571               0               0
##                   0.857142857142853              0               0
##                   0.857142857142854              0               0
##                   0.857142857142855              0               0
##                   0.857142857142856              0               0
##                   0.999999996818995              0               0
##                                     Student
## probability.of.Social.Media.Addiction ANUSHKA CHAUBE BATUL KHAMBATA
##                   3.18100531826685e-09              0             0
##                   3.18100541552969e-09              0             0
##                   3.18100541561804e-09              0             0
##                   3.18100541563938e-09              0             0
##                   3.18100541601663e-09              0             0
##                   3.18100541614883e-09              0             0
##                   0.14285714285714                  0             0
##                   0.142857142857142                 7             0
##                   0.285714285714279                 0             0
##                   0.285714285714281                 0             0
##                   0.285714285714283                 0             7
##                   0.285714285714286                 0             0
##                   0.285714285714287                 0             0
##                   0.285714285714288                 0             0
##                   0.428571428571426                 0             0
##                   0.71428571428571                  0             0
##                   0.857142857142853                 0             0
##                   0.857142857142854                 0             0
##                   0.857142857142855                 0             0
##                   0.857142857142856                 0             0
##                   0.999999996818995                 0             0
##                                     Student
## probability.of.Social.Media.Addiction CHENHAO ZHOU JIAYUE GAO KIREETI MANTRALA
##                   3.18100531826685e-09            0          0               0
##                   3.18100541552969e-09            0          0               0
##                   3.18100541561804e-09            0          0               0
##                   3.18100541563938e-09            0          0               0
```

```
##                   3.18100541601663e-09            0          0               0
##                   3.18100541614883e-09            0          0               0
##                   0.14285714285714                0          0               0
##                   0.142857142857142               0          0               0
##                   0.285714285714279               0          0               0
##                   0.285714285714281               0          0               0
##                   0.285714285714283               0          0               0
##                   0.285714285714286               0          0               0
##                   0.285714285714287               0          0               0
##                   0.285714285714288               0          0               0
##                   0.428571428571426               0          0               0
##                   0.71428571428571                0          0               7
##                   0.857142857142853               0          0               0
##                   0.857142857142854               0          0               0
##                   0.857142857142855               7          0               0
##                   0.857142857142856               0          0               0
##                   0.999999996818995               0          7               0
##                                       Student
## probability.of.Social.Media.Addiction MUSKAN CHOWATIA NAGA ASRITHA NARRA
##                   3.18100531826685e-09               0                  0
##                   3.18100541552969e-09               0                  0
##                   3.18100541561804e-09               0                  0
##                   3.18100541563938e-09               0                  0
##                   3.18100541601663e-09               0                  0
##                   3.18100541614883e-09               0                  0
##                   0.14285714285714                   0                  0
##                   0.142857142857142                  0                  0
##                   0.285714285714279                  0                  0
##                   0.285714285714281                  0                  0
##                   0.285714285714283                  0                  0
##                   0.285714285714286                  0                  0
##                   0.285714285714287                  0                  0
##                   0.285714285714288                  0                  0
##                   0.428571428571426                  0                  0
##                   0.71428571428571                   7                  0
##                   0.857142857142853                  0                  0
##                   0.857142857142854                  0                  0
##                   0.857142857142855                  0                  0
##                   0.857142857142856                  0                  0
##                   0.999999996818995                  0                  7
##                                       Student
## probability.of.Social.Media.Addiction NAMRATA RATH PARTHVI KALPESH SONI
##                   3.18100531826685e-09            0                   0
##                   3.18100541552969e-09            0                   7
##                   3.18100541561804e-09            0                   0
##                   3.18100541563938e-09            0                   0
##                   3.18100541601663e-09            7                   0
##                   3.18100541614883e-09            0                   0
##                   0.14285714285714                0                   0
##                   0.142857142857142               0                   0
##                   0.285714285714279               0                   0
##                   0.285714285714281               0                   0
```

```
##                   0.285714285714283                0                   0
##                   0.285714285714286                0                   0
##                   0.285714285714287                0                   0
##                   0.285714285714288                0                   0
##                   0.428571428571426                0                   0
##                   0.71428571428571                 0                   0
##                   0.857142857142853                0                   0
##                   0.857142857142854                0                   0
##                   0.857142857142855                0                   0
##                   0.857142857142856                0                   0
##                   0.999999996818995                0                   0
##                                       Student
## probability.of.Social.Media.Addiction POOJA BYLAPLAR JAYANNA
##                   3.18100531826685e-09                        0
##                   3.18100541552969e-09                        0
##                   3.18100541561804e-09                        0
##                   3.18100541563938e-09                        0
##                   3.18100541601663e-09                        0
##                   3.18100541614883e-09                        0
##                   0.14285714285714                            0
##                   0.142857142857142                           0
##                   0.285714285714279                           0
##                   0.285714285714281                           0
##                   0.285714285714283                           0
##                   0.285714285714286                           0
##                   0.285714285714287                           0
##                   0.285714285714288                           7
##                   0.428571428571426                           0
##                   0.71428571428571                            0
##                   0.857142857142853                           0
##                   0.857142857142854                           0
##                   0.857142857142855                           0
##                   0.857142857142856                           0
##                   0.999999996818995                           0
##                                       Student
## probability.of.Social.Media.Addiction PRINCE RAMESHBHAI KHENI PRIYAM KUMARI
##                   3.18100531826685e-09                          0             0
##                   3.18100541552969e-09                          0             0
##                   3.18100541561804e-09                          0             0
##                   3.18100541563938e-09                          0             0
##                   3.18100541601663e-09                          0             0
##                   3.18100541614883e-09                          0             0
##                   0.14285714285714                              0             0
##                   0.142857142857142                             0             0
##                   0.285714285714279                             0             0
##                   0.285714285714281                             0             0
##                   0.285714285714283                             0             0
##                   0.285714285714286                             0             0
##                   0.285714285714287                             0             0
##                   0.285714285714288                             0             0
##                   0.428571428571426                             0             7
##                   0.71428571428571                              0             0
```

```
##                   0.857142857142853                           0             0
##                   0.857142857142854                           0             0
##                   0.857142857142855                           0             0
##                   0.857142857142856                           7             0
##                   0.999999996818995                           0             0
##                                     Student
## probability.of.Social.Media.Addiction RUCHIT JATIN MODY
##                   3.18100531826685e-09                  0
##                   3.18100541552969e-09                  0
##                   3.18100541561804e-09                  0
##                   3.18100541563938e-09                  0
##                   3.18100541601663e-09                  0
##                   3.18100541614883e-09                  0
##                   0.14285714285714                      7
##                   0.142857142857142                     0
##                   0.285714285714279                     0
##                   0.285714285714281                     0
##                   0.285714285714283                     0
##                   0.285714285714286                     0
##                   0.285714285714287                     0
##                   0.285714285714288                     0
##                   0.428571428571426                     0
##                   0.71428571428571                      0
##                   0.857142857142853                     0
##                   0.857142857142854                     0
##                   0.857142857142855                     0
##                   0.857142857142856                     0
##                   0.999999996818995                     0
##                                     Student
## probability.of.Social.Media.Addiction RUTWIK SANJAY GUNTOORKAR SAILESH POTTURI
##                   3.18100531826685e-09                          0              0
##                   3.18100541552969e-09                          0              0
##                   3.18100541561804e-09                          0              0
##                   3.18100541563938e-09                          0              0
##                   3.18100541601663e-09                          0              0
##                   3.18100541614883e-09                          7              0
##                   0.14285714285714                              0              0
##                   0.142857142857142                             0              0
##                   0.285714285714279                             0              0
##                   0.285714285714281                             0              0
##                   0.285714285714283                             0              0
##                   0.285714285714286                             0              7
##                   0.285714285714287                             0              0
##                   0.285714285714288                             0              0
##                   0.428571428571426                             0              0
##                   0.71428571428571                              0              0
##                   0.857142857142853                             0              0
##                   0.857142857142854                             0              0
##                   0.857142857142855                             0              0
##                   0.857142857142856                             0              0
##                   0.999999996818995                             0              0
##                                     Student
```

```
## probability.of.Social.Media.Addiction SARJAK ATUL MANIAR SHREYASH MEHTA
##                  3.18100531826685e-09                   0              0
##                  3.18100541552969e-09                   0              0
##                  3.18100541561804e-09                   0              0
##                  3.18100541563938e-09                   0              7
##                  3.18100541601663e-09                   0              0
##                  3.18100541614883e-09                   0              0
##                  0.14285714285714                       0              0
##                  0.142857142857142                      0              0
##                  0.285714285714279                      0              0
##                  0.285714285714281                      0              0
##                  0.285714285714283                      0              0
##                  0.285714285714286                      0              0
##                  0.285714285714287                      0              0
##                  0.285714285714288                      0              0
##                  0.428571428571426                      0              0
##                  0.71428571428571                       0              0
##                  0.857142857142853                      7              0
##                  0.857142857142854                      0              0
##                  0.857142857142855                      0              0
##                  0.857142857142856                      0              0
##                  0.999999996818995                      0              0
##                                    Student
## probability.of.Social.Media.Addiction SHRUTI SANJIVAN SONTAKKE
##                  3.18100531826685e-09                         0
##                  3.18100541552969e-09                         0
##                  3.18100541561804e-09                         0
##                  3.18100541563938e-09                         0
##                  3.18100541601663e-09                         0
##                  3.18100541614883e-09                         0
##                  0.14285714285714                             0
##                  0.142857142857142                            0
##                  0.285714285714279                            0
##                  0.285714285714281                            0
##                  0.285714285714283                            0
##                  0.285714285714286                            0
##                  0.285714285714287                            0
##                  0.285714285714288                            0
##                  0.428571428571426                            7
##                  0.71428571428571                             0
##                  0.857142857142853                            0
##                  0.857142857142854                            0
##                  0.857142857142855                            0
##                  0.857142857142856                            0
##                  0.999999996818995                            0
##                                    Student
## probability.of.Social.Media.Addiction TANAY RAJESH DANGAICH TARUN KAUSHIK
##                  3.18100531826685e-09                       0            0
##                  3.18100541552969e-09                       0            0
##                  3.18100541561804e-09                       0            0
##                  3.18100541563938e-09                       0            0
##                  3.18100541601663e-09                       0            0
```

```
##                   3.18100541614883e-09                     0            0
##                   0.14285714285714                         0            0
##                   0.142857142857142                        0            0
##                   0.285714285714279                        0            0
##                   0.285714285714281                        0            0
##                   0.285714285714283                        0            0
##                   0.285714285714286                        0            0
##                   0.285714285714287                        0            7
##                   0.285714285714288                        0            0
##                   0.428571428571426                        0            0
##                   0.71428571428571                         0            0
##                   0.857142857142853                        0            0
##                   0.857142857142854                        0            0
##                   0.857142857142855                        0            0
##                   0.857142857142856                        0            0
##                   0.999999996818995                        7            0
##                                     Student
## probability.of.Social.Media.Addiction TEJESH ALAPARTHI VEDA ALLOORI
##                   3.18100531826685e-09                0            0
##                   3.18100541552969e-09                0            0
##                   3.18100541561804e-09                0            0
##                   3.18100541563938e-09                0            0
##                   3.18100541601663e-09                0            0
##                   3.18100541614883e-09                0            0
##                   0.14285714285714                    0            0
##                   0.142857142857142                   0            0
##                   0.285714285714279                   7            0
##                   0.285714285714281                   0            0
##                   0.285714285714283                   0            0
##                   0.285714285714286                   0            0
##                   0.285714285714287                   0            0
##                   0.285714285714288                   0            0
##                   0.428571428571426                   0            0
##                   0.71428571428571                    0            0
##                   0.857142857142853                   0            0
##                   0.857142857142854                   0            7
##                   0.857142857142855                   0            0
##                   0.857142857142856                   0            0
##                   0.999999996818995                   0            0
##                                     Student
## probability.of.Social.Media.Addiction VIDHI AMBWANI
##                   3.18100531826685e-09             0
##                   3.18100541552969e-09             0
##                   3.18100541561804e-09             0
##                   3.18100541563938e-09             0
##                   3.18100541601663e-09             0
##                   3.18100541614883e-09             0
##                   0.14285714285714                 0
##                   0.142857142857142                0
##                   0.285714285714279                0
##                   0.285714285714281                7
##                   0.285714285714283                0
```

```
##                 0.285714285714286               0
##                 0.285714285714287               0
##                 0.285714285714288               0
##                 0.428571428571426               0
##                 0.71428571428571                0
##                 0.857142857142853               0
##                 0.857142857142854               0
##                 0.857142857142855               0
##                 0.857142857142856               0
##                 0.999999996818995               0
```

```
logistic <- glm(Social.Media.Addiction ~ ., data=Students, family="binomial")
```

```
## Warning: glm.fit: algorithm did not converge
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(logistic)
```

```
##
## Call:
## glm(formula = Social.Media.Addiction ~ ., family = "binomial",
##     data = Students)
##
## Deviance Residuals:
##        Min          1Q      Median          3Q         Max
## -3.841e-05  -2.100e-08  -2.100e-08   2.100e-08   3.196e-05
##
## Coefficients:
##                                        Estimate Std. Error z value
## (Intercept)                           4.528e+02  3.725e+05   0.001
## StudentAKASH SHANMUGAM                7.428e+00  2.887e+05   0.000
## StudentANUSHKA CHAUBE                -3.666e+01  2.175e+05   0.000
## StudentBATUL KHAMBATA                -2.835e+00  4.054e+05   0.000
## StudentCHENHAO ZHOU                  -2.047e+02  9.021e+07   0.000
## StudentJIAYUE GAO                    -1.780e+02  9.342e+06   0.000
## StudentKIREETI MANTRALA              -1.394e+01  2.599e+06   0.000
## StudentMUSKAN CHOWATIA                3.292e+00  2.614e+05   0.000
## StudentNAGA ASRITHA NARRA             1.598e+02  2.139e+06   0.000
## StudentNAMRATA RATH                  -4.036e+01  2.225e+05   0.000
## StudentPARTHVI KALPESH SONI          -1.234e+01  4.423e+05   0.000
## StudentPOOJA BYLAPLAR JAYANNA        -2.577e+01  4.044e+05   0.000
## StudentPRINCE RAMESHBHAI KHENI        4.287e+01  3.411e+05   0.000
## StudentPRIYAM KUMARI                  3.557e+01  2.088e+05   0.000
## StudentRUCHIT JATIN MODY              2.595e+01  2.067e+05   0.000
## StudentRUTWIK SANJAY GUNTOORKAR       1.697e+02  3.054e+05   0.001
## StudentSAILESH POTTURI               -3.539e+01  3.249e+05   0.000
## StudentSARJAK ATUL MANIAR             4.852e+01  4.528e+05   0.000
## StudentSHREYASH MEHTA                -9.889e+00  4.116e+05   0.000
## StudentSHRUTI SANJIVAN SONTAKKE      -4.507e+01  2.495e+05   0.000
## StudentTANAY RAJESH DANGAICH         -5.428e+01  2.678e+05   0.000
## StudentTARUN KAUSHIK                  4.284e+01  2.421e+05   0.000
## StudentTEJESH ALAPARTHI               2.061e+01  3.738e+05   0.000
## StudentVEDA ALLOORI                  -5.015e+01  3.839e+05   0.000
## StudentVIDHI AMBWANI                 -1.622e+01  2.597e+05   0.000
## WeekApr 9 - Apr 15                   -2.921e+01  1.580e+05   0.000
## WeekFeb 26 - Mar 4                   -1.508e+01  1.278e+05   0.000
## WeekMar 12 - Mar 18                  -3.690e+01  9.123e+04   0.000
## WeekMar 19 - Mar 25                  -7.800e+00  7.155e+04   0.000
## WeekMar 26 - Apr 1                   -3.741e+00  9.254e+04   0.000
## WeekMar 5 - Mar 11                   -1.118e+01  1.610e+05   0.000
## Whatsapp..hrs.                       -4.759e+03  5.897e+07   0.000
## Instagram..hrs.                      -4.752e+03  5.897e+07   0.000
## Snapchat.hrs.                        -4.750e+03  5.897e+07   0.000
## Telegram..hrs.                       -4.754e+03  5.897e+07   0.000
## Facebook.Messenger..hrs.             -4.772e+03  5.896e+07   0.000
## BeReal..hrs.                         -4.759e+03  5.897e+07   0.000
## TikTok..hrs.                         -4.705e+03  6.098e+07   0.000
## WeChat..hrs.                         -4.742e+03  5.137e+07   0.000
## Twitter..hrs.                        -4.769e+03  5.894e+07   0.000
## Linkedin..hrs.                       -4.758e+03  5.897e+07   0.000
```

```
## Messages..hrs.                            -4.771e+03  5.896e+07   0.000
## Total.Social.Media.Screen.Time..hrs.       4.756e+03  5.897e+07   0.000
## Number.of.times.opened..hourly.intervals. -4.144e+00  2.491e+03  -0.002
##                                          Pr(>|z|)
## (Intercept)                                 0.999
## StudentAKASH SHANMUGAM                      1.000
## StudentANUSHKA CHAUBE                       1.000
## StudentBATUL KHAMBATA                       1.000
## StudentCHENHAO ZHOU                         1.000
## StudentJIAYUE GAO                           1.000
## StudentKIREETI MANTRALA                     1.000
## StudentMUSKAN CHOWATIA                      1.000
## StudentNAGA ASRITHA NARRA                   1.000
## StudentNAMRATA RATH                         1.000
## StudentPARTHVI KALPESH SONI                 1.000
## StudentPOOJA BYLAPLAR JAYANNA               1.000
## StudentPRINCE RAMESHBHAI KHENI              1.000
## StudentPRIYAM KUMARI                        1.000
## StudentRUCHIT JATIN MODY                    1.000
## StudentRUTWIK SANJAY GUNTOORKAR             1.000
## StudentSAILESH POTTURI                      1.000
## StudentSARJAK ATUL MANIAR                   1.000
## StudentSHREYASH MEHTA                       1.000
## StudentSHRUTI SANJIVAN SONTAKKE             1.000
## StudentTANAY RAJESH DANGAICH                1.000
## StudentTARUN KAUSHIK                        1.000
## StudentTEJESH ALAPARTHI                     1.000
## StudentVEDA ALLOORI                         1.000
## StudentVIDHI AMBWANI                        1.000
## WeekApr 9 - Apr 15                          1.000
## WeekFeb 26 - Mar 4                          1.000
## WeekMar 12 - Mar 18                         1.000
## WeekMar 19 - Mar 25                         1.000
## WeekMar 26 - Apr 1                          1.000
## WeekMar 5 - Mar 11                          1.000
## Whatsapp..hrs.                              1.000
## Instagram..hrs.                             1.000
## Snapchat.hrs.                               1.000
## Telegram..hrs.                              1.000
## Facebook.Messenger..hrs.                    1.000
## BeReal..hrs.                                1.000
## TikTok..hrs.                                1.000
## WeChat..hrs.                                1.000
## Twitter..hrs.                               1.000
## Linkedin..hrs.                              1.000
## Messages..hrs.                              1.000
## Total.Social.Media.Screen.Time..hrs.        1.000
## Number.of.times.opened..hourly.intervals.   0.999
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 2.3902e+02  on 174  degrees of freedom
```

```
## Residual deviance: 1.4765e-08  on 131  degrees of freedom
## AIC: 88
##
## Number of Fisher Scoring iterations: 25
```

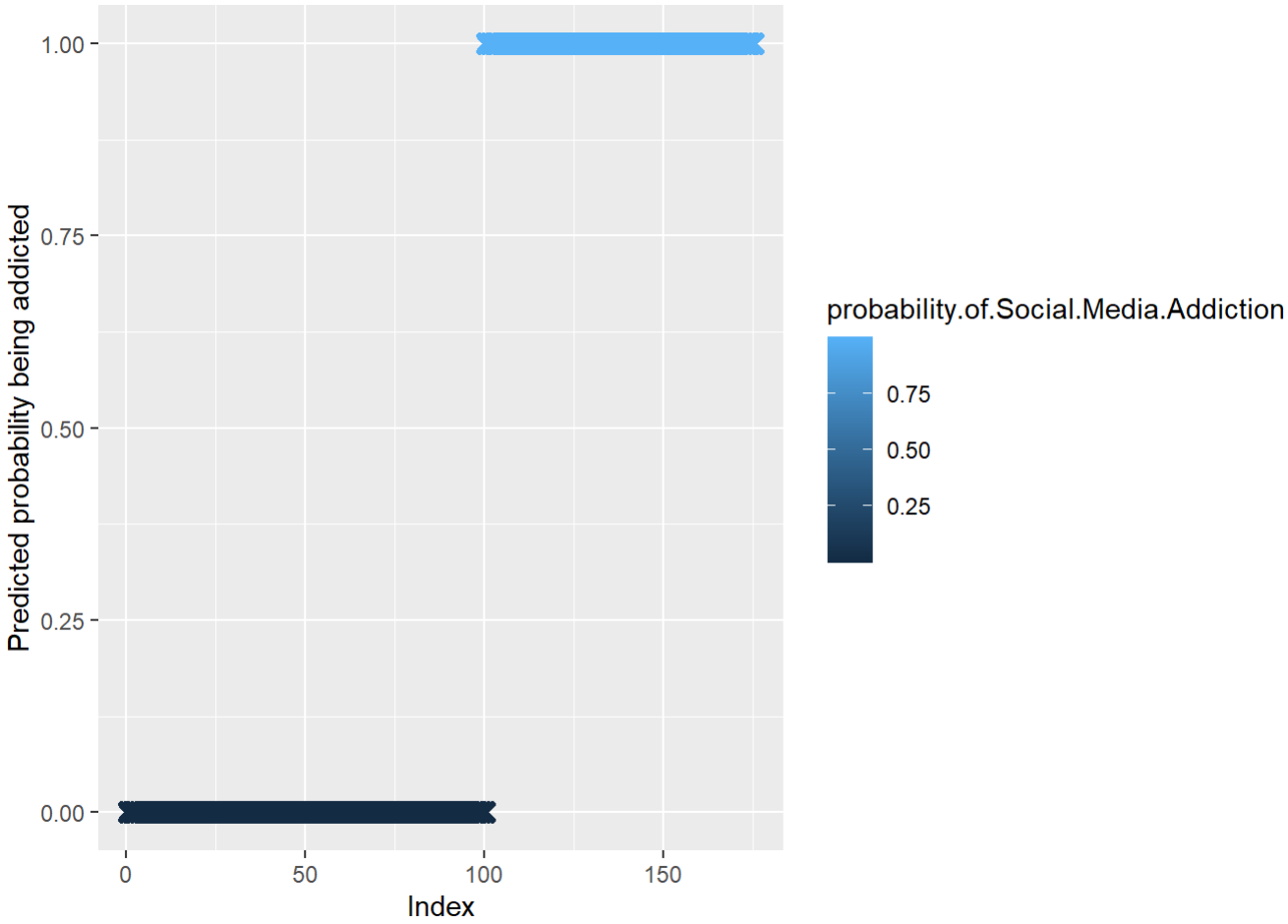
```
ll.null <- logistic$null.deviance/-2
ll.proposed <- logistic$deviance/-2
(ll.null - ll.proposed) / ll.null
```

```
## [1] 1
```

```
1 - pchisq(2*(ll.proposed - ll.null), df=(length(logistic$coefficients)-1))
```

```
## [1] 0
```

```
predicted.data <- data.frame(probability.of.Social.Media.Addiction=logistic$fitted.values,probab
ility.of.Social.Media.Addiction=Students$Social.Media.Addiction)
predicted.data <- predicted.data[order(predicted.data$probability.of.Social.Media.Addiction, dec
reasing=FALSE),]
predicted.data$rank <- 1:nrow(predicted.data)
## Lastly, we can plot the predicted probabilities for each
ggplot(data=predicted.data, aes(x=rank, y=probability.of.Social.Media.Addiction)) +
geom_point(aes(color=probability.of.Social.Media.Addiction), alpha=1, shape=4, stroke=2) +
xlab("Index") +
ylab("Predicted probability being addicted")
```




```
# From Caret
pdata <- predict(logistic,newdata=Students,type="response" )
pdata
```

```
##            1            2            3            4            5            6
## 3.519820e-12 2.220446e-16 2.220446e-16 2.220446e-16 2.104757e-11 6.698217e-12
##            7            8            9           10           11           12
## 2.220446e-16 2.220446e-16 2.220446e-16 6.938332e-12 1.000000e+00 1.000000e+00
##           13           14           15           16           17           18
## 2.220446e-16 2.220446e-16 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##           19           20           21           22           23           24
## 1.000000e+00 2.220446e-16 1.000000e+00 2.220446e-16 2.220446e-16 2.576155e-10
##           25           26           27           28           29           30
## 2.220446e-16 1.000000e+00 1.000000e+00 2.220446e-16 1.000000e+00 3.469889e-10
##           31           32           33           34           35           36
## 1.000000e+00 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 1.000000e+00
##           37           38           39           40           41           42
## 2.220446e-16 2.220446e-16 2.220446e-16 6.859470e-10 2.220446e-16 2.220446e-16
##           43           44           45           46           47           48
## 2.854889e-10 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##           49           50           51           52           53           54
## 2.220446e-16 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##           55           56           57           58           59           60
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##           61           62           63           64           65           66
## 1.000000e+00 1.000000e+00 1.000000e+00 5.098119e-11 2.220446e-16 2.220446e-16
##           67           68           69           70           71           72
## 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 1.000000e+00 1.000000e+00
##           73           74           75           76           77           78
## 3.146483e-11 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 1.000000e+00
##           79           80           81           82           83           84
## 2.220446e-16 2.220446e-16 7.304984e-11 2.220446e-16 2.555974e-10 1.000000e+00
##           85           86           87           88           89           90
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##           91           92           93           94           95           96
## 5.971289e-10 7.378236e-10 2.220446e-16 2.220446e-16 2.220446e-16 1.000000e+00
##           97           98           99          100          101          102
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 2.220446e-16
##          103          104          105          106          107          108
## 1.000000e+00 1.000000e+00 1.000000e+00 2.220446e-16 2.220446e-16 1.000000e+00
##          109          110          111          112          113          114
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 2.220446e-16 2.220446e-16
##          115          116          117          118          119          120
## 2.220446e-16 2.220446e-16 4.154179e-11 2.220446e-16 2.220446e-16 3.653514e-11
##          121          122          123          124          125          126
## 2.220446e-16 1.000000e+00 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16
##          127          128          129          130          131          132
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##          133          134          135          136          137          138
## 1.000000e+00 2.220446e-16 1.000000e+00 2.220446e-16 7.269967e-11 1.000000e+00
##          139          140          141          142          143          144
## 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16
##          145          146          147          148          149          150
## 2.220446e-16 4.235201e-11 2.220446e-16 2.220446e-16 4.118294e-11 2.220446e-16
##          151          152          153          154          155          156
## 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16 2.220446e-16
```

```
##          157          158          159          160          161          162
## 2.220446e-16 2.220446e-16 4.219502e-11 2.220446e-16 2.220446e-16 2.220446e-16
##          163          164          165          166          167          168
## 2.220446e-16 1.000000e+00 1.630014e-10 1.000000e+00 1.000000e+00 2.220446e-16
##          169          170          171          172          173          174
## 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00 1.000000e+00
##          175
## 2.220446e-16
```

```
Students$Social.Media.Addiction
```

```
##   [1] Addicted     Addicted     Addicted     Addicted     Addicted
##   [6] Addicted     Addicted     Addicted     Addicted     Addicted
##  [11] Not Addicted Not Addicted Addicted     Addicted     Not Addicted
##  [16] Not Addicted Not Addicted Not Addicted Not Addicted Addicted
##  [21] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [26] Not Addicted Not Addicted Addicted     Not Addicted Addicted
##  [31] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [36] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [41] Addicted     Addicted     Addicted     Not Addicted Not Addicted
##  [46] Not Addicted Not Addicted Not Addicted Addicted     Not Addicted
##  [51] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [56] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [61] Not Addicted Not Addicted Not Addicted Addicted     Addicted
##  [66] Addicted     Addicted     Addicted     Addicted     Addicted
##  [71] Not Addicted Not Addicted Addicted     Addicted     Addicted
##  [76] Addicted     Addicted     Not Addicted Addicted     Addicted
##  [81] Addicted     Addicted     Addicted     Not Addicted Not Addicted
##  [86] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [91] Addicted     Addicted     Addicted     Addicted     Addicted
##  [96] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
## [101] Not Addicted Addicted     Not Addicted Not Addicted Not Addicted
## [106] Addicted     Addicted     Not Addicted Not Addicted Not Addicted
## [111] Not Addicted Not Addicted Addicted     Addicted     Addicted
## [116] Addicted     Addicted     Addicted     Addicted     Addicted
## [121] Addicted     Not Addicted Addicted     Addicted     Addicted
## [126] Addicted     Not Addicted Not Addicted Not Addicted Not Addicted
## [131] Not Addicted Not Addicted Not Addicted Addicted     Not Addicted
## [136] Addicted     Addicted     Not Addicted Addicted     Addicted
## [141] Addicted     Addicted     Addicted     Addicted     Addicted
## [146] Addicted     Addicted     Addicted     Addicted     Addicted
## [151] Addicted     Addicted     Addicted     Addicted     Addicted
## [156] Addicted     Addicted     Addicted     Addicted     Addicted
## [161] Addicted     Addicted     Addicted     Not Addicted Addicted
## [166] Not Addicted Not Addicted Addicted     Not Addicted Not Addicted
## [171] Not Addicted Not Addicted Not Addicted Not Addicted Addicted
## Levels: Addicted Not Addicted
```

```
pdataF <- as.factor(ifelse(test=as.numeric(pdata>0.5) == 0, yes="Addicted", no="Not Addicted"))
```

```
library(caTools)
```

```
## Warning: package 'caTools' was built under R version 4.2.3
```

```
library(pROC)
```

```
## Warning: package 'pROC' was built under R version 4.2.3
```

```
## Type 'citation("pROC")' for a citation.
```

```
##
## Attaching package: 'pROC'
```

```
## The following objects are masked from 'package:stats':
##
##     cov, smooth, var
```

```
summary(Students)
```

```
##             Student                  Week    Whatsapp..hrs.   Instagram..hrs.
##  AJAY ADDALA    :  7   Apr 2 - Apr 8  :25   Min.   : 0.000   Min.   : 0.000
##  AKASH SHANMUGAM:  7   Apr 9 - Apr 15 :25   1st Qu.: 5.055   1st Qu.: 4.750
##  ANUSHKA CHAUBE :  7   Feb 26 - Mar 4 :25   Median : 7.500   Median : 7.800
##  BATUL KHAMBATA :  7   Mar 12 - Mar 18:25   Mean   : 7.878   Mean   : 8.253
##  CHENHAO ZHOU   :  7   Mar 19 - Mar 25:25   3rd Qu.:10.000   3rd Qu.:11.225
##  JIAYUE GAO     :  7   Mar 26 - Apr 1 :25   Max.   :22.500   Max.   :24.000
##  (Other)        :133   Mar 5 - Mar 11 :25
##  Snapchat.hrs.    Telegram..hrs.   Facebook.Messenger..hrs.  BeReal..hrs.
##  Min.   : 0.000   Min.   :0.0000   Min.   :0.0000           Min.   :0.0000
##  1st Qu.: 0.000   1st Qu.:0.0000   1st Qu.:0.0000           1st Qu.:0.0000
##  Median : 0.800   Median :0.0000   Median :0.0000           Median :0.0000
##  Mean   : 1.406   Mean   :0.1169   Mean   :0.1624           Mean   :0.1174
##  3rd Qu.: 1.535   3rd Qu.:0.0600   3rd Qu.:0.0000           3rd Qu.:0.0000
##  Max.   :12.100   Max.   :2.3900   Max.   :2.3500           Max.   :8.6000
##
##   TikTok..hrs.      WeChat..hrs.     Twitter..hrs.    Linkedin..hrs.
##  Min.   :0.00000   Min.   : 0.0000   Min.   :0.0000   Min.   : 0.000
##  1st Qu.:0.00000   1st Qu.: 0.0000   1st Qu.:0.0000   1st Qu.: 0.415
##  Median :0.00000   Median : 0.0000   Median :0.0000   Median : 1.420
##  Mean   :0.08754   Mean   : 0.3498   Mean   :0.2525   Mean   : 3.255
##  3rd Qu.:0.00000   3rd Qu.: 0.0000   3rd Qu.:0.0000   3rd Qu.: 4.000
##  Max.   :3.90000   Max.   :10.5000   Max.   :8.5000   Max.   :22.800
##
##  Messages..hrs.   Total.Social.Media.Screen.Time..hrs.
##  Min.   : 0.000   Min.   : 0.58
##  1st Qu.: 0.000   1st Qu.:15.68
##  Median : 0.060   Median :21.62
##  Mean   : 0.591   Mean   :22.47
##  3rd Qu.: 0.400   3rd Qu.:28.09
##  Max.   :10.300   Max.   :55.60
##
##  Number.of.times.opened..hourly.intervals.  Social.Media.Addiction
##  Min.   : 30.0                             Addicted    :100
##  1st Qu.: 94.0                             Not Addicted: 75
##  Median :110.0
##  Mean   :111.2
##  3rd Qu.:128.0
##  Max.   :257.0
##
```

```
Students$Social.Media.Addiction<-as.factor(Students$Social.Media.Addiction)
str(Students)
```

```
## 'data.frame':    175 obs. of  16 variables:
##  $ Student                                  : Factor w/ 25 levels "AJAY ADDALA",..: 1 1 1 1 1
1 1 23 23 23 ...
##  $ Week                                     : Factor w/ 7 levels "Apr 2 - Apr 8",..: 3 7 4 5
6 1 2 3 7 4 ...
##  $ Whatsapp..hrs.                           : num  8.9 11.8 12.2 12.3 8.5 ...
##  $ Instagram..hrs.                          : num  7.1 11.2 16.8 12.9 11.9 ...
##  $ Snapchat.hrs.                            : num  1.9 2.45 3.25 3.12 1.9 1.2 1.67 2 1.4 2.1
...
##  $ Telegram..hrs.                           : num  0.02 0.06 0.01 0.06 0.05 0.16 0 0.25 0.35
0.33 ...
##  $ Facebook.Messenger..hrs.                 : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ BeReal..hrs.                             : num  0 0 0 0 0 0 0 0.35 0.21 0.65 ...
##  $ TikTok..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ WeChat..hrs.                             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Twitter..hrs.                            : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Linkedin..hrs.                           : num  4.5 5.5 9.5 9 7.5 8 6.5 2.5 2.67 1.55 ...
##  $ Messages..hrs.                           : num  0.1 0.04 0.01 0.2 0.1 0.01 0 0.2 0.8 0.5
...
##  $ Total.Social.Media.Screen.Time..hrs.     : num  22.5 31.1 41.8 37.6 29.9 ...
##  $ Number.of.times.opened..hourly.intervals.: int  111 119 124 121 116 115 113 150 121 110
...
##  $ Social.Media.Addiction                   : Factor w/ 2 levels "Addicted","Not Addicted": 1
1 1 1 1 1 1 1 1 ...
```

```
set.seed(123)
split <- sample.split(Students$Social.Media.Addiction, SplitRatio = 0.70)
train_cs <- subset(Students, split == TRUE)
test_cs <- subset(Students, split == FALSE)

Xtrain_cs <- train_cs[, 1:14]
Ytrain_cs <- train_cs[, 16]
Ytrain_cs <- unlist(Ytrain_cs)

Ytrain_cs
```

```
##   [1] Addicted     Addicted     Addicted     Addicted     Addicted
##   [6] Addicted     Not Addicted Not Addicted Addicted     Not Addicted
##  [11] Not Addicted Addicted     Not Addicted Addicted     Addicted
##  [16] Addicted     Not Addicted Not Addicted Addicted     Addicted
##  [21] Not Addicted Addicted     Not Addicted Addicted     Addicted
##  [26] Addicted     Addicted     Addicted     Not Addicted Not Addicted
##  [31] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [36] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [41] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [46] Addicted     Addicted     Addicted     Addicted     Addicted
##  [51] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [56] Addicted     Not Addicted Not Addicted Not Addicted Addicted
##  [61] Addicted     Addicted     Not Addicted Not Addicted Not Addicted
##  [66] Not Addicted Not Addicted Addicted     Not Addicted Addicted
##  [71] Addicted     Not Addicted Not Addicted Not Addicted Not Addicted
##  [76] Not Addicted Addicted     Addicted     Addicted     Addicted
##  [81] Addicted     Addicted     Not Addicted Addicted     Not Addicted
##  [86] Not Addicted Not Addicted Not Addicted Not Addicted Not Addicted
##  [91] Not Addicted Addicted     Not Addicted Addicted     Not Addicted
##  [96] Addicted     Addicted     Addicted     Addicted     Addicted
## [101] Addicted     Addicted     Addicted     Addicted     Addicted
## [106] Addicted     Addicted     Addicted     Addicted     Addicted
## [111] Addicted     Addicted     Addicted     Addicted     Addicted
## [116] Not Addicted Not Addicted Addicted     Not Addicted Not Addicted
## [121] Not Addicted Addicted
## Levels: Addicted Not Addicted
```

```
Xtest_cs <- test_cs[, 1:14]
x_cs <- cbind(Xtrain_cs, Ytrain_cs)
logistic_v <- glm(Ytrain_cs ~ ., data = x_cs, family = 'binomial')
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(logistic_v)
```

```
##
## Call:
## glm(formula = Ytrain_cs ~ ., family = "binomial", data = x_cs)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.72016  -0.00285   0.00000   0.00016   2.58769
##
## Coefficients:
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)                       6.798e+00  1.079e+04   0.001   0.9995
## StudentAKASH SHANMUGAM            1.057e+01  1.621e+04   0.001   0.9995
## StudentANUSHKA CHAUBE             2.285e+01  1.079e+04   0.002   0.9983
## StudentBATUL KHAMBATA             4.512e+01  1.079e+04   0.004   0.9967
## StudentCHENHAO ZHOU               3.577e+02  8.817e+04   0.004   0.9968
## StudentJIAYUE GAO                 6.985e+01  2.060e+04   0.003   0.9973
## StudentKIREETI MANTRALA           3.005e+01  1.079e+04   0.003   0.9978
## StudentMUSKAN CHOWATIA            1.883e+01  1.079e+04   0.002   0.9986
## StudentNAGA ASRITHA NARRA         1.112e+02  1.277e+04   0.009   0.9930
## StudentNAMRATA RATH               1.380e+01  1.321e+04   0.001   0.9992
## StudentPARTHVI KALPESH SONI      -1.522e+01  1.361e+04  -0.001   0.9991
## StudentPOOJA BYLAPLAR JAYANNA     4.015e+01  1.079e+04   0.004   0.9970
## StudentPRINCE RAMESHBHAI KHENI    2.047e+01  1.079e+04   0.002   0.9985
## StudentPRIYAM KUMARI              2.717e+01  1.079e+04   0.003   0.9980
## StudentRUCHIT JATIN MODY          2.547e+01  1.079e+04   0.002   0.9981
## StudentRUTWIK SANJAY GUNTOORKAR  -6.603e+00  1.648e+04   0.000   0.9997
## StudentSAILESH POTTURI            1.183e+01  1.079e+04   0.001   0.9991
## StudentSARJAK ATUL MANIAR         1.097e+01  1.079e+04   0.001   0.9992
## StudentSHREYASH MEHTA            -9.809e+00  1.523e+04  -0.001   0.9995
## StudentSHRUTI SANJIVAN SONTAKKE   9.054e+00  1.079e+04   0.001   0.9993
## StudentTANAY RAJESH DANGAICH      5.373e+01  1.333e+04   0.004   0.9968
## StudentTARUN KAUSHIK             -1.531e+00  1.426e+04   0.000   0.9999
## StudentTEJESH ALAPARTHI           1.601e+01  1.079e+04   0.001   0.9988
## StudentVEDA ALLOORI               2.905e+01  1.079e+04   0.003   0.9979
## StudentVIDHI AMBWANI              1.189e+01  1.079e+04   0.001   0.9991
## WeekApr 9 - Apr 15               -5.739e-01  2.568e+00  -0.223   0.8232
## WeekFeb 26 - Mar 4                2.883e+00  2.315e+00   1.245   0.2130
## WeekMar 12 - Mar 18               3.518e-01  2.963e+00   0.119   0.9055
## WeekMar 19 - Mar 25              -3.976e+00  3.118e+00  -1.275   0.2023
## WeekMar 26 - Apr 1                3.304e+00  1.956e+00   1.689   0.0912 .
## WeekMar 5 - Mar 11                1.874e+00  2.816e+00   0.666   0.5056
## Whatsapp..hrs.                   -1.291e+03  1.241e+06  -0.001   0.9992
## Instagram..hrs.                  -1.291e+03  1.241e+06  -0.001   0.9992
## Snapchat.hrs.                    -1.289e+03  1.241e+06  -0.001   0.9992
## Telegram..hrs.                   -1.291e+03  1.241e+06  -0.001   0.9992
## Facebook.Messenger..hrs.         -1.289e+03  1.241e+06  -0.001   0.9992
## BeReal..hrs.                     -1.294e+03  1.241e+06  -0.001   0.9992
## TikTok..hrs.                     -1.233e+03  1.239e+06  -0.001   0.9992
## WeChat..hrs.                     -1.341e+03  1.245e+06  -0.001   0.9991
## Twitter..hrs.                    -1.290e+03  1.241e+06  -0.001   0.9992
## Linkedin..hrs.                   -1.291e+03  1.241e+06  -0.001   0.9992
## Messages..hrs.                   -1.296e+03  1.241e+06  -0.001   0.9992
```

```
## Total.Social.Media.Screen.Time..hrs.  1.289e+03  1.241e+06   0.001   0.9992
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 166.462  on 121  degrees of freedom
## Residual deviance:  33.258  on  79  degrees of freedom
## AIC: 119.26
##
## Number of Fisher Scoring iterations: 20
```

```
# for reproducibility
set.seed(1234)
probabilities_cs <- predict(logistic_v, newdata = Xtest_cs, type = "response")

predicted_cs <- ifelse(probabilities_cs > 1.5, "Yes", "No")
actual_cs <- ifelse(test_cs$Social.Media.Addiction== 1, "Yes", "No")
confusion_cs <- table(predicted_cs, actual_cs)
confusion_cs
```

```
##             actual_cs
## predicted_cs No
##           No 53
```

```
roc_cs <- roc(test_cs$Social.Media.Addiction, probabilities_cs)
```

```
## Setting levels: control = Addicted, case = Not Addicted
```

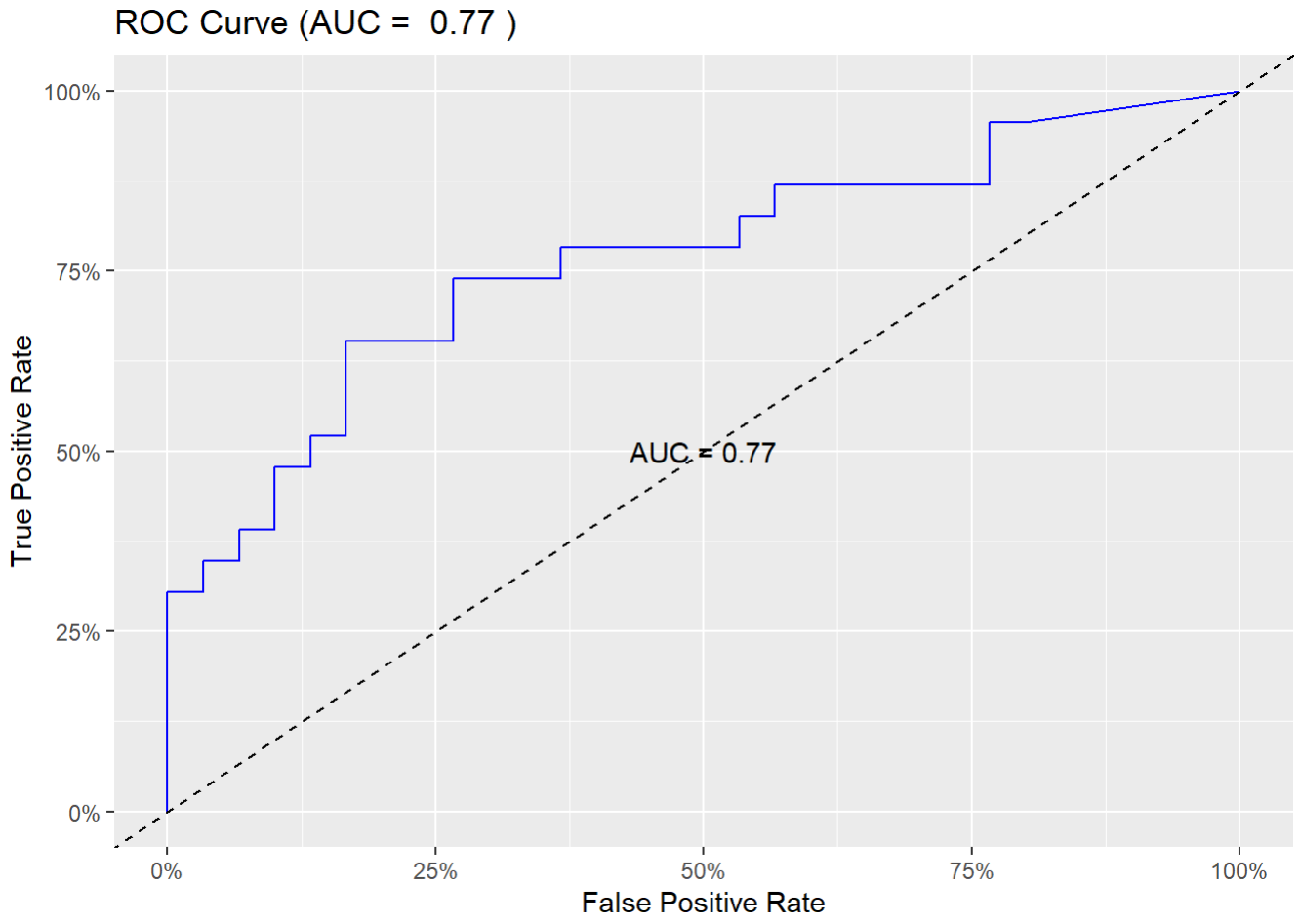
```
## Setting direction: controls < cases
```

```
auc_cs <- auc(roc_cs)
auc_cs
```

```
## Area under the curve: 0.7667
```

```
ggroc(roc_cs, color = "blue", legacy.axes = TRUE) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(labels = scales::percent_format()) +
  scale_y_continuous(labels = scales::percent_format()) +
  labs(x = "False Positive Rate", y = "True Positive Rate",
       title = paste("ROC Curve (AUC = ", round(auc_cs, 2), ")")) +
  annotate("text", x = 0.5, y = 0.5, label = paste0("AUC = ", round(auc_cs, 2)))
```

```
## Scale for x is already present.
## Adding another scale for x, which will replace the existing scale.
```




```
set.seed(1234)
probabilities_cs <- predict(logistic_v, newdata = Xtest_cs, type = "response")

predicted_cs <- ifelse(probabilities_cs > 1.5, "Addicted", "Not Addicted")
actual_cs <- ifelse(test_cs$Social.Media.Addiction== 1, "Addcited", "Not Addicted")
confusion_cs <- table(predicted_cs, actual_cs)
confusion_cs
```

```
##               actual_cs
## predicted_cs   Not Addicted
##   Not Addicted           53
```

```
roc_cs <- roc(test_cs$Social.Media.Addiction, probabilities_cs)
```

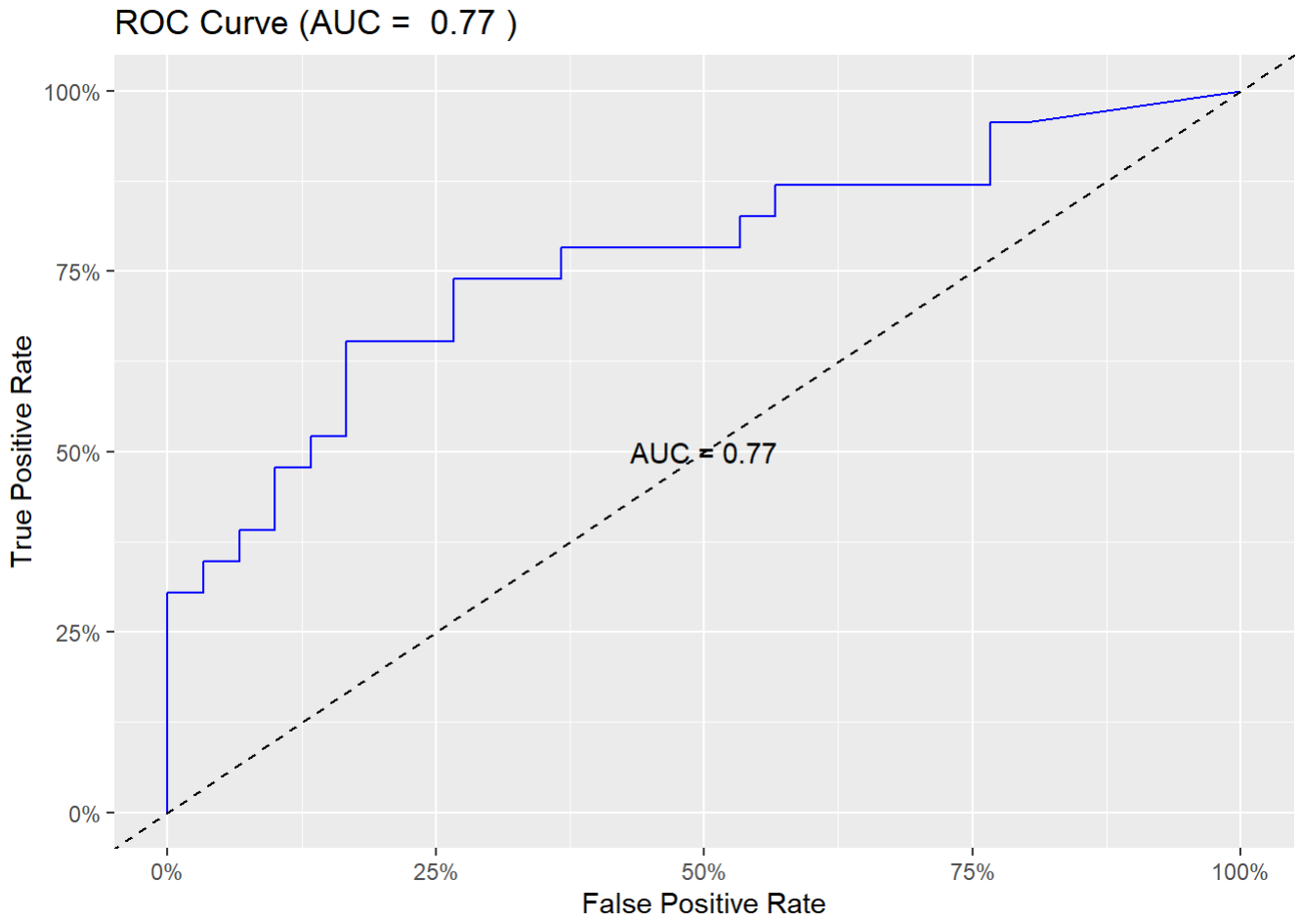
```
## Setting levels: control = Addicted, case = Not Addicted
## Setting direction: controls < cases
```

```
auc_cs <- auc(roc_cs)
auc_cs
```

```
## Area under the curve: 0.7667
```

```
ggroc(roc_cs, color = "blue", legacy.axes = TRUE) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(labels = scales::percent_format()) +
  scale_y_continuous(labels = scales::percent_format()) +
  labs(x = "False Positive Rate", y = "True Positive Rate",
       title = paste("ROC Curve (AUC = ", round(auc_cs, 2), ")")) +
  annotate("text", x = 0.5, y = 0.5, label = paste0("AUC = ", round(auc_cs, 2)))
```

```
## Scale for x is already present.
## Adding another scale for x, which will replace the existing scale.
```




```
## Clustering

#Distance measure
Students_dist <- get_dist(Students[3:13], stand = TRUE, method = "euclidean")
Students_dist
```

```
##              1           2           3           4           5           6
## 2    1.07878720
## 3    2.36514507  1.44156330
## 4    1.74974835  0.87597952  0.79325747
## 5    1.14061534  0.88204922  1.46144284  1.06310369
## 6    1.24513821  0.98661390  1.66193632  1.19351697  0.56531816
## 7    1.02407791  0.90737068  1.61945581  1.26078045  0.30199409  0.72287016
## 8    1.54665506  1.68230196  2.48925619  2.18696619  1.45746758  1.56591925
## 9    1.61255791  2.21615917  3.26259660  2.75736437  1.98373483  1.93261898
## 10   1.64911638  2.28256259  3.48875786  2.88956173  2.33797992  2.28118135
## 11   2.75193476  3.15495784  4.15932307  3.58203286  3.20652883  3.06202164
## 12   3.00122125  3.41192413  4.44068889  3.90400888  3.39850264  3.15948152
## 13   3.38439452  3.56923349  4.43627787  3.98904258  3.62710048  3.40790780
## 14   2.19540248  2.59378352  3.62135294  3.09855185  2.56218151  2.41576660
## 15   4.98463030  4.58237083  4.39787094  4.42581760  4.89315335  5.25257279
## 16   1.38257579  1.88166743  2.80312994  2.37972406  1.84734224  2.19590297
## 17   7.27523096  7.50342450  7.90496402  7.68851265  7.48159967  7.58076701
## 18  11.73989485 11.78650076 11.91864654 11.82627244 11.82780116 11.96790404
## 19   3.53742004  3.75805908  4.30283745  3.95557389  3.86110984  4.16364298
## 20   2.32839477  2.37483955  2.72174744  2.53343835  2.24345436  2.67248606
## 21   2.09440037  2.32885756  2.88961297  2.62653219  2.15552056  2.56016687
## 22   1.13030957  1.92593906  3.25232516  2.72826353  2.01450874  2.00510339
## 23   1.29377561  1.80004483  2.83812382  2.51078136  1.66344648  1.86551835
## 24   1.48423566  2.09042155  3.08927286  2.76473636  1.86487260  2.07371384
## 25   1.26988186  2.22785056  3.47349966  2.95901499  2.15032346  2.25854114
## 26   1.22045906  1.94956559  3.04518459  2.64958648  1.74938090  1.91558124
## 27   1.05389344  1.93624653  3.17024258  2.68287300  1.87407308  1.99922251
## 28   1.04594409  1.63419009  2.83432789  2.42058156  1.63523718  1.73932893
## 29   5.07363153  4.96441265  4.63301259  4.40847144  4.81809202  4.98602912
## 30   4.91623900  4.68131743  4.17374102  4.02887558  4.51463722  4.66259542
## 31   2.74688232  2.56335773  2.04496260  2.13369544  1.80854529  2.06288717
## 32   1.76862630  2.22356240  2.74004760  2.37382548  1.49444169  1.47856645
## 33   2.11663490  2.17562362  2.30237379  2.06421195  1.45127489  1.37353759
## 34   2.10767866  2.15938145  2.32538284  2.02838797  1.51907081  1.38890497
## 35   1.77047343  1.66062125  1.94393953  1.71539770  1.05924681  1.01378053
## 36   1.57093775  1.63799819  2.56612772  2.30439888  1.72737057  1.92238225
## 37   2.25810936  2.20801765  2.67324330  2.65118956  2.01011402  2.29339233
## 38   3.29302024  2.95162028  2.89707845  3.17210058  2.74869356  3.00999966
## 39   1.67665600  1.93427265  2.75211067  2.53888267  1.76531721  2.03993062
## 40   1.72453951  1.83897663  2.63662782  2.45888309  1.75041675  1.98475422
## 41   2.07892141  2.20147376  2.80921444  2.73195165  1.93356320  2.18537060
## 42   1.90063683  1.69995628  2.34573257  2.28480193  1.73375295  1.95097381
## 43   1.79011298  2.15520273  3.30058229  2.75121606  2.19827069  1.95134968
## 44   1.02202018  1.60202508  2.87882860  2.39998740  1.71688813  1.74617769
## 45   1.87653429  2.30805974  3.43087725  2.91470113  2.26108772  1.99975709
## 46   1.15358657  1.85706233  3.15750580  2.67885717  1.95898207  1.99329679
## 47   1.05048313  1.64631446  2.93593870  2.47967163  1.80296404  1.88595777
## 48   1.05667375  1.63190271  2.90532963  2.44368023  1.73773963  1.74045052
## 49   1.81981347  1.88995919  2.97967538  2.48363816  2.06680819  1.77405830
## 50   2.73156865  2.70089574  3.81808373  3.30073017  3.36255206  3.17411605
## 51   1.50019213  2.13427949  3.50708673  2.89003131  2.44449371  2.31454525
## 52   3.99655497  3.93431694  4.76362301  4.36418748  4.45507038  4.30933683
```

```
## 53   2.88354225  2.78467784  3.84365679  3.34849016  3.46452590  3.27105011
## 54   2.18337407  2.57047508  3.78903654  3.21237014  2.93878640  2.79585878
## 55   4.13375464  4.02420681  4.81649130  4.43383688  4.56671285  4.41601190
## 56   2.14750431  2.23791560  3.47614051  2.92561337  2.86000290  2.70450839
## 57   2.68692897  3.71940773  4.87783207  4.35645085  3.46003486  3.51758068
## 58   2.70373413  3.73235695  4.88885879  4.36904244  3.47470193  3.53105158
##               7           8           9          10          11          12
## 2
## 3
## 4
## 5
## 6
## 7
## 8    1.40116351
## 9    1.95131500  1.13758417
## 10   2.29882925  1.58892850  1.02492182
## 11   3.26472667  2.39000027  1.75869459  1.48725530
## 12   3.43300017  2.50924507  1.74561437  1.84970458  1.06321172
## 13   3.68872048  2.67718032  2.27839835  2.33996665  1.25547227  0.98215737
## 14   2.58744939  1.60287757  0.97538978  1.08279067  0.92038305  0.99031113
## 15   4.95834341  4.90846593  5.47825507  5.30697354  5.38867207  6.16295838
## 16   1.74381330  1.56934753  1.80358273  1.85688423  2.70280295  3.16978654
## 17   7.44969751  6.93512771  7.05608817  6.44624571  6.99406671  7.54350021
## 18  11.83089825 11.30884492 11.56012661 10.93681779 11.26509297 11.91830551
## 19   3.85857676  3.38239778  3.49415790  3.03346246  3.57722234  4.36040671
## 20   2.23484019  1.87813070  2.39085676  2.51623596  3.21056583  3.72697323
## 21   2.10483369  1.70821396  2.03485815  2.30767268  3.07176124  3.45293598
## 22   1.80485023  1.87847813  1.71491764  1.72152156  2.96131949  2.94713578
## 23   1.42331149  1.17335502  1.53746208  1.89767869  3.01509730  3.04659309
## 24   1.63499960  1.26978561  1.49584747  1.92023301  3.00717128  3.02605294
## 25   1.95178009  1.78052221  1.47144019  1.55166050  2.73404811  2.83151252
## 26   1.52010346  1.32087062  1.39655562  1.75595801  2.90782504  2.94058180
## 27   1.66261228  1.54056042  1.41747604  1.55801435  2.76360319  2.85685676
## 28   1.39468277  1.37752888  1.57437223  1.78968556  2.98640194  2.99775477
## 29   5.02029912  5.57418855  5.65136086  5.59808466  5.58895437  6.36350946
## 30   4.73585599  5.38598836  5.55444194  5.56119868  5.61875529  6.32611385
## 31   1.96393547  2.67328195  3.14527348  3.66208295  4.23412095  4.49059668
## 32   1.47752843  2.20888482  2.16497133  2.66886048  3.55438435  3.58956033
## 33   1.53069330  2.51444209  2.69134367  3.16248264  3.97428082  4.02009751
## 34   1.61265944  2.64700801  2.77492781  3.17878719  3.98672730  4.05149738
## 35   1.08510657  2.05380740  2.36931670  2.86257266  3.79860596  3.77257945
## 36   1.54180201  1.41618126  1.92912578  2.22368400  3.28623347  3.29374647
## 37   1.85596896  1.51321815  2.24368892  2.78145703  3.68931309  3.64582310
## 38   2.65121291  2.40285080  3.27374913  3.83407176  4.59047249  4.49975928
## 39   1.56198453  1.16754488  1.73254488  2.19433477  3.21126769  3.23313272
## 40   1.54277172  1.27801728  1.92452137  2.33202771  3.34943289  3.34182238
## 41   1.73119963  1.35407731  2.05286801  2.60475706  3.55818113  3.49197386
## 42   1.54038898  1.42791909  2.26817053  2.62571194  3.60036171  3.58707191
## 43   2.19918129  1.54543121  0.99218176  1.26631787  1.61240371  1.35939817
## 44   1.50733919  1.62777401  1.66349162  1.79055653  3.02486053  3.00267617
## 45   2.23795977  1.57125166  1.02314164  1.38409144  1.74235113  1.39827881
## 46   1.73437907  1.71484233  1.68434035  1.73929422  2.97051113  2.95826374
```

```
## 47   1.57740642  1.54986516  1.68080278  1.73618173  2.94485642  2.98911452
## 48   1.51267167  1.66331763  1.74711855  1.85499233  3.07333452  3.04311775
## 49   2.08003966  1.53133892  1.41589374  1.60351747  1.96701741  1.75813988
## 50   3.27106339  3.69068405  3.70424907  3.31924829  4.21891576  4.24573317
## 51   2.29389551  2.59223330  2.33595353  2.07328098  3.21003517  3.22580400
## 52   4.38837145  4.72508192  4.75646861  4.43772745  5.15060358  5.18084568
## 53   3.38160752  3.82348230  3.86911457  3.48872904  4.36536301  4.39321515
## 54   2.82401771  3.15321126  2.96622260  2.67827883  3.64950266  3.67762529
## 55   4.50497825  4.85843718  4.91474085  4.59228765  5.29511295  5.32551382
## 56   2.74808601  3.13016346  3.13149137  2.77527535  3.75840335  3.80498910
## 57   3.29113947  3.00560312  2.31166509  2.44359530  3.28787154  3.24772736
## 58   3.30562023  3.02348024  2.34000101  2.46557896  3.30300852  3.26608817
##              13          14          15          16          17          18
## 2
## 3
## 4
## 5
## 6
## 7
## 8
## 9
## 10
## 11
## 12
## 13
## 14   1.36914061
## 15   5.81211611  5.42085231
## 16   3.37942581  2.27778377  4.12648940
## 17   7.69273196  7.04340065  8.26831526  7.06359575
## 18  11.87590326 11.43323462 11.31026635 11.39903804  5.04915047
## 19   4.50375085  3.59600709  3.91678732  2.82387022  5.41308057  9.22707152
## 20   3.83101688  2.80145541  3.66373137  1.49489900  6.68269062 10.73024290
## 21   3.67473570  2.57635931  4.10381223  1.29476113  7.00526941 11.18537782
## 22   3.46641586  2.32044709  5.76210083  1.92233021  7.36629255 11.96677896
## 23   3.38608012  2.25118276  5.22824839  1.41700353  7.30456866 11.79365324
## 24   3.39846344  2.25369731  5.34443462  1.43256833  7.27853734 11.78839640
## 25   3.35741000  2.15317895  5.53978097  1.48374333  7.20088557 11.78701327
## 26   3.36774708  2.17700279  5.40981724  1.41235941  7.26119330 11.80606297
## 27   3.32723344  2.12037268  5.38786754  1.36883265  7.21986828 11.77876165
## 28   3.39518503  2.24790953  5.39250859  1.59504406  7.33817192 11.86756690
## 29   6.36356884  5.75919407  4.76482000  4.93977806  8.61929337 11.92387641
## 30   6.31308866  5.69547592  4.82215322  4.90906148  8.67660264 12.02828148
## 31   4.63703642  3.71056098  5.16663108  2.91681756  7.83766917 11.96006961
## 32   4.06875468  2.93295215  6.08147027  2.52768279  7.59009029 12.12694506
## 33   4.39763307  3.35787081  6.08298571  2.96751758  7.82753585 12.25605006
## 34   4.44165653  3.40767010  6.11958182  3.04633630  7.85256192 12.28068343
## 35   4.14998614  3.07206819  5.81893220  2.69116115  7.76845500 12.19584836
## 36   3.57712578  2.52164800  5.06053050  1.83158270  7.46824579 11.85204610
## 37   3.84017133  2.87214786  5.09552499  2.15782801  7.59950352 11.88969847
## 38   4.53529752  3.78024497  5.31734964  3.17007193  8.06431334 12.13836188
## 39   3.50834843  2.42417864  5.04398587  1.56059798  7.37277143 11.77295170
## 40   3.58147956  2.55229316  5.10967936  1.78716627  7.45674270 11.84474854
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## 41   3.71349456  2.72313132  5.30749366  2.00900427  7.52455775 11.90544848
## 42   3.72992578  2.79888171  5.02616848  2.06913807  7.59147297 11.90887111
## 43   1.82440132  0.88031518  5.64732161  2.30657321  7.49363170 11.96448282
## 44   3.47108824  2.31161366  5.54274604  1.85055817  7.40013254 11.94432204
## 45   1.86748898  0.99299180  5.87152082  2.38838901  7.51182056 12.02682373
## 46   3.42349699  2.29114246  5.61174395  1.80366664  7.35515443 11.92500869
## 47   3.38355736  2.26149838  5.33577732  1.61701766  7.33196710 11.85005227
## 48   3.48349031  2.36187670  5.62313292  1.90724629  7.41622133 11.97442854
## 49   1.98217568  1.27901432  5.52248385  2.43929535  7.59943419 12.01022867
## 50   4.58145247  3.85240596  6.28584490  3.74918169  8.13704937 12.48359371
## 51   3.76826985  2.73693060  6.04951019  2.54671568  7.54413868 12.12933998
## 52   5.44521058  4.85757422  6.87831132  4.77113434  8.66726678 12.82361079
## 53   4.70453924  4.00294277  6.32562367  3.90258568  8.22684375 12.53810081
## 54   4.15317774  3.25681813  6.24518171  3.11795627  7.77294830 12.27421620
## 55   5.57060917  5.00368390  6.93203361  4.92009359  8.76716549 12.88722523
## 56   4.17171924  3.34336110  5.96081034  3.15696382  7.85579858 12.27036592
## 57   3.95656927  2.90305507  6.69570036  2.69840641  7.39161879 12.07022445
## 58   3.96723593  2.92237647  6.70335707  2.71444924  7.39686408 12.07372514
##              19          20          21          22          23          24
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## 20   2.11760315
## 21   2.43395897  0.68295406
## 22   4.01062421  2.97509280  2.59849246
## 23   3.70893518  2.24024645  1.86556094  1.12842411
## 24   3.71315965  2.26835356  1.85572355  1.25734163  0.34565094
## 25   3.65119828  2.63400047  2.21620886  0.80128960  1.03707591  0.96147488
## 26   3.71848010  2.36213480  1.95561149  0.96259793  0.40548883  0.34509348
## 27   3.62760517  2.47418284  2.07608019  0.68044423  0.74279070  0.75530273
## 28   3.82935354  2.51520675  2.15519810  0.68238885  0.50204271  0.75167278
## 29   5.13569465  4.82188567  5.13690246  6.14499217  5.99709822  6.05619006
## 30   5.26450565  4.74114184  5.06710814  6.01902256  5.84360072  5.93004579
## 31   4.48194277  2.79794634  2.88777425  3.61032549  3.05461898  3.10570305
## 32   4.51206692  3.10005278  2.87502452  2.22388965  2.15054235  2.16030479
## 33   4.82784233  3.34078425  3.21781364  2.72892716  2.61351298  2.70301100
## 34   4.86876498  3.46015833  3.34493320  2.74441737  2.73494550  2.84083018
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## 35   4.51759365  2.95020344  2.76347848  2.29406937  2.10830220  2.27201634
## 36   3.69784900  2.21776308  1.87853110  1.57052495  1.01595080  1.26597787
## 37   3.87666498  2.09876792  1.78197622  2.33814324  1.39010091  1.49690040
## 38   4.60469400  2.78969847  2.65425546  3.43390557  2.49419987  2.60297228
## 39   3.60951381  1.96828510  1.57542290  1.67629982  0.67499150  0.77442822
## 40   3.81157715  2.19580447  1.87122362  1.69947135  0.83297794  1.01986627
## 41   4.01699273  2.28464424  1.95755296  2.02689556  1.00341356  1.06096115
## 42   4.02574867  2.36348174  2.14223688  1.95040371  1.15898503  1.42037770
## 43   4.03206975  3.01065357  2.70439599  1.79739353  1.93392307  2.01891871
## 44   3.88100089  2.69442333  2.31778173  0.55621182  0.94589717  1.17551518
## 45   4.25217018  3.18102860  2.87120210  1.76713995  1.89242614  1.94064607
## 46   3.93084561  2.81813668  2.44090157  0.29646201  0.89473139  1.05786988
## 47   3.77946203  2.59665119  2.24729932  0.56312447  0.75186354  0.98752065
## 48   4.03932535  2.84153016  2.49616672  0.45607082  0.93332941  1.16361185
## 49   4.18726382  3.07328549  2.83464020  1.90059928  1.98116242  2.14927181
## 50   5.14844809  4.56183653  4.37071742  2.50645075  3.31497228  3.58600195
## 51   4.35238153  3.59373831  3.27742396  0.95715029  2.03074343  2.19999715
## 52   5.92307306  5.43268377  5.28167908  3.85446843  4.43971954  4.66120705
## 53   5.26732514  4.68100339  4.50597719  2.69622781  3.47370858  3.75316069
## 54   4.70614502  4.04912978  3.78396541  1.87982583  2.70642390  2.88306261
## 55   6.04774286  5.56011517  5.42104938  4.00806133  4.58707178  4.81838041
## 56   4.69856233  4.02368643  3.80624549  1.89491685  2.71124429  2.97437526
## 57   4.37437987  3.70769889  3.24314900  2.13864468  2.41459077  2.17259908
## 58   4.39800656  3.73146369  3.27284656  2.15767035  2.43357746  2.19341719
##             25          26          27          28          29          30
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## 26   0.70145574
## 27   0.34272056  0.45891623
## 28   0.92128107  0.55181008  0.59975704
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## 29   5.92029352  5.93253619  5.85380245  6.01761989
## 30   5.86922350  5.80895580  5.76429494  5.85603701  0.78826552
## 31   3.50385619  3.08423668  3.30512482  3.20769732  4.15853194  3.76094801
## 32   2.21856819  1.97991580  2.10435243  2.10475247  5.10009722  4.84609101
## 33   2.86802101  2.54734907  2.68931250  2.54789399  4.94023600  4.56733817
## 34   2.92445856  2.65703762  2.75338162  2.62138422  4.85622971  4.48008903
## 35   2.56430200  2.14412852  2.31779497  2.02133645  5.36498368  4.99282207
## 36   1.75662911  1.30235298  1.46348709  1.05725395  6.12420096  5.91465913
## 37   2.33119668  1.71104745  2.05895787  1.70866049  6.32259318  6.08218717
## 38   3.48937948  2.83495311  3.20552330  2.79560679  6.84989320  6.52376948
## 39   1.57107956  0.97716876  1.30701535  1.05134470  6.06563532  5.88978035
## 40   1.74973865  1.16635553  1.46076107  1.08144782  6.17992159  5.97146701
## 41   1.97778119  1.31123877  1.71639973  1.38475844  6.35712879  6.13718514
## 42   2.14851562  1.55024312  1.82469546  1.32031673  6.27362351  6.01158725
## 43   1.89427906  1.87777190  1.80188294  1.79153798  5.92395921  5.78909470
## 44   1.08878721  0.94274138  0.83478326  0.49761827  6.06810041  5.89729706
## 45   1.83707478  1.80496937  1.76431533  1.76888196  6.07048744  5.93376945
## 46   0.80872224  0.80862219  0.60292949  0.45334941  6.19035270  6.05659340
## 47   0.92089396  0.78495764  0.64066631  0.33206554  6.05771768  5.91484547
## 48   1.07592481  0.92099986  0.82051533  0.43611980  6.12369947  5.94810072
## 49   2.16156758  2.02865244  1.99031316  1.81047406  5.98158431  5.78744024
## 50   3.20524732  3.34970743  3.07886569  2.84811334  6.82075464  6.61536669
## 51   1.59631676  1.89616066  1.55572102  1.54370780  6.20820832  6.08177863
## 52   4.37120910  4.47765322  4.26955908  4.08778899  7.42783162  7.23203762
## 53   3.39969885  3.52260234  3.26314331  3.01279351  6.88019485  6.65989482
## 54   2.39310348  2.62448682  2.34310637  2.28673833  6.41101537  6.27241018
## 55   4.54279867  4.63669917  4.43205851  4.23222417  7.51363985  7.30515519
## 56   2.58358245  2.73242456  2.45377449  2.24142272  6.49709642  6.31178045
## 57   1.58933475  2.04029357  1.89920630  2.40166828  6.60294071  6.66063137
## 58   1.61427126  2.06174535  1.92102752  2.42011019  6.60896974  6.66711215
##             31          32          33          34          35          36
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## 32   1.93932941
## 33   1.60663345  0.83415500
## 34   1.77545841  0.95293888  0.29690305
## 35   1.96260446  1.26086922  0.98521841  1.07818906
## 36   3.22024775  2.57915176  2.83283909  2.93181800  2.07783849
## 37   3.02439546  2.77751653  2.98139672  3.16191842  2.24969667  1.03128032
## 38   3.35242098  3.57492518  3.57392344  3.78066739  2.85553024  2.05656854
## 39   3.00231191  2.41703380  2.78678008  2.93914127  2.17070373  0.73532302
## 40   3.07044030  2.49459617  2.78709644  2.92873017  2.12466452  0.53564786
## 41   2.98686861  2.51011698  2.81343649  3.00243173  2.20436951  1.07215428
## 42   3.09631015  2.70168177  2.84681892  2.98198300  2.10966198  0.87408275
## 43   3.60373908  2.60064653  2.97206229  2.99672831  2.58139880  2.11970888
## 44   3.37929106  2.17908571  2.57722039  2.60972110  1.97368135  1.11704273
## 45   3.60235183  2.49944203  2.91718266  2.95788152  2.60548524  2.22453457
## 46   3.56833225  2.30139493  2.78341484  2.82200316  2.28995016  1.34310257
## 47   3.44335474  2.33950769  2.77007434  2.81630237  2.23592386  1.13596548
## 48   3.39451942  2.15020453  2.55284741  2.58565450  2.01551895  1.25279488
## 49   3.57197796  2.72228308  2.95102625  2.96833866  2.47496447  2.00734490
## 50   5.08247987  3.98415789  4.06154874  3.92808177  3.54547174  3.09882708
## 51   4.10348211  2.65895924  3.04088556  2.96341651  2.65482645  2.22036900
## 52   5.90186399  4.99410071  5.03803919  4.92376601  4.60658130  3.92911857
## 53   5.17077221  4.11971224  4.15988003  4.02178307  3.63695831  3.22373411
## 54   4.51073079  3.21703127  3.48873603  3.39112209  3.11891521  2.53968291
## 55   6.01411818  5.13901468  5.15499374  5.03651598  4.71283541  4.05661085
## 56   4.60939833  3.47197205  3.62283327  3.51296080  3.10252682  2.54505451
## 57   4.39023389  2.88890034  3.70207794  3.76796985  3.64484670  3.15269041
## 58   4.40198153  2.90413031  3.71475451  3.78014968  3.66460694  3.17630985
##              37          38          39          40          41          42
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## 38   1.19130524
## 39   0.78961940  1.94009176
## 40   0.79794122  1.83730932  0.41416940
## 41   0.63069839  1.57172311  0.57515920  0.59973253
## 42   0.88862564  1.63016330  0.93287105  0.73957524  0.86463588
## 43   2.62738093  3.55973446  2.17966622  2.22825285  2.46671623  2.41480779
## 44   1.91266568  2.99015105  1.34871561  1.33991518  1.70899112  1.53072682
## 45   2.68103679  3.60164831  2.20130924  2.24747766  2.42646034  2.45017151
## 46   2.09414315  3.18666344  1.43291249  1.45155308  1.78302341  1.69337874
## 47   1.90577061  2.99007827  1.25223838  1.25924986  1.63042913  1.46283773
## 48   2.01711025  3.05984691  1.42957260  1.38847527  1.73034664  1.54886503
## 49   2.53428921  3.35367990  2.18410300  2.14446723  2.41460162  2.18774842
## 50   4.02611955  4.80668300  3.65085113  3.47820569  3.95061909  3.37015379
## 51   3.11878568  4.15626688  2.52521702  2.48188941  2.88588253  2.62950655
## 52   4.85458067  5.46431185  4.54005679  4.25371144  4.80460854  4.44614828
## 53   4.13859242  4.88087818  3.79184629  3.60762541  4.07991986  3.47258941
## 54   3.53417303  4.46061803  3.00554611  2.83524558  3.35090606  3.12347896
## 55   4.97502580  5.55481252  4.68184079  4.38845477  4.93893088  4.55030701
## 56   3.49694823  4.35369043  3.06560343  2.91077203  3.39079864  2.86735355
## 57   3.51611168  4.62619522  2.83033613  3.06283289  3.11547270  3.54537572
## 58   3.54039359  4.64643491  2.85354570  3.08277635  3.13481969  3.56156132
##              43          44          45          46          47          48
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## 44   1.75266134
## 45   0.43588054  1.80223544
## 46   1.79206938  0.45052640  1.76968339
## 47   1.79079713  0.44638879  1.80566573  0.30914702
## 48   1.79269622  0.31572251  1.77912192  0.34669328  0.39842488
## 49   0.60086105  1.75915579  0.80222238  1.85595382  1.79733539  1.77351002
## 50   3.19222396  2.49657784  3.33130264  2.59209744  2.60612841  2.47209353
## 51   2.12870247  1.22134264  2.16682940  1.17866816  1.33676102  1.16903499
## 52   4.33353347  3.83686307  4.44969735  3.90844705  3.90996730  3.82208257
## 53   3.34013613  2.66366653  3.48557644  2.77386567  2.77668273  2.64073189
## 54   2.68969245  2.01056612  2.75337361  2.01866308  2.10681534  1.97922739
## 55   4.47073487  3.97583184  4.59373519  4.05813833  4.05248482  3.96156986
## 56   2.69286783  1.89714758  2.82210791  1.97913018  1.99305830  1.87182103
## 57   2.85581479  2.51505631  2.69185104  2.24017908  2.44463208  2.49593000
## 58   2.87565507  2.53801874  2.70750487  2.25896501  2.46232889  2.51326562
##              49          50          51          52          53          54
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## 50   2.94377294
## 51   2.16067728  1.74696644
## 52   4.12874551  2.74417762  3.36950101
## 53   3.06558059  0.21727758  1.95132509  2.73675488
## 54   2.65473384  1.87659511  1.37700303  2.11923464  2.02841008
## 55   4.24340955  2.77197180  3.50691418  0.23309319  2.74642227  2.29248038
## 56   2.48733886  0.63536879  1.18637192  2.76729241  0.82397525  1.46726605
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## 57   3.31230288  4.37256785  2.66379538  5.34189040  4.58398749  3.33730779
## 58   3.32792752  4.38151882  2.67792651  5.34925428  4.59262983  3.34850448
##              55          56          57          58          59          60
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## 56   2.84031919
## 57   5.54129745  3.80230796
## 58   5.54847602  3.81271648  0.13212180
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##              73          74          75          76          77          78
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##              79          80          81          82          83          84
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##              163          164          165          166          167          168
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##             169         170         171         172         173         174
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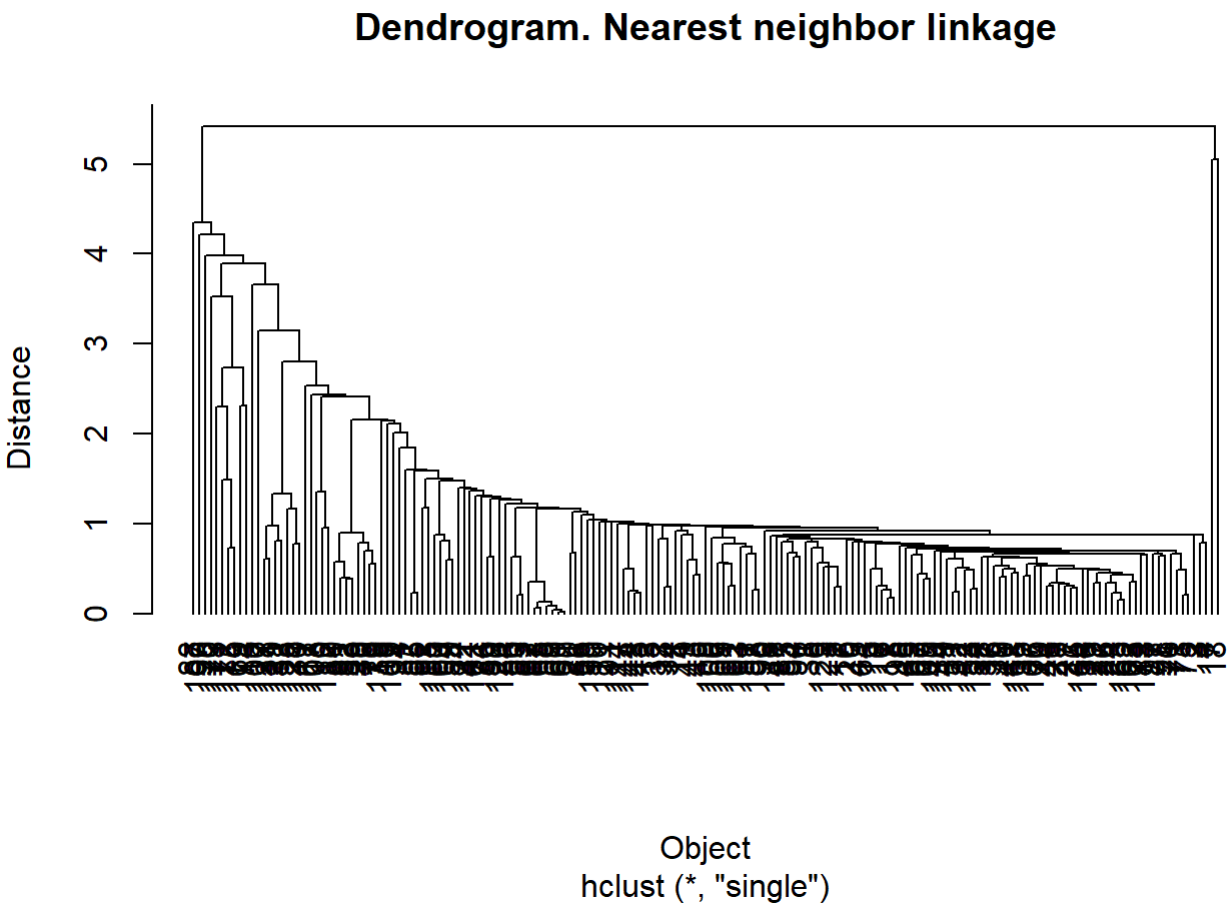
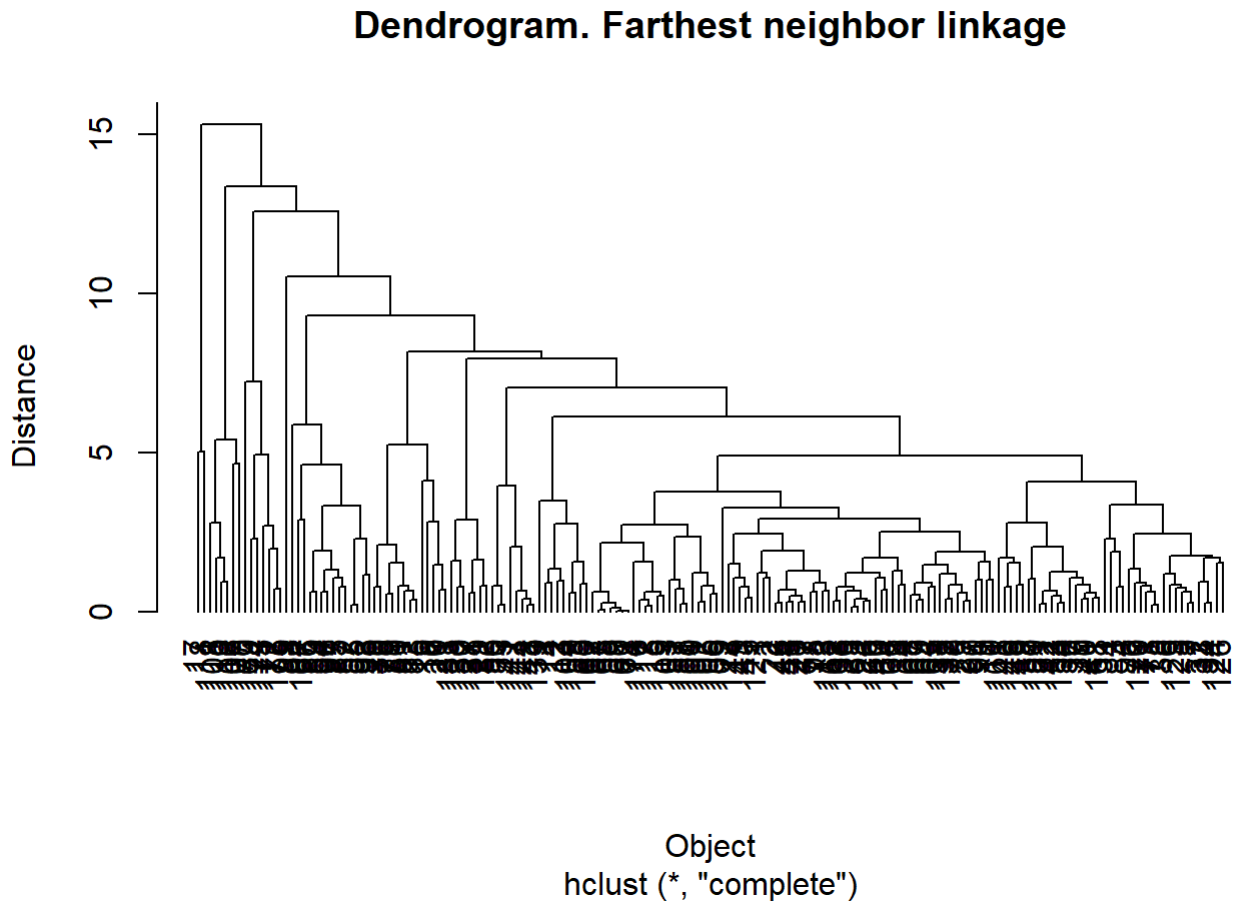
##  [ reached getOption("max.print") -- omitted 117 rows ]
```

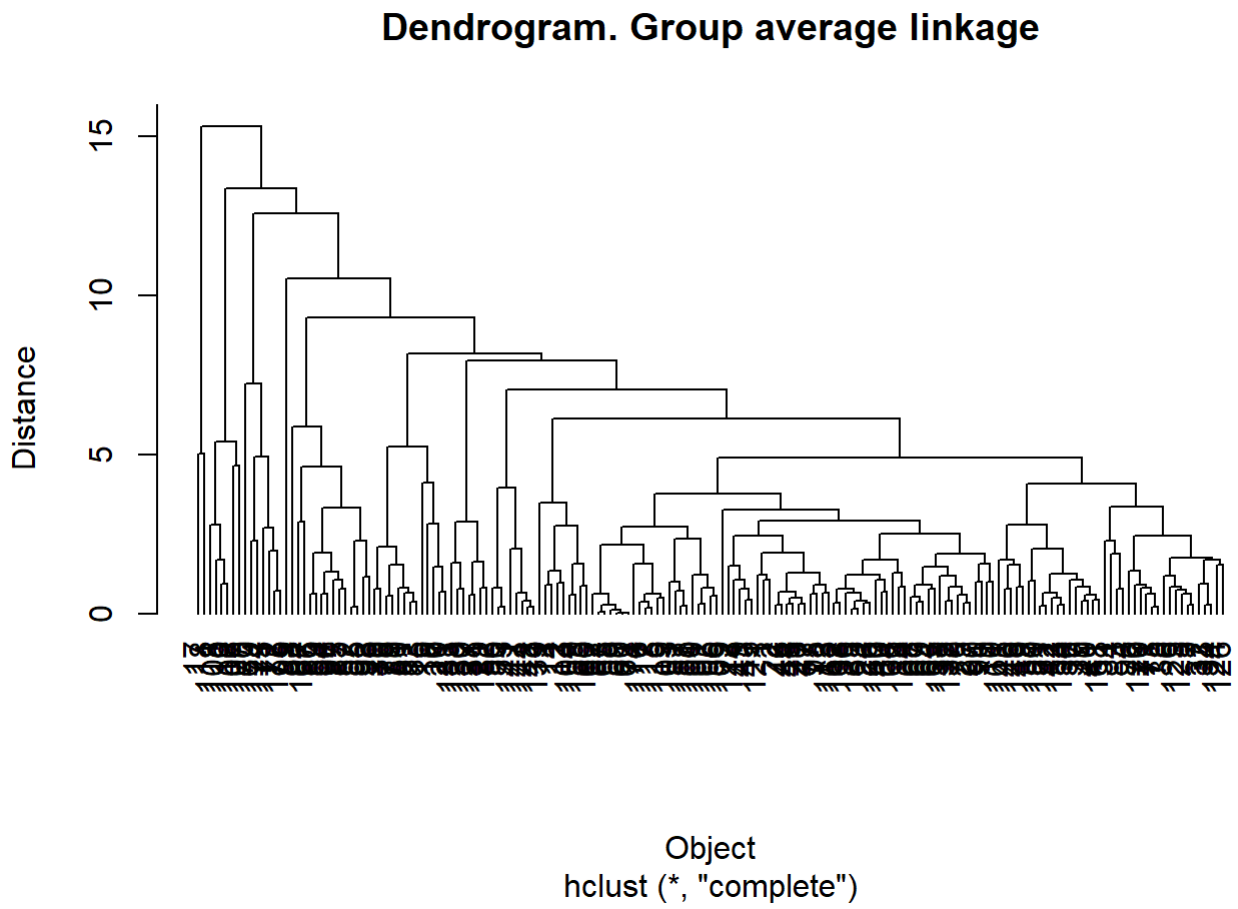
```
Students_sn <- hclust(Students_dist, method = "single")
plot(Students_sn, hang=-1,xlab="Object",ylab="Distance",
     main="Dendrogram. Nearest neighbor linkage")
```



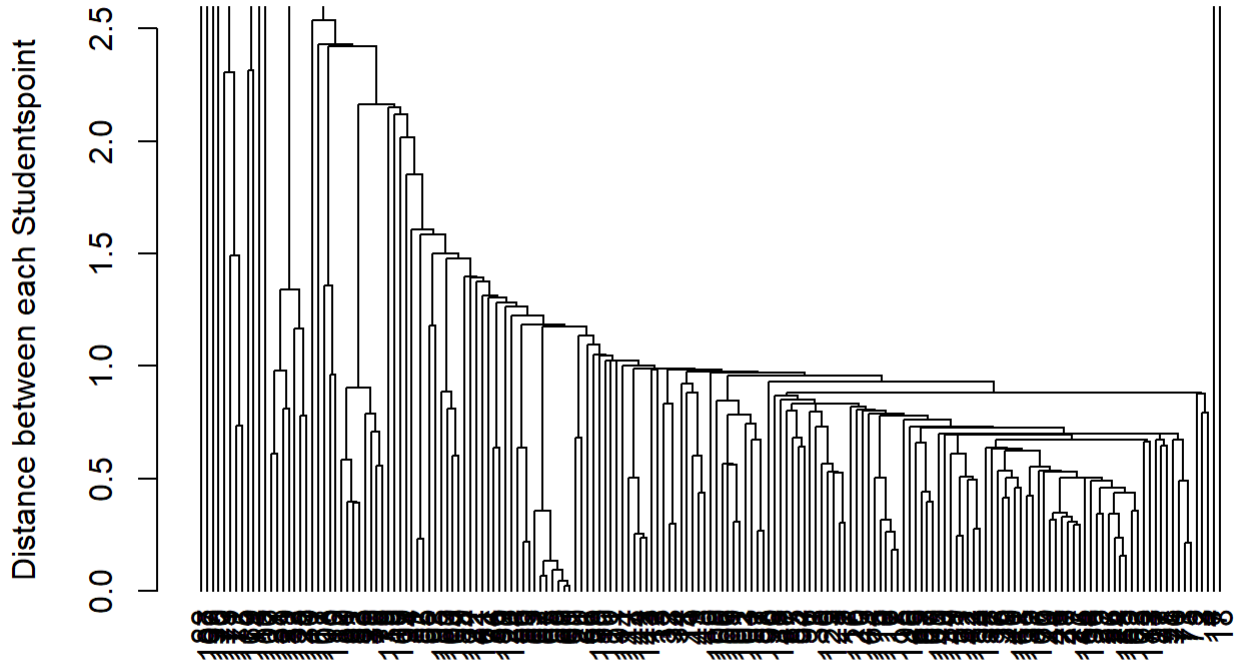
```
Students_fn <- hclust(Students_dist)
plot(Students_fn, hang=-1,xlab="Object",ylab="Distance",
     main="Dendrogram. Farthest neighbor linkage")
```



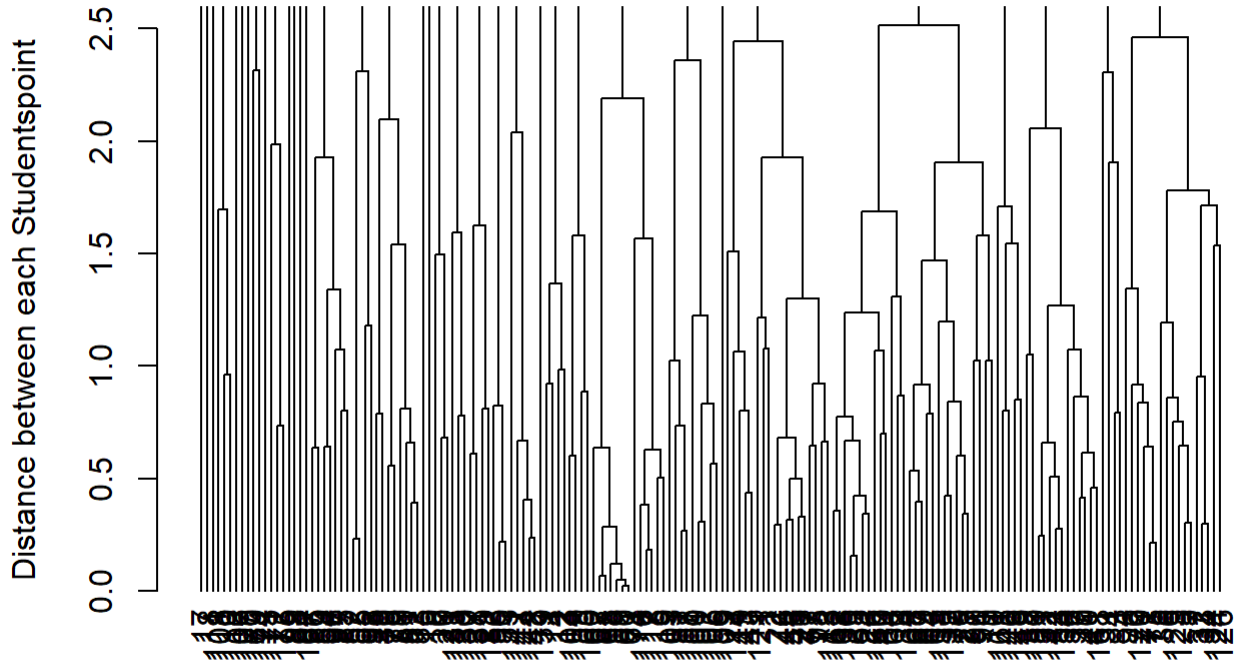

```
Students_avg <- hclust(Students_dist)
plot(Students_avg, hang=-1,xlab="Object",ylab="Distance",
     main="Dendrogram. Group average linkage")
```




```
plot(as.dendrogram(Students_sn),ylab="Distance between each Studentspoint",ylim=c(0,2.5))
```




```
plot(as.dendrogram(Students_fn),ylab="Distance between each Studentspoint",ylim=c(0,2.5))
```




```
#Students Scaling
matstd_Students <- scale(Students[3:13])
matstd_Students
```

```
##        Whatsapp..hrs. Instagram..hrs. Snapchat.hrs. Telegram..hrs.
##   [1,]     0.21906630     -0.22655759   0.226966377    -0.32935512
##   [2,]     0.85136518      0.57126739   0.479778710    -0.19333825
##   [3,]     0.93710063      1.66975054   0.847505741    -0.36335933
##   [4,]     0.95424771      0.91319237   0.787750099    -0.19333825
##   [5,]     0.13333086      0.71668376   0.226966377    -0.22734247
##   [6,]     0.34766946      0.58895316  -0.094794775     0.14670390
##   [7,]     0.07974621      0.68720747   0.121244855    -0.39736355
##   [8,]    -0.46681723      0.73633462   0.272932256     0.45274184
##   [9,]    -0.72402356     -0.19708130  -0.002863018     0.79278399
##  [10,]    -0.23104477     -0.73747999   0.318898134     0.72477556
##  [11,]    -0.42394951     -0.93398860   0.847505741     2.05093997
##  [12,]    -0.50968495     -0.73747999  -0.025845957     2.39098212
##  [13,]    -0.35964793     -0.24620845   0.502761650     2.86704114
##  [14,]    -0.46681723     -0.34446276   0.318898134     1.60888517
##  [15,]     0.56200807      1.28655874   4.915486021    -0.39736355
##  [16,]    -0.57398653     -0.04969984   1.192249833    -0.39736355
##  [17,]    -0.98122988     -0.83573429   1.330147469    -0.39736355
##  [18,]    -0.93836216     -0.24620845   3.950202565    -0.39736355
##  [19,]    -0.56755638     -0.38376448   2.626385253    -0.39736355
##  [20,]    -0.76689128      0.79528721   1.743840379    -0.39736355
##  [21,]    -0.89549444      0.57912773   1.330147469    -0.39736355
##  [22,]     0.11189700     -0.48201879  -0.517680861    -0.39736355
##  [23,]    -0.46038707      0.39244455  -0.094794775    -0.39736355
##  [24,]    -0.78832514      0.29419024  -0.117777715    -0.39736355
##  [25,]    -0.56326960     -0.63922568  -0.117777715    -0.39736355
##  [26,]    -0.61685426      0.04855447  -0.186726533    -0.39736355
##  [27,]    -0.40251565     -0.34446276  -0.094794775    -0.39736355
##  [28,]    -0.08100774      0.12715792  -0.278658291    -0.39736355
##  [29,]    -0.08100774     -0.65887654   3.720373170    -0.19333825
##  [30,]     0.21906630     -0.08900156   3.306680261    -0.19333825
##  [31,]    -0.85262672      1.34551133   0.594693408    -0.39736355
##  [32,]    -0.70258970      0.06820533  -0.646385322    -0.39736355
##  [33,]    -0.25247863      0.55947687  -0.646385322    -0.39736355
##  [34,]    -0.03814002      0.38261912  -0.646385322    -0.39736355
##  [35,]     0.11189700      0.87389065  -0.646385322    -0.39736355
##  [36,]     0.10761023      0.80707772  -0.002863018    -0.39736355
##  [37,]    -0.52683204      1.57149623   0.043102861    -0.39736355
##  [38,]    -0.50539818      2.75840826   0.024716510    -0.39736355
##  [39,]    -0.56326960      0.85227470   0.084472152    -0.39736355
##  [40,]    -0.28891619      0.99965617  -0.039635721    -0.39736355
##  [41,]    -0.71973679      1.30620960  -0.182129945    -0.39736355
##  [42,]     0.09046314      1.40053374  -0.039635721    -0.39736355
##  [43,]     0.02616156     -0.24620845  -0.186726533     1.30284723
##  [44,]     0.24050016     -0.04969984  -0.416555927    -0.39736355
##  [45,]    -0.18817705     -0.24620845  -0.416555927     1.30284723
##  [46,]     0.06902928     -0.24620845  -0.416555927    -0.39736355
##  [47,]     0.13333086     -0.04969984  -0.186726533    -0.39736355
##  [48,]     0.24050016     -0.04969984  -0.508487685    -0.39736355
##  [49,]     0.45483877      0.14680878  -0.186726533     1.30284723
##  [50,]     2.59822481     -0.76892136  -0.627998970    -0.39736355
##  [51,]     0.88351597     -1.01259205  -0.646385322    -0.39736355
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##  [52,]     2.81256341     -0.73747999  -0.582033091    -0.39736355
##  [53,]     2.79755971     -0.68835283  -0.627998970    -0.39736355
##  [54,]     1.31004980     -1.06564937  -0.646385322    -0.39736355
##  [55,]     3.03333218     -0.66280671  -0.582033091    -0.39736355
##  [56,]     1.99164656     -0.69228301  -0.485504746    -0.39736355
##  [57,]    -1.68854728     -1.59622263  -0.646385322    -0.39736355
##  [58,]    -1.68854728     -1.60211789  -0.646385322    -0.39736355
##  [59,]    -1.68854728     -1.59622263  -0.646385322    -0.39736355
##  [60,]    -1.66282664     -1.55888599  -0.646385322    -0.39736355
##  [61,]    -1.68426050     -1.55299074  -0.646385322    -0.39736355
##  [62,]    -1.67140019     -1.56281617  -0.646385322    -0.39736355
##  [63,]    -1.68854728     -1.55299074  -0.646385322    -0.39736355
##  [64,]    -0.61471087     -0.59206361   0.291318607    -0.39736355
##  [65,]    -0.99837697     -0.39555500   0.415426480    -0.39736355
##  [66,]    -1.03910131      0.76777600   0.392443541    -0.39736355
##  [67,]    -0.51825850     -0.60581921   0.318898134    -0.39736355
##  [68,]    -0.77546482     -0.52721577   0.066085801    -0.39736355
##  [69,]    -0.76260451     -0.82590886   0.493568474    -0.39736355
##  [70,]    -0.37036486     -0.77874680   0.033909685    -0.39736355
##  [71,]     0.77634667     -0.30516103  -0.641788734    -0.36335933
##  [72,]     0.71204509     -0.01039811  -0.641788734    -0.36335933
##  [73,]     0.45483877     -0.03004897  -0.641788734    -0.32935512
##  [74,]    -1.04553146     -0.91433774  -0.641788734    -0.36335933
##  [75,]     0.24050016     -0.04969984  -0.641788734    -0.32935512
##  [76,]     0.45483877      0.44157170  -0.641788734    -0.36335933
##  [77,]     0.88351597      0.24506309  -0.646385322    -0.39736355
##  [78,]     0.04759542      0.48087342   2.984919109    -0.39736355
##  [79,]     0.51914035      0.44157170   2.709123835    -0.39736355
##  [80,]     1.41936249      0.63808031   3.398612018    -0.39736355
##  [81,]     1.18359002      0.59877859   2.755089714    -0.39736355
##  [82,]     1.26932546      0.46122256   3.076850866    -0.39736355
##  [83,]     1.03355300      0.42192084   3.168782624    -0.39736355
##  [84,]     0.51914035      0.02890361   1.697874500    -0.39736355
##  [85,]     0.68418107     -1.13049722  -0.517680861    -0.19333825
##  [86,]     0.10546684     -1.02241748  -0.513084273     0.07869547
##  [87,]     0.05402558     -1.14425282  -0.540663800    -0.09132561
##  [88,]     0.12261393     -1.01259205  -0.572839916     3.34310015
##  [89,]     0.35195624     -1.12263687  -0.540663800    -0.02331718
##  [90,]    -0.34678761     -1.00473170  -0.609612619     0.31672498
##  [91,]    -0.15173948     -0.36214853  -0.605016031     0.41873762
##  [92,]     1.00783237     -0.79053731  -0.646385322    -0.39736355
##  [93,]     1.95092222     -0.13223345  -0.646385322    -0.39736355
##  [94,]     1.73015346      1.12935185  -0.646385322    -0.39736355
##  [95,]     1.35506090     -0.04969984  -0.646385322    -0.39736355
##  [96,]     0.92638370     -0.63922568  -0.646385322    -0.39736355
##  [97,]     0.26193402     -0.24620845  -0.646385322    -0.39736355
##  [98,]     0.45483877      0.14680878  -0.646385322    -0.39736355
##  [99,]     0.11832716     -1.62176875  -0.646385322     7.72964394
## [100,]    -0.35964793     -1.62176875  -0.646385322     1.50687252
## [101,]    -0.34250084     -1.62176875  -0.646385322     0.58875870
## [102,]    -0.14745271     -1.62176875  -0.646385322     0.58875870
## [103,]     0.74205250     -1.62176875  -0.646385322     0.31672498
```

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## [104,]    0.09046314    -1.62176875  -0.646385322    3.17307908
## [105,]    0.25121709    -1.62176875  -0.646385322    0.92880086
## [106,]    0.31337529     2.01364062  -0.094794775   -0.39736355
## [107,]   -0.08315113     2.02936131  -0.407362752   -0.39736355
## [108,]   -0.14102255     0.40816524  -0.131567478   -0.39736355
## [109,]   -0.51825850    -0.17743044  -0.453328630   -0.39736355
## [110,]   -0.51611511     1.60686778  -0.421152515   -0.39736355
## [111,]   -0.74545742     0.43764153  -0.453328630   -0.39736355
## [112,]   -0.75831773     0.82083333  -0.402766164   -0.39736355
## [113,]    0.37553348    -0.17743044  -0.646385322   -0.39736355
## [114,]    0.18262874    -0.08900156  -0.646385322    0.75877978
## [115,]   -0.44538337    -0.68835283  -0.646385322   -0.39736355
## [116,]   -0.72831033    -0.36804379  -0.646385322   -0.39736355
## [117,]   -0.78832514    -0.41324077  -0.646385322   -0.39736355
## [118,]   -0.85905688    -0.41717094  -0.646385322   -0.39736355
## [119,]   -0.57827331    -0.60188904  -0.646385322   -0.39736355
## [120,]    0.45483877    -0.14795414  -0.416555927   -0.39736355
## [121,]    0.93710063    -0.01039811  -0.186726533    0.45274184
## [122,]    0.24050016     0.28436481  -0.508487685    1.30284723
## [123,]   -0.13459240     0.86799539  -0.278658291   -0.39736355
## [124,]    0.20620599    -0.68442266   0.190193674   -0.39736355
## [125,]    0.24050016     0.44157170  -0.186726533   -0.39736355
## [126,]   -0.31035005    -0.21476707  -0.361396873    0.79278399
## [127,]   -0.40251565     0.14680878   0.272932256   -0.39736355
## [128,]   -0.18817705    -0.04969984   0.272932256   -0.39736355
## [129,]   -0.18817705    -0.83573429   0.272932256   -0.39736355
## [130,]    0.02616156    -0.63922568  -0.186726533   -0.39736355
## [131,]   -0.61685426    -0.24620845   0.272932256   -0.39736355
## [132,]   -0.18817705    -0.63922568  -0.186726533   -0.39736355
## [133,]    0.29408481     0.14680878   0.870488681   -0.39736355
## [134,]   -0.50968495     0.42192084  -0.186726533    0.01068704
## [135,]   -0.99837697    -0.38769465   0.038506273   -0.05732139
## [136,]   -0.78832514     0.03872904  -0.002863018   -0.02331718
## [137,]   -0.95979602    -0.59009853   0.043102861    0.11269969
## [138,]   -0.97694311    -1.17372911  -0.094794775    0.21471233
## [139,]   -0.55255267     1.65992511  -0.439538867    2.66301584
## [140,]   -0.91907169     0.79135703  -0.411959339   -0.02331718
## [141,]    3.13407132     3.09443800  -0.646385322   -0.39736355
## [142,]    2.49105551     1.91538631   0.043102861   -0.39736355
## [143,]    2.27671690     1.81713200   0.043102861   -0.39736355
## [144,]    2.59822481     1.91538631  -0.186726533   -0.39736355
## [145,]    1.52653179     0.93284324   0.043102861   -0.39736355
## [146,]    0.88351597     1.22760616  -0.186726533   -0.39736355
## [147,]    2.38388620     1.32586047   0.043102861   -0.39736355
## [148,]    1.00140221     2.13547596   0.070682389   -0.09132561
## [149,]    0.48270278     1.78765571   0.052296037    0.04469125
## [150,]    0.05188219     2.60906172  -0.168340182   -0.32935512
## [151,]    0.24264355     1.39463848  -0.177533357   -0.39736355
## [152,]    0.30480174     1.52433417  -0.136164066   -0.39736355
## [153,]   -0.14530933     1.33372081  -0.388976400   -0.39736355
## [154,]    0.04759542     1.13524711  -0.398169576   -0.39736355
## [155,]    0.91137999    -1.03224291  -0.416555927    2.66301584
```

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## [156,]     0.34766946     -1.16979894  -0.554453564     0.62276292
## [157,]     0.56200807     -1.62176875  -0.646385322    -0.19333825
## [158,]     0.74633927     -1.62176875  -0.646385322    -0.36335933
## [159,]    -0.03814002     -1.62176875  -0.646385322     3.75115074
## [160,]     0.39053718     -1.03224291  -0.646385322     3.00305800
## [161,]     0.99068528      1.18830444  -0.646385322     0.96280507
## [162,]    -0.71973679      0.46122256   0.360267425    -0.39736355
## [163,]    -0.57184315      0.20183119   0.548727529    -0.39736355
## [164,]    -1.22986266      0.50052428  -0.002863018    -0.39736355
## [165,]    -0.59542039      0.41209541  -0.053425484    -0.39736355
## [166,]    -0.95979602     -0.20690673  -0.434942279    -0.39736355
## [167,]    -0.57398653      0.53982601  -0.384379812    -0.39736355
## [168,]    -0.56755638      1.09005013   0.043102861    -0.39736355
## [169,]    -1.67997373     -0.12830328  -0.646385322    -0.39736355
## [170,]    -1.68854728     -1.26805325  -0.646385322    -0.39736355
## [171,]    -1.53208010     -0.37786922  -0.646385322    -0.39736355
## [172,]    -1.65639649      0.20576136  -0.646385322    -0.39736355
## [173,]    -1.68211712     -0.20690673  -0.646385322    -0.39736355
## [174,]    -1.67783035     -0.91433774  -0.646385322    -0.39736355
## [175,]    -1.68640389      0.34331739  -0.646385322    -0.39736355
##        Facebook.Messenger..hrs. BeReal..hrs. TikTok..hrs. WeChat..hrs.
##   [1,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [2,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [3,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [4,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [5,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [6,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [7,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##   [8,]              -0.38621651   0.29879810   -0.1887538  -0.21483824
##   [9,]              -0.38621651   0.11893192   -0.1887538  -0.21483824
##  [10,]              -0.38621651   0.68422563   -0.1887538  -0.21483824
##  [11,]              -0.38621651   0.38873119   -0.1887538  -0.21483824
##  [12,]              -0.38621651   0.04184642   -0.1887538  -0.21483824
##  [13,]              -0.38621651   0.02899883   -0.1887538  -0.21483824
##  [14,]              -0.38621651   0.26025535   -0.1887538  -0.21483824
##  [15,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [16,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [17,]              -0.38621651   6.78682817   -0.1887538  -0.21483824
##  [18,]              -0.38621651  10.89805514   -0.1887538  -0.21483824
##  [19,]              -0.38621651   1.86620339   -0.1887538  -0.21483824
##  [20,]              -0.38621651   0.49151187   -0.1887538  -0.21483824
##  [21,]              -0.38621651   0.10608434   -0.1887538  -0.21483824
##  [22,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [23,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [24,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [25,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [26,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [27,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [28,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [29,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [30,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [31,]              -0.38621651  -0.15086735   -0.1887538  -0.21483824
```

```
##  [32,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [33,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [34,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [35,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [36,]              0.08941959  -0.15086735   -0.1887538  -0.21483824
##  [37,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [38,]             -0.05327124  -0.15086735   -0.1887538  -0.21483824
##  [39,]             -0.12461666  -0.15086735   -0.1887538  -0.21483824
##  [40,]              0.08941959  -0.15086735   -0.1887538  -0.21483824
##  [41,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [42,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [43,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [44,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [45,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [46,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [47,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [48,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [49,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [50,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [51,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [52,]              2.34869104  -0.15086735   -0.1887538  -0.21483824
##  [53,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [54,]              0.92178275  -0.15086735   -0.1887538  -0.21483824
##  [55,]              2.34869104  -0.15086735   -0.1887538  -0.21483824
##  [56,]             -0.29108929  -0.15086735   -0.1887538  -0.21483824
##  [57,]             -0.38621651  -0.15086735   -0.1887538   0.01238777
##  [58,]             -0.38621651  -0.15086735   -0.1887538   0.13521263
##  [59,]             -0.38621651  -0.15086735   -0.1887538   0.22733128
##  [60,]             -0.38621651  -0.15086735   -0.1887538   0.24575501
##  [61,]             -0.38621651  -0.15086735   -0.1887538   0.24575501
##  [62,]             -0.38621651  -0.15086735   -0.1887538   0.60194712
##  [63,]             -0.38621651  -0.15086735   -0.1887538  -0.03060094
##  [64,]              0.25589222  -0.15086735   -0.1887538  -0.21483824
##  [65,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [66,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [67,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [68,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [69,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [70,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [71,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [72,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [73,]              1.04069178  -0.15086735   -0.1887538  -0.21483824
##  [74,]              0.32723763  -0.15086735   -0.1887538  -0.21483824
##  [75,]              1.04069178  -0.15086735   -0.1887538  -0.21483824
##  [76,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [77,]             -0.14839846  -0.15086735   -0.1887538  -0.21483824
##  [78,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [79,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [80,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [81,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [82,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [83,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
```

```
##  [84,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
##  [85,]              0.54127388  -0.15086735   -0.1887538  -0.21483824
##  [86,]              2.32490923  -0.15086735   -0.1887538  -0.21483824
##  [87,]              1.01690997  -0.15086735   -0.1887538  -0.21483824
##  [88,]              5.20250761  -0.15086735   -0.1887538  -0.21483824
##  [89,]              2.18221840  -0.15086735   -0.1887538  -0.21483824
##  [90,]              0.30345583  -0.15086735   -0.1887538  -0.21483824
##  [91,]              0.16076500  -0.15086735   -0.1887538  -0.21483824
##  [92,]              3.18105420  -0.15086735   -0.1887538  -0.21483824
##  [93,]              3.06214518  -0.15086735   -0.1887538  -0.21483824
##  [94,]              4.37014444  -0.15086735   -0.1887538  -0.21483824
##  [95,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [96,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [97,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
##  [98,]              0.32723763  -0.15086735   -0.1887538  -0.21483824
##  [99,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [100,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [101,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [102,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [103,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [104,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [105,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [106,]              5.17872580   0.09323675   -0.1887538  -0.21483824
## [107,]              3.18105420   0.20886501   -0.1887538  -0.21483824
## [108,]              0.27967402  -0.02239150   -0.1887538  -0.21483824
## [109,]             -0.10083485   1.00541524   -0.1887538  -0.21483824
## [110,]              0.44614666   0.11893192   -0.1887538  -0.21483824
## [111,]              2.70541811   0.05469400   -0.1887538  -0.21483824
## [112,]              0.16076500   0.10608434   -0.1887538  -0.21483824
## [113,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [114,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [115,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [116,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [117,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [118,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [119,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [120,]              0.80287373  -0.15086735   -0.1887538  -0.21483824
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## [123,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
## [124,]             -0.38621651  -0.15086735   -0.1887538  -0.21483824
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```

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## [173,]             -0.38621651  -0.15086735    3.0454409   6.23346725
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##   [2,]   -0.24600661    0.469409559  -0.3328328135
##   [3,]   -0.24600661    1.305848544  -0.3509553221
##   [4,]   -0.24600661    1.201293671  -0.2361794348
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##   [6,]   -0.24600661    0.992183925  -0.3509553221
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##   [9,]   -0.24600661   -0.122371024   0.1262707355
##  [10,]   -0.24600661   -0.356573940  -0.0549543496
##  [11,]   -0.24600661   -0.272930041  -0.1153627114
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##  [12,]   -0.24600661   -0.502950762   0.0658623738
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##  [16,]   -0.05116091   -0.262474554  -0.3569961582
##  [17,]    0.92306757   -0.367029427  -0.3569961582
##  [18,]   -0.24600661   -0.471584300  -0.3569961582
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##  [35,]   -0.24600661    1.243115620   0.1262707355
##  [36,]   -0.24600661   -0.672329657   0.1866790972
##  [37,]   -0.24600661   -0.653509779   0.3195774930
##  [38,]   -0.24600661   -0.657691974   0.3437408377
##  [39,]   -0.24600661   -0.663965267  -0.0005868241
##  [40,]   -0.24600661   -0.676511852  -0.1153627114
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##  [64,]   -0.24600661   -0.009451761   0.4343533803
##  [65,]   -0.24600661    0.049098968   0.5189250867
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##  [76,]   -0.24600661    0.155744939  -0.3569961582
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##  [78,]   -0.24600661    4.066097197  -0.3569961582
##  [79,]   -0.24600661    3.982453298  -0.2965877965
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##  [99,]   -0.22652204   -0.396304791  -0.2663836157
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## [103,]   -0.10961462   -0.045000417  -0.2603427795
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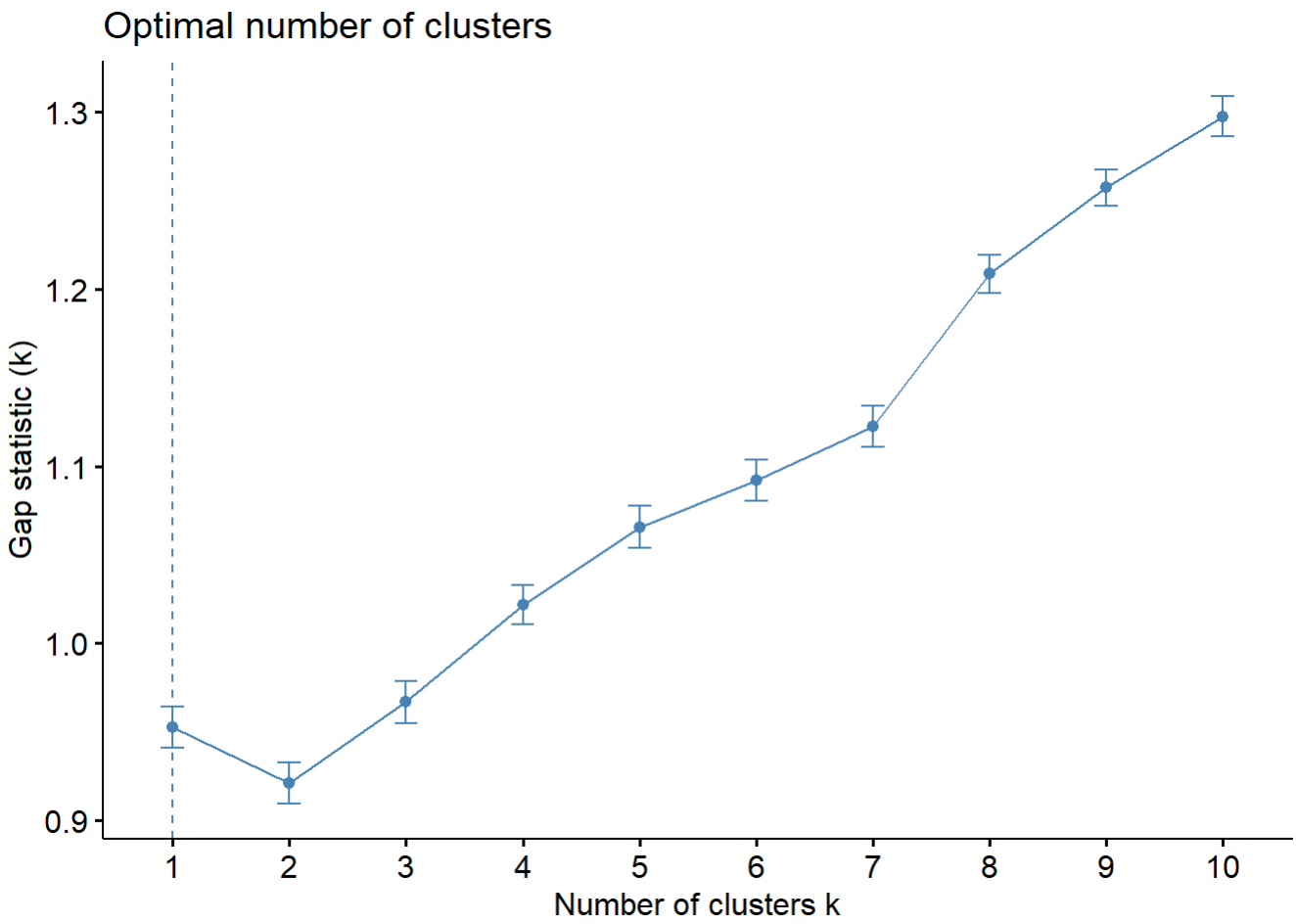
##               7.87794286               8.25291429               1.40622857
##           Telegram..hrs. Facebook.Messenger..hrs.             BeReal..hrs.
##               0.11685714               0.16240000               0.11742857
##             TikTok..hrs.             WeChat..hrs.            Twitter..hrs.
##               0.08754286               0.34982857               0.25251429
##           Linkedin..hrs.           Messages..hrs.
##               3.25520000               0.59097143
## attr(,"scaled:scale")
##           Whatsapp..hrs.          Instagram..hrs.            Snapchat.hrs.
##                4.6655151                5.0888354                2.1755268
##           Telegram..hrs. Facebook.Messenger..hrs.             BeReal..hrs.
##                0.2940812                0.4204895                0.7783564
##             TikTok..hrs.             WeChat..hrs.            Twitter..hrs.
##                0.4637940                1.6283348                1.0264533
##           Linkedin..hrs.           Messages..hrs.
##                4.7821779                1.6554000
```

```
#Kmeans
kmeans.res <- kmeans(matstd_Students,3, nstart = 25)
kmeans.res
```

```
## K-means clustering with 3 clusters of sizes 7, 146, 22
##
## Cluster means:
##   Whatsapp..hrs. Instagram..hrs. Snapchat.hrs. Telegram..hrs.
## 1    -1.65762128     -0.33519878    -0.6463853    -0.39736355
## 2     0.07042395      0.00121743    -0.2674187     0.07613351
## 3     0.06006603      0.09857485     1.9803557    -0.37881579
##   Facebook.Messenger..hrs. BeReal..hrs. TikTok..hrs. WeChat..hrs. Twitter..hrs.
## 1              -0.38621651   -0.1508673    4.3884018    4.7358812    0.12141670
## 2               0.07671424   -0.1114446   -0.1819605   -0.1946899    0.01990438
## 3              -0.38621651    0.7875903   -0.1887538   -0.2148382   -0.17072532
##   Linkedin..hrs. Messages..hrs.
## 1     -0.5510460      0.4326274
## 2     -0.2116007     -0.2214083
## 3      1.5795922      1.3316921
##
## Clustering vector:
##   [1] 2 2 2 2 2 2 2 2 2 2 2 2 2 3 2 3 3 3 3 2 2 2 2 2 2 2 2 3 3 3 2 2 2 2 2 2
##  [38] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
##  [75] 2 2 2 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## [112] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## [149] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1
##
## Within cluster sum of squares by cluster:
## [1]  44.3436 899.6785 407.5686
##  (between_SS / total_SS =  29.4 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"    "size"         "iter"         "ifault"
```

```
# Determining the optimal numbers of Clusters

fviz_nbclust(matstd_Students, kmeans, method = "gap_stat")
```


Optimal number of clusters
Gap statistic (k)
1.3
1.2
1.1
1.0
0.9
1
2
3
4
5
6
7
8
9
10
Number of clusters k

```
fviz_nbclust <- function (x, FUNcluster = NULL, method = c("silhouette", "wss",
                                                           "gap_stat"), diss = NULL, k.max = 10,
nboot = 100, verbose = interactive(),
                          barfill = "steelblue", barcolor = "steelblue", linecolor = "steelblu
e",
                          print.summary = TRUE, ...)
{
  set.seed(123)
  if (k.max < 2)
    stop("k.max must bet > = 2")
  method = match.arg(method)
  if (!inherits(x, c("ProCon.frame", "matrix")) & !("Best.nc" %in%
                                                    names(x)))
    stop("x should be an object of class matrix/ProCon.frame or ",
         "an object created by the function NbClust() [NbClust package].")
  if (inherits(x, "list") & "Best.nc" %in% names(x)) {
    best_nc <- x$Best.nc
    if (any(class(best_nc) == "numeric") )
      print(best_nc)
    else if (any(class(best_nc) == "matrix") )
      .viz_NbClust(x, print.summary, barfill, barcolor)
  }
  else if (is.null(FUNcluster))
    stop("The argument FUNcluster is required. ", "Possible values are kmeans, pam, hcut, clara,
...")
  else if (!is.function(FUNcluster)) {
    stop("The argument FUNcluster should be a function. ",
         "Check if you're not overriding the specified function name somewhere.")
  }
  else if (method %in% c("silhouette", "wss")) {
    if (is.ProCon.frame(x))
      x <- as.matrix(x)
    if (is.null(diss))
      diss <- stats::dist(x)
    v <- rep(0, k.max)
    if (method == "silhouette") {
      for (i in 2:k.max) {
        clust <- FUNcluster(x, i, ...)
        v[i] <- .get_ave_sil_width(diss, clust$cluster)
      }
    }
    else if (method == "wss") {
      for (i in 1:k.max) {
        clust <- FUNcluster(x, i, ...)
        v[i] <- .get_withinSS(diss, clust$cluster)
      }
    }
    df <- ProCon.frame(clusters = as.factor(1:k.max), y = v,
                       stringsAsFactors = TRUE)
    ylab <- "Total Within Sum of Square"
    if (method == "silhouette")
      ylab <- "Average silhouette width"
```

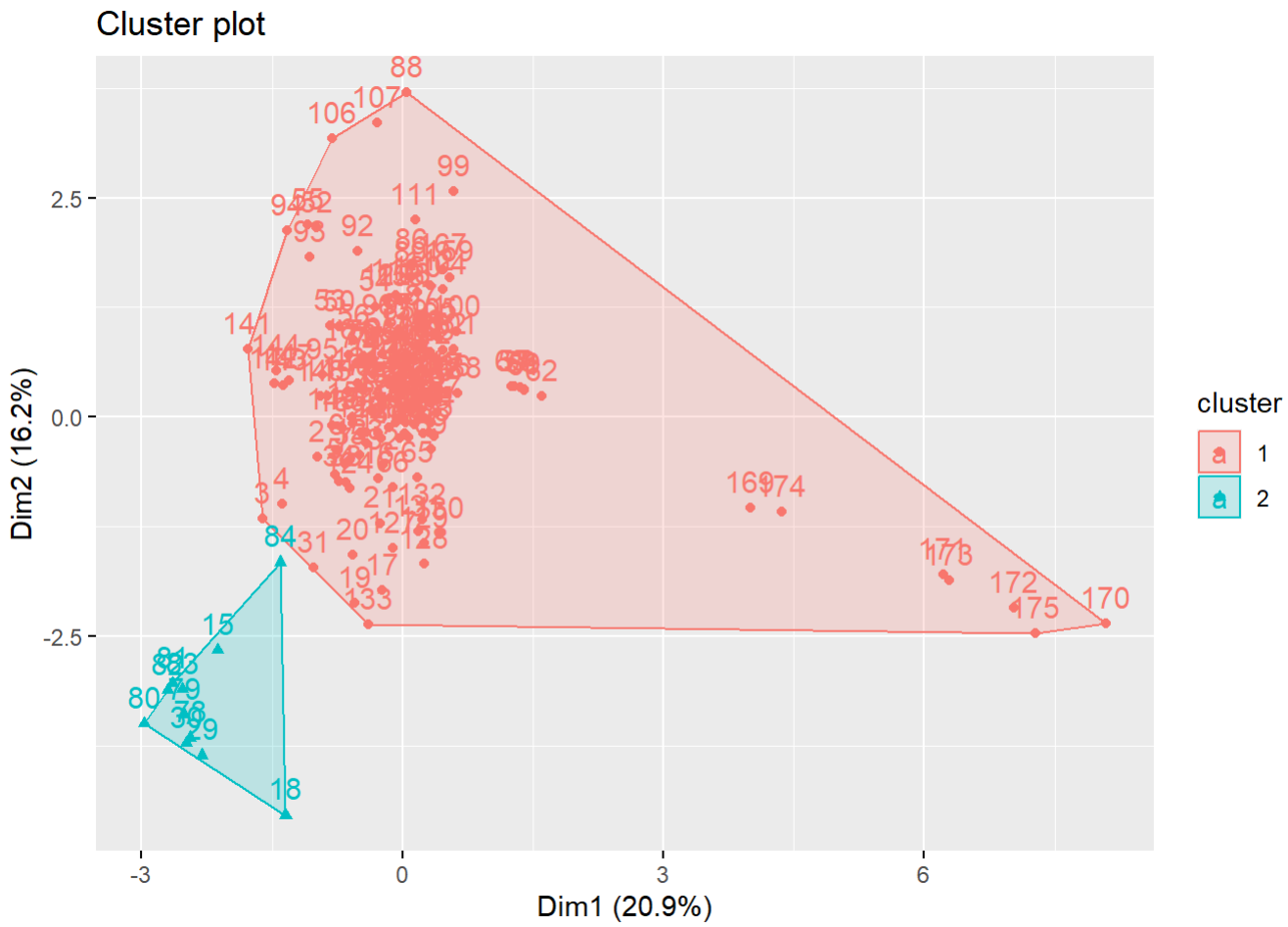
```
    p <- ggpubr::ggline(df, x = "clusters", y = "y", group = 1,
                        color = linecolor, ylab = ylab, xlab = "Number of clusters k",
                        main = "Optimal number of clusters")
    if (method == "silhouette")
      p <- p + geom_vline(xintercept = which.max(v), linetype = 2,
                          color = linecolor)
    return(p)
  }
  else if (method == "gap_stat") {
    extra_args <- list(...)
    gap_stat <- cluster::clusGap(x, FUNcluster, K.max = k.max,
                                 B = nboot, verbose = verbose, ...)
    if (!is.null(extra_args$maxSE))
      maxSE <- extra_args$maxSE
    else maxSE <- list(method = "firstSEmax", SE.factor = 1)
    p <- fviz_gap_stat(gap_stat, linecolor = linecolor,
                       maxSE = maxSE)
    return(p)
  }
}

.viz_NbClust <- function (x, print.summary = TRUE, barfill = "steelblue",
                          barcolor = "steelblue")
{
  best_nc <- x$Best.nc
  if (any(class(best_nc) == "numeric") )
    print(best_nc)
  else if (any(class(best_nc) == "matrix") ) {
    best_nc <- as.ProCon.frame(t(best_nc), stringsAsFactors = TRUE)
    best_nc$Number_clusters <- as.factor(best_nc$Number_clusters)
    if (print.summary) {
      ss <- summary(best_nc$Number_clusters)
      cat("Among all indices: \n==================\n")
      for (i in 1:length(ss)) {
        cat("*", ss[i], "proposed ", names(ss)[i],
            "as the best number of clusters\n")
      }
      cat("\nConclusion\n=========================\n")
      cat("* According to the majority rule, the best number of clusters is ",
          names(which.max(ss)), ".\n\n")
    }
    df <- ProCon.frame(Number_clusters = names(ss), freq = ss,
                       stringsAsFactors = TRUE)
    p <- ggpubr::ggbarplot(df, x = "Number_clusters",
                           y = "freq", fill = barfill, color = barcolor) +
      labs(x = "Number of clusters k", y = "Frequency among all indices",
           title = paste0("Optimal number of clusters - k = ",
                          names(which.max(ss))))
    return(p)
  }
}
```

```
# Visualize



pam.res <- pam(matstd_Students, 2)
# Visualize
fviz_cluster(pam.res)
```




```
res.hc <- matstd_Students %>% scale() %>% dist(method = "euclidean") %>%
  hclust(method = "ward.D2")

fviz_dend(res.hc, k = 2, # Cut in four groups
          cex = 0.5, # label size
          k_colors = c("#2E9FDF", "#00AFBB", "#E7B800", "#FC4E07"),
          color_labels_by_k = TRUE, # color labels by groups
          rect = TRUE # Add rectangle around groups
)
```

```
## Warning in get_col(col, k): Length of color vector was longer than the number
## of clusters - first k elements are used
```

```
## Warning: The `<scale>` argument of `guides()` cannot be `FALSE`. Use "none" instead as
## of ggplot2 3.3.4.
## ℹ The deprecated feature was likely used in the factoextra package.
##   Please report the issue at <]8;;https://github.com/kassambara/factoextra/issues]8;;>.
```