

Survey Fundamentals

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Contents

1. Introduction	3
2. Communication	6
3. Course Quality	11
4. University Environment	15
5. Teaching Experience	19
6. Overall Question	22
7. Collaborative learning event.....	25
8. Conclusion.....	26
Appendix A	28
Appendix B	29
Bibliography	30

1. Introduction

This semester (Spring 2021), we are doing a survey that aims to assess student perceptions of teaching quality at Oxford Brookes University, named "Student self-completion survey of teaching quality."

The pilot survey will be distributed to a small group of students. The data was collected from a simple random sample of students at Oxford Brookes University, the mix of students in the sample accurately reflects the population in gender, field of study, and age. After modifying the pilot, based on its reception, a final survey will be distributed to a larger sample of students from the population of Oxford Brookes. The population is ecologically valid (Gouvier, Barker, & Musso, 2014) as the research pertains to Brookes University. In this report, we will do some analysis of the pilot survey to have an overview.

The sample size was set at a minimum of 30 (here it is 34 responses) to ensure a margin of error no greater than 20% (Sitanshu Sekhar Kar, Jan - Mar 2013). There are 30 questions, which the last three questions about collaborative learning events are check box and yes/no. A more detailed description of the data can be found in Appendix A.

The first 27 questions are evaluated by Likert scale:

- Leave it blank if the question is not applicable
- Select 1 if strongly disagree
- Select 2 if somewhat disagree

- Select 3 if neither agree/disagree
- Select 4 if somewhat agree
- Select 5 if strongly agree

Strongly agree and somewhat agree are known as positive responses. Strongly disagree and somewhat disagree are known as negative responses. Blank and neither agree/disagree are known as neutral responses.

The ordinal data meets all of the assumptions of the parametric test. These are:

1. The sampling distribution (not necessarily the data itself) is normally distributed; this will be true if:
 - Sample size (n) is greater than 30, or
 - $n < 30$, and the data appear to be normally distributed on inspection.
2. There are at least five levels to the ordinal scale.
3. There are no extreme scores - and it is essentially impossible to have extreme scores on a Likert scale since options are limited.
4. The variance of the two samples (or more) being compared is approximately equal. It is not an issue because $n > 30$.

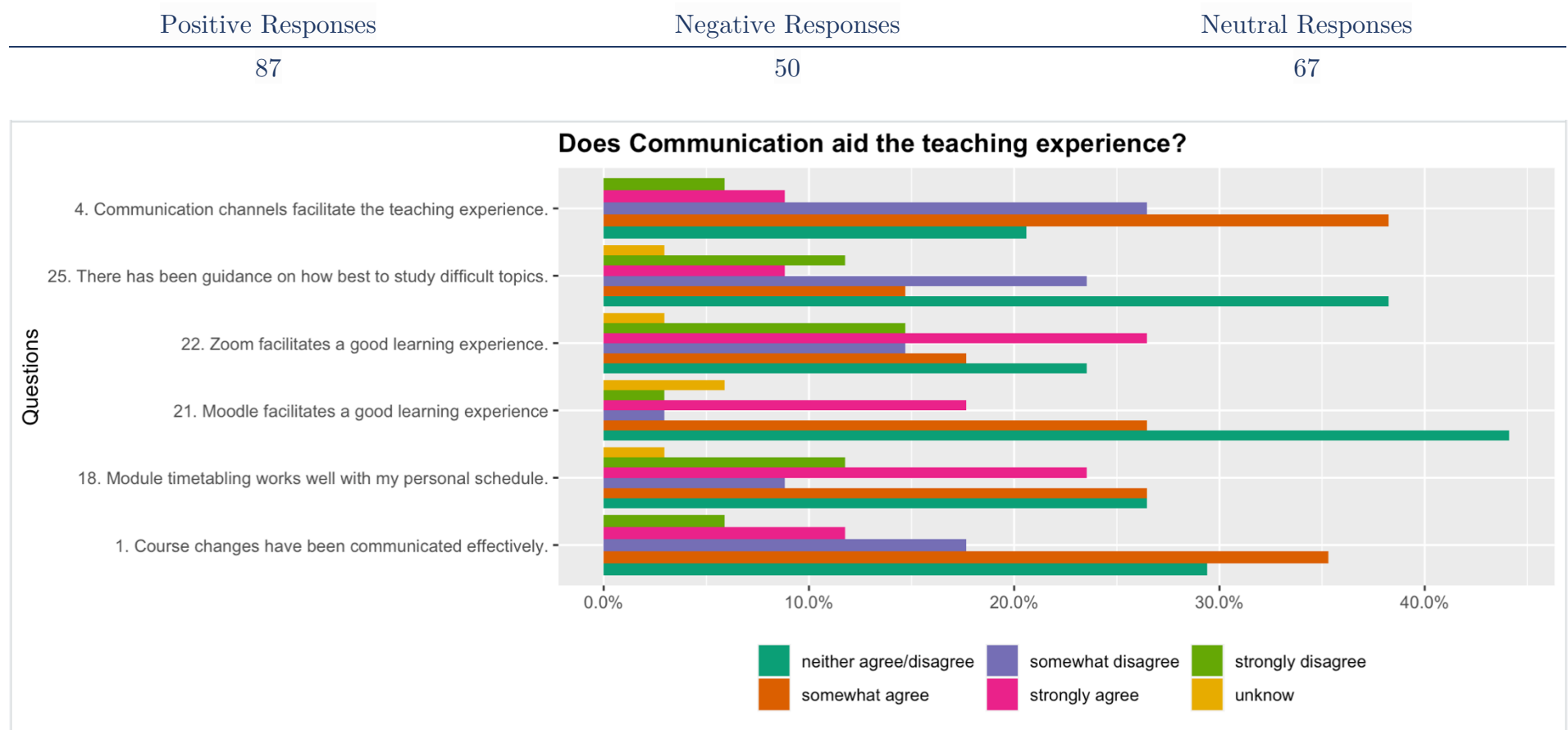
Hence, we can analyze the data using parametric tests, such as the t-test or an ANOVA (Willett, n.d.). In ANOVA, we assumed all the blank responses are equal to the mean of other responses.

In this report, the visualizations will answer followed questions:

- Does Communication aid the teaching experience?
- Does the Course Quality aid the teaching experience?
- Does the University Environment aid the teaching experience?
- Does Teaching Experience match expectations?

And performing multiple linear regression will help us answer more detail about which factors contribute to the Communication, Course Quality, University Environment, Teaching Experience and Overall question about the course satisfaction.

2. Communication



The positive responses are more than negative responses, which shows a good evaluation of Communication. The conclusion question for the Communication topic is question 4. Communication channels facilitate the teaching experience. Let check ANOVA to see whether the answers to other questions affect question 4.

```
# Summary
```

```
summary(comm.model)
```

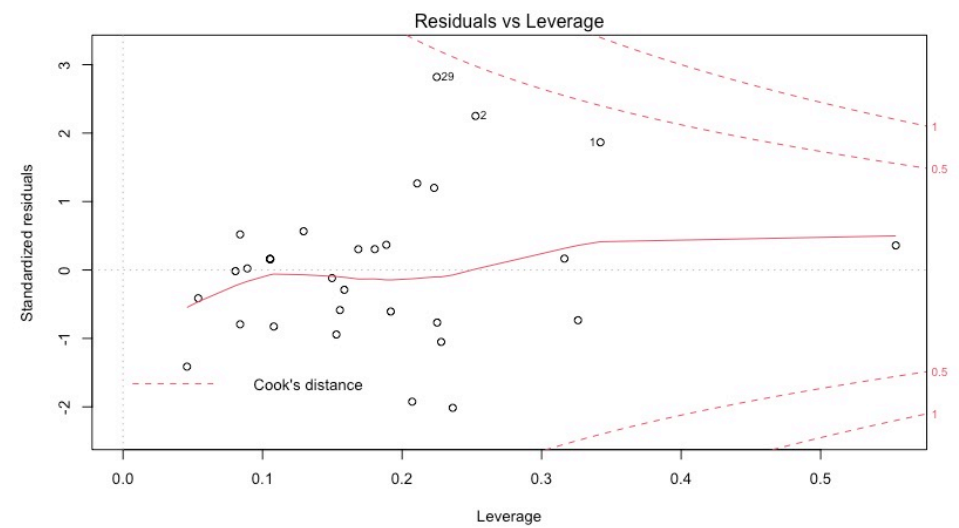
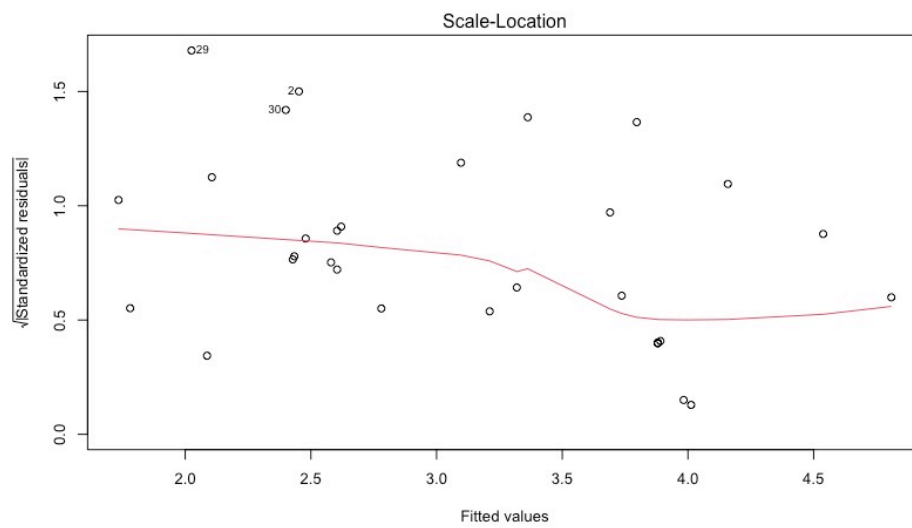
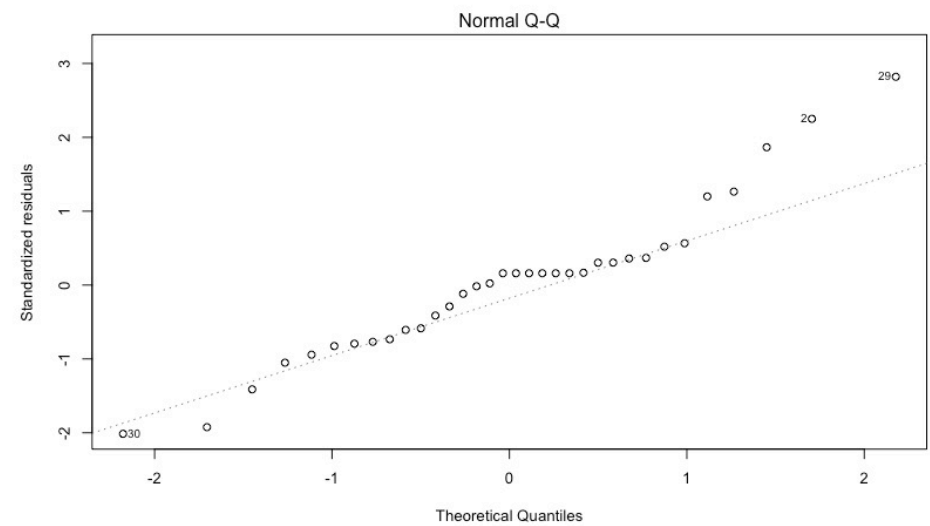
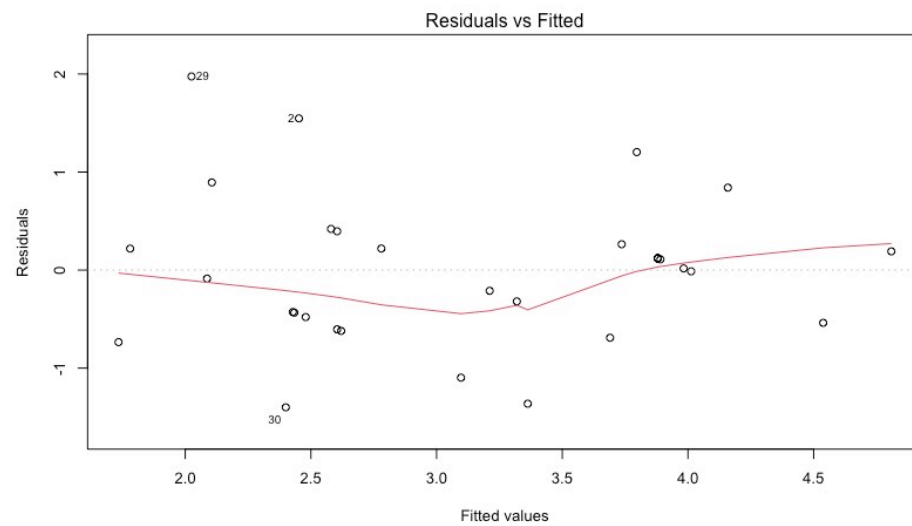
```
##
## Call:
## lm(formula = Q4 ~ Q1 + Q18 + Q21 + Q22 + Q25, data = comm)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.4000 -0.4679  0.1149  0.2197  1.9751
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.35061    0.79922   0.439  0.66425
## Q1             0.33845    0.15772   2.146  0.04070 *
## Q18            -0.08381    0.13829  -0.606  0.54936
## Q21             0.02976    0.17162   0.173  0.86359
## Q22             0.22212    0.11535   1.926  0.06436 .
## Q25             0.40900    0.14607   2.800  0.00915 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7955 on 28 degrees of freedom
## Multiple R-squared:  0.5672, Adjusted R-squared:  0.49
## F-statistic: 7.34 on 5 and 28 DF, p-value: 0.0001667
```

On F-statistic, the probability is 0.0001667 that the model is insignificant. However, the model explains only 49% of the variance of y; in other words, the model explains only 49% of the responses of question 4.

The sign of the median indicates the skew's direction, and the magnitude of the median indicates the extent (Long & Teetor, 2019). In this case, the median is positive, which suggests some skew to the right. The larger magnitude of 3Q versus 1Q (0.2197 versus -0.4679) indicates a slight skew to the right in the data, plus the positive median makes the situation clear-cut to the right.

The p-values of questions 25 and 1 are significant, we can conclude that the communication channels facilitate the teaching experience mostly by the guidance on how the best to study the difficult topics and how course changes are communicated effectively. In other words, how good is the guidance of complex topics and course changed, significantly impacting the teaching experience.

We plot the diagnostic plot of the residuals:



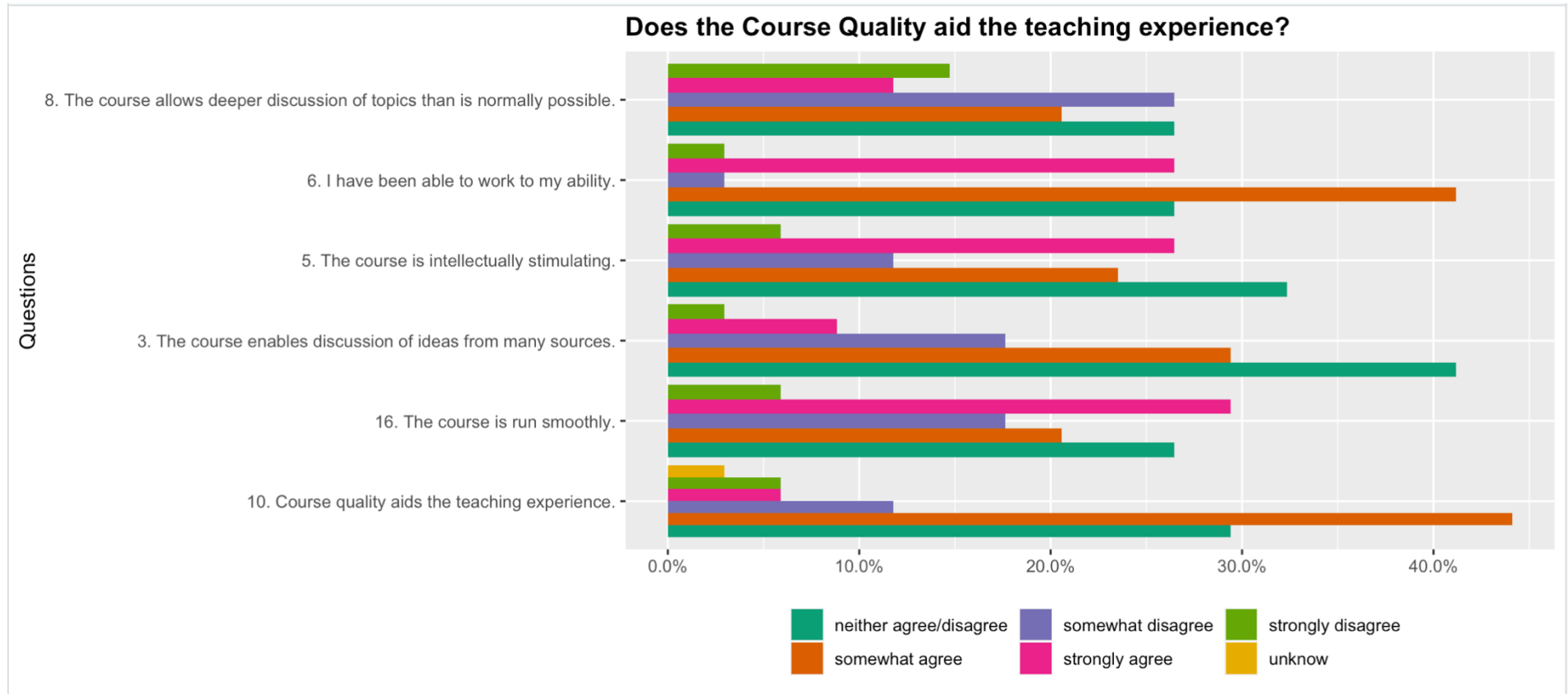
These plots allow us to check whether the deviation from the group means (the residuals) are likely to have been drawn from a normal distribution. This does not look great. The points in the Residuals vs Fitted plot are randomly scattered with no particular pattern. However, in Normal Q-Q, the points deviate from the line systematically, so it looks like the normality assumption may not be satisfied. The right tail is above the line, telling us that the tails of the residual distribution do not extend out as far as they should – the distribution is ‘squashed’ toward its middle (Dylan Z. Childs, 2021). In both the Scale–Location plot and the Residuals vs Leverage plots, the points are in a group and not too far from the centre.

There are some points that stick out in every plot, warning the points could be an outlier. The outlierTest identifies the model’s most outlying observation. In here, it is the 29th responder. If all the tests identify the 29th responder, we properly need to remove observation number 29 to preserve the comprehensiveness of statistical significance.

```
# Check outlier  
outlierTest(comm.model)
```

```
## No Studentized residuals with Bonferroni p < 0.05  
## Largest |rstudent|:  
##      rstudent unadjusted p-value Bonferroni p  
## 29 3.272735      0.0029147      0.099099
```

3. Course Quality



Positive Responses

Negative Responses

Neutral Responses

98

43

63

There are many more positive responses than negative responses, indicating a good quality of the courses. In general, half students (17 by 34 responses) agreed that the course quality aids the teaching experience.

The conclusion question for Course Quality is question 10. Course Quality aids the teaching experience. However, the p-value in F statistic is bigger than 0.05. This model does not give any meaning, probably the questions are not designed to determine course quality.

```
# Summary
summary(course.model)

##
## Call:
## lm(formula = Q10 ~ Q3 + Q5 + Q6 + Q8 + Q16, data = course)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.4425 -0.2573  0.1578  0.3733  1.4226
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.63827    1.31011   1.250   0.221
## Q3             0.09805    0.22276   0.440   0.663
## Q5             0.29044    0.18407   1.578   0.126
## Q6            -0.16938    0.23640  -0.717   0.480
## Q8             0.05597    0.15092   0.371   0.714
## Q16           0.24116    0.16057   1.502   0.144
##
## Residual standard error: 0.8954 on 28 degrees of freedom
## Multiple R-squared:  0.2835, Adjusted R-squared:  0.1555
## F-statistic: 2.216 on 5 and 28 DF,  p-value: 0.08078
```

If we go further to select the best regression variables:

```
# Selecting the best regression variables
reduced.model <- step(course.model, direction = "backward")

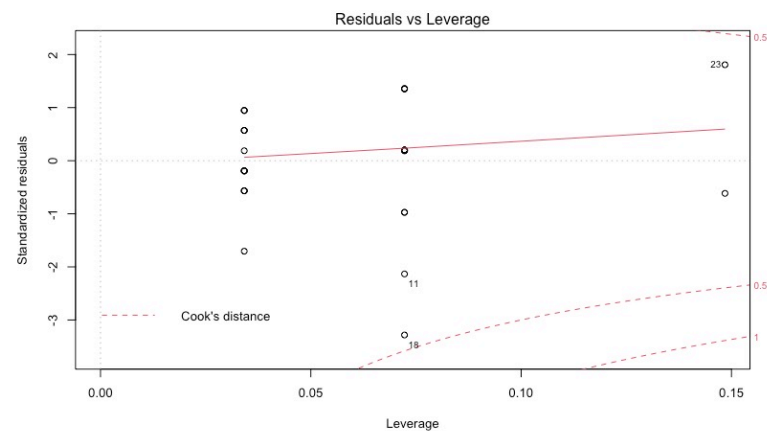
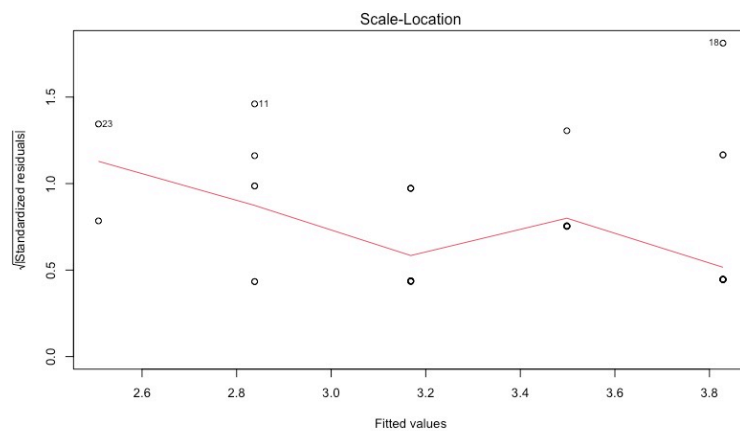
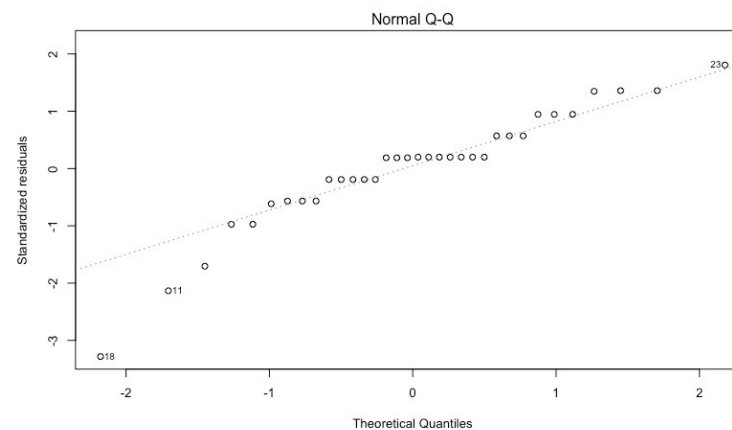
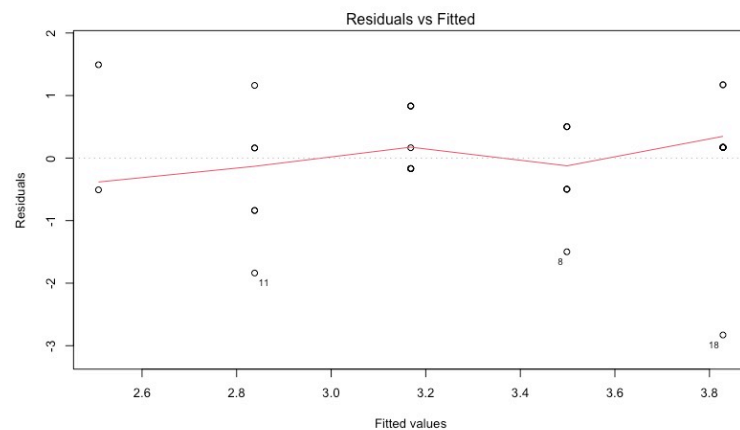
# Summary
summary(reduced.model)

##
## Call:
## lm(formula = Q10 ~ Q16, data = course)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.8286 -0.4159  0.1683  0.5016  1.4921
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.1778     0.4586   4.749 4.11e-05 ***
## Q16             0.3302     0.1235   2.674  0.0117 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8946 on 32 degrees of freedom
## Multiple R-squared:  0.1826, Adjusted R-squared:  0.1571
## F-statistic:  7.15 on 1 and 32 DF,  p-value: 0.0117
```

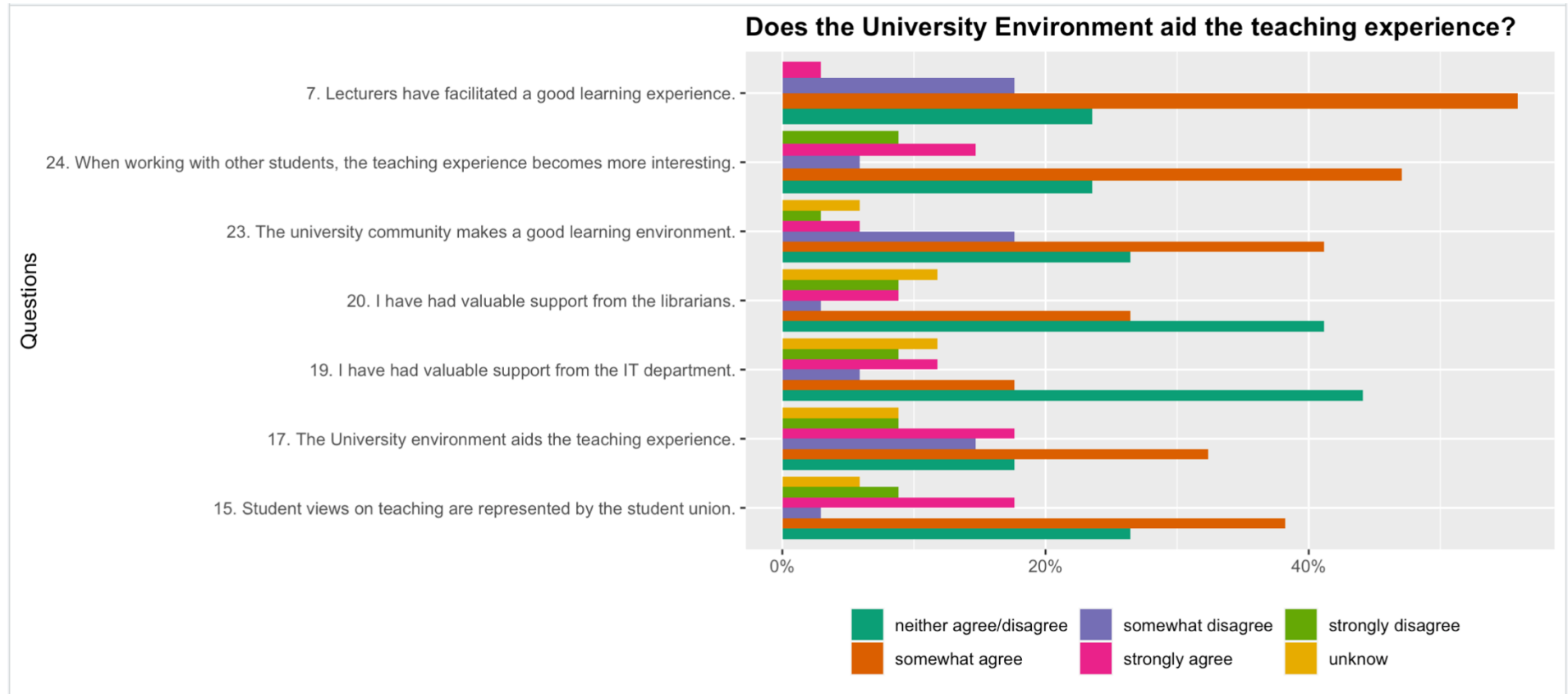
The p-value in F statistic now is small enough to check the model. However, this model can explain only 15.71%. The course quality responses depend on how smooth the course run. Diagnosing the linear regression, these plots look good, except for some outliers, the normality assumption may be satisfied. The outlier is responder number 18.

```
# Check outlier
outlierTest(reduced.model)
```

```
##      rstudent unadjusted p-value Bonferroni p
## 18 -3.967207      0.00040014      0.013605
```



4. University Environment



Positive Responses

Negative Responses

Neutral Responses

105

39

84

There are pretty many unknown responses, which makes sense for this online academic year. Very few negatives responses are showing that the University is giving a friendly environment for students.

Let check the ANOVA for question 17. The University environment aids the teaching experience.

```
# Summary
summary(envi.model)

##
## Call:
## lm(formula = Q17 ~ Q7 + Q15 + Q19 + Q20 + Q23 + Q24, data = envi)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.11220 -0.41726  0.00422  0.37714  1.96531
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.8766     0.9175  -2.045  0.05068 .
## Q7             0.6474     0.2229   2.904  0.00726 **
## Q15            0.5417     0.1622   3.340  0.00246 **
## Q19           -0.0645     0.1570  -0.411  0.68436
## Q20            0.3489     0.1762   1.980  0.05802 .
## Q23            0.2725     0.1826   1.493  0.14708
## Q24           -0.2068     0.1787  -1.157  0.25727
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8044 on 27 degrees of freedom
## Multiple R-squared:  0.6311, Adjusted R-squared:  0.5491
## F-statistic: 7.699 on 6 and 27 DF,  p-value: 6.9e-05
```

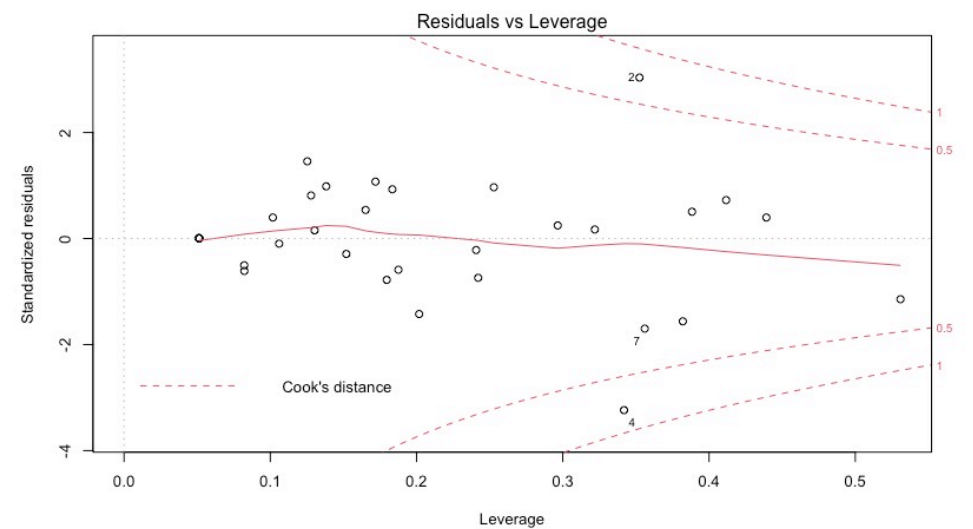
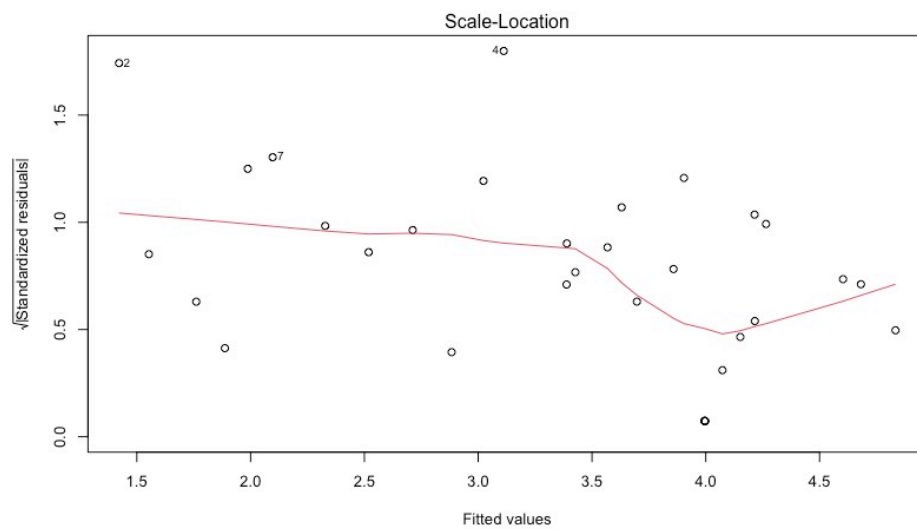
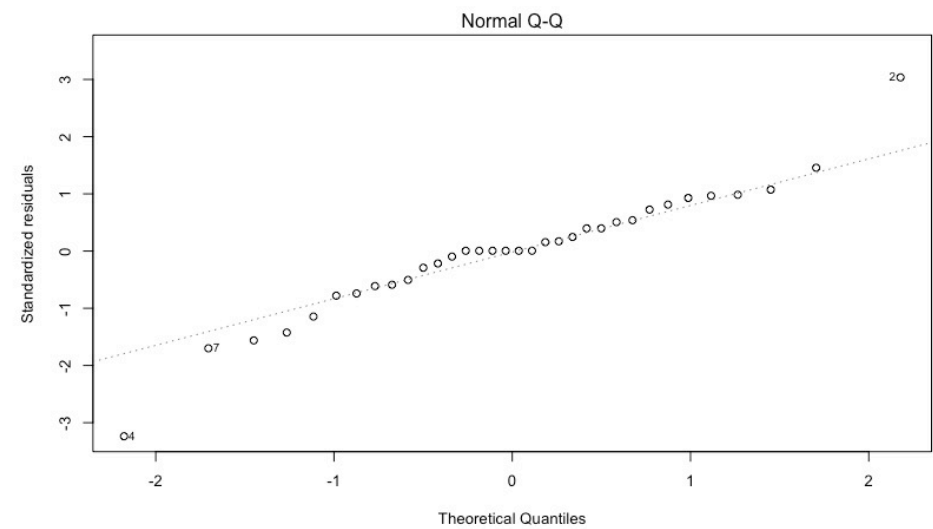
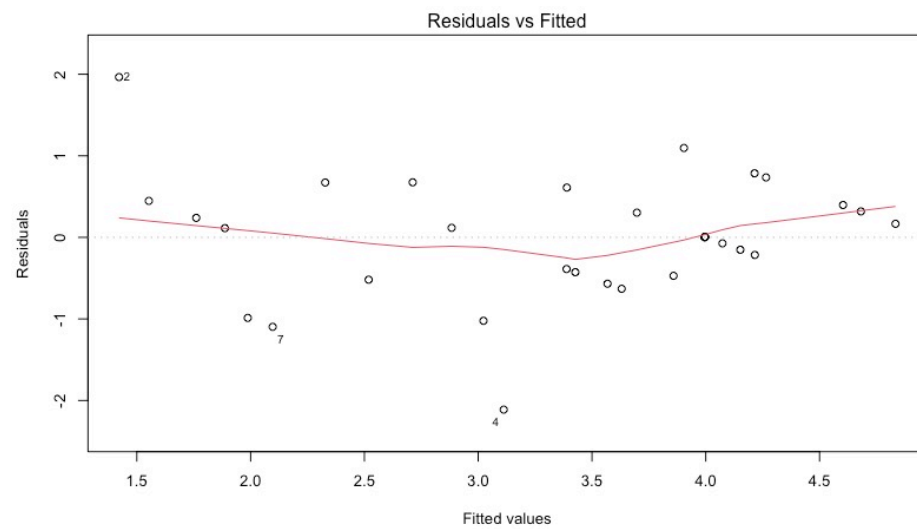

The adjusted R-squared is 0.5491, and the p-value is very small ($6.9e-05$), indicating a good model. P-values are small at questions 7 and 15, which means lecturers and student union have an enormous impact on the university environment.

Most of the answers for questions 19 and 20 are unknown or neither agree/disagree, showing that IT and library support are not crucial since students study online this year.

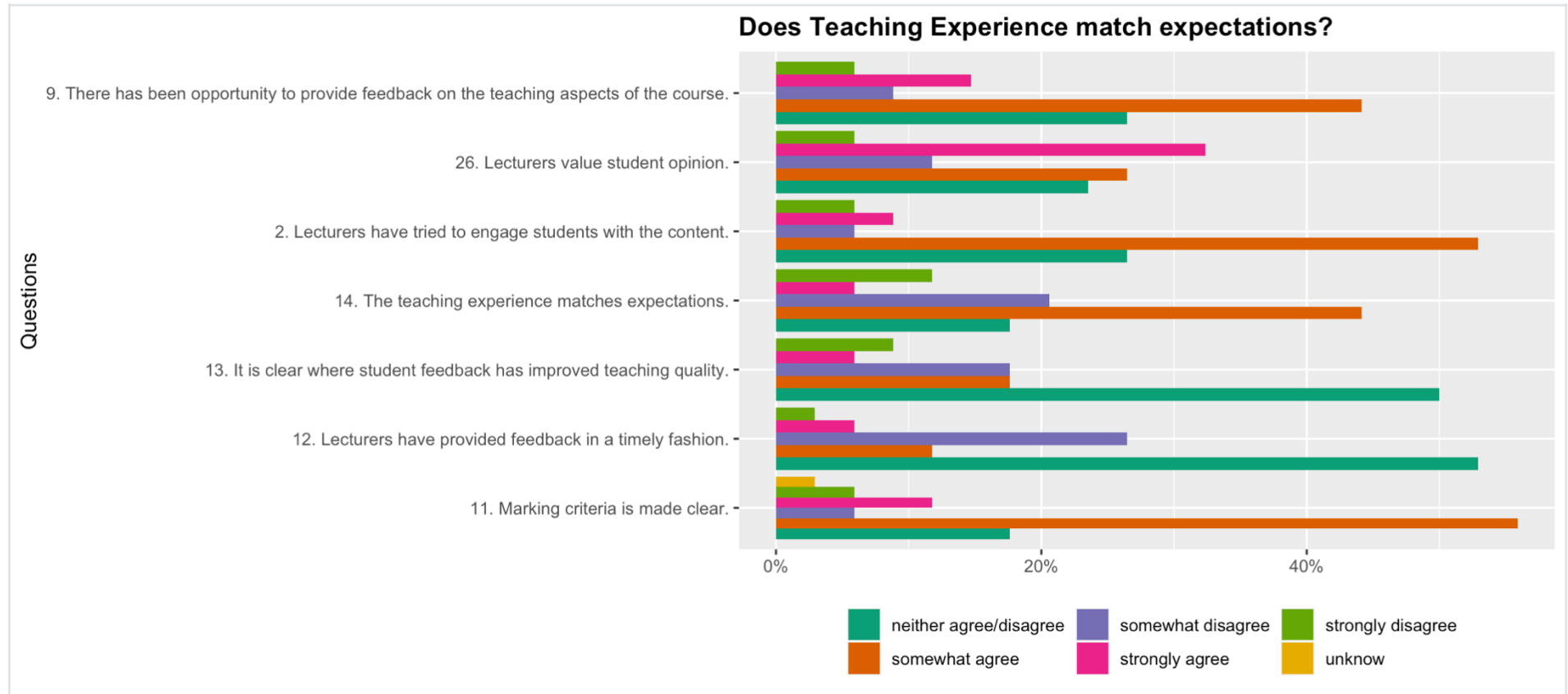
In the Normal Q-Q plot, the points stick around the line, the normality assumption is satisfied. Points number 2 and 4 are outliers.

```
# Check outlier  
outlierTest(envi.model)
```

```
##      rstudent unadjusted p-value Bonferroni p  
## 4 -4.060466      0.00039924      0.013574  
## 2  3.671578      0.00109420      0.037204
```



5. Teaching Experience



Positive Responses

Negative Responses

Neutral Responses

105

49

74

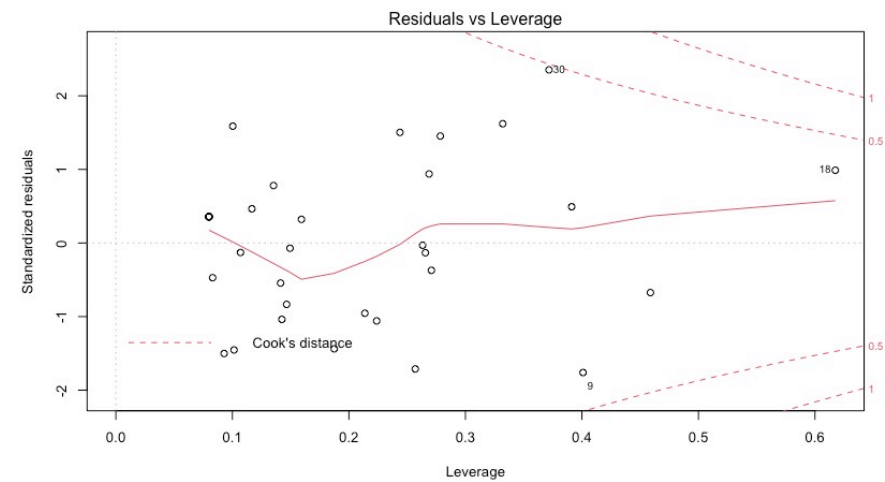
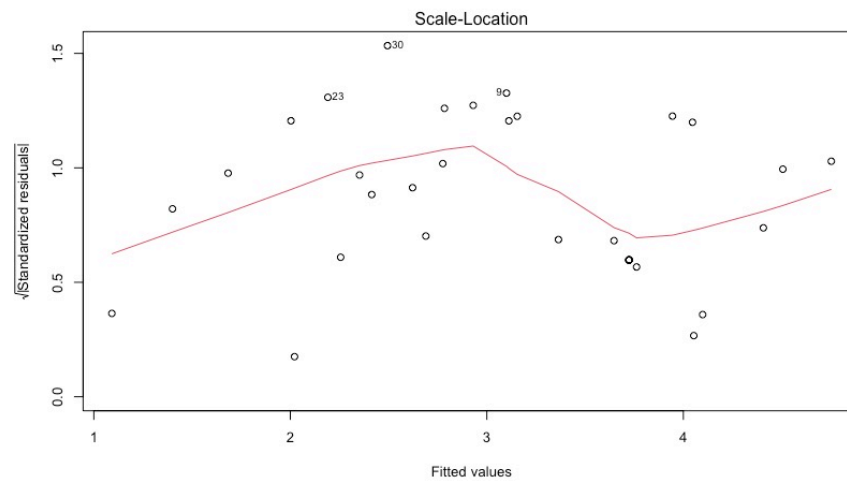
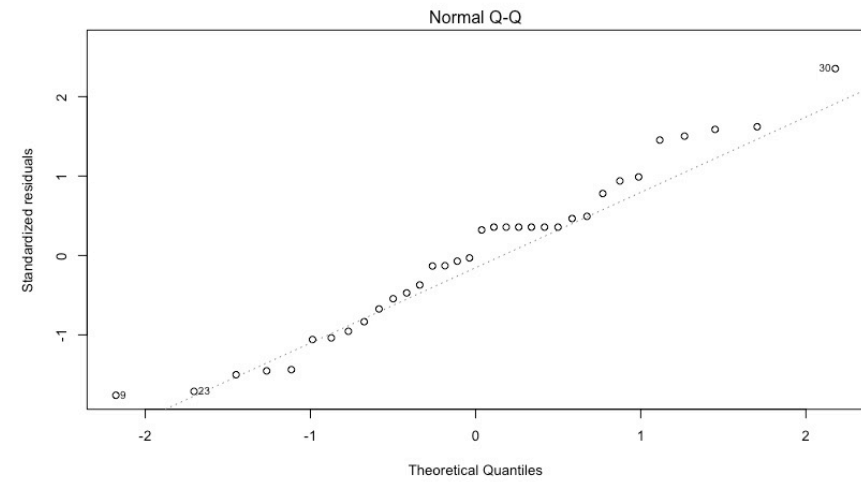
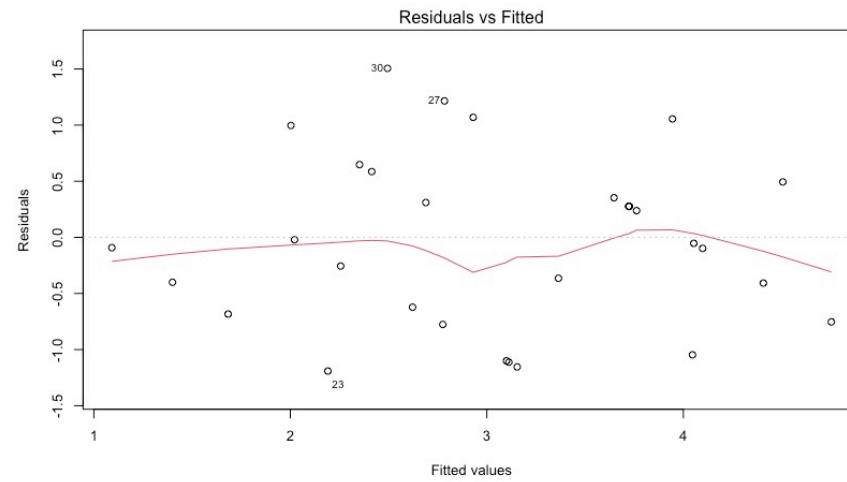
```

# Summary
summary(teaching.model)

##
## Call:
## lm(formula = Q14 ~ Q2 + Q9 + Q11 + Q12 + Q13 + Q26, data = teaching)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.16422 -0.62141  0.02003  0.31351  1.63006
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.219927   0.908419  -1.343 0.190482
## Q2           0.007035   0.224005   0.031 0.975178
## Q9           0.061576   0.162659   0.379 0.707974
## Q11          0.286743   0.177055   1.620 0.116960
## Q12         -0.010912   0.183245  -0.060 0.952955
## Q13          0.623816   0.167075   3.734 0.000891 ***
## Q26          0.339928   0.163602   2.078 0.047366 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8102 on 27 degrees of freedom
## Multiple R-squared:  0.6107, Adjusted R-squared:  0.5242
## F-statistic:  7.06 on 6 and 27 DF,  p-value: 0.0001346

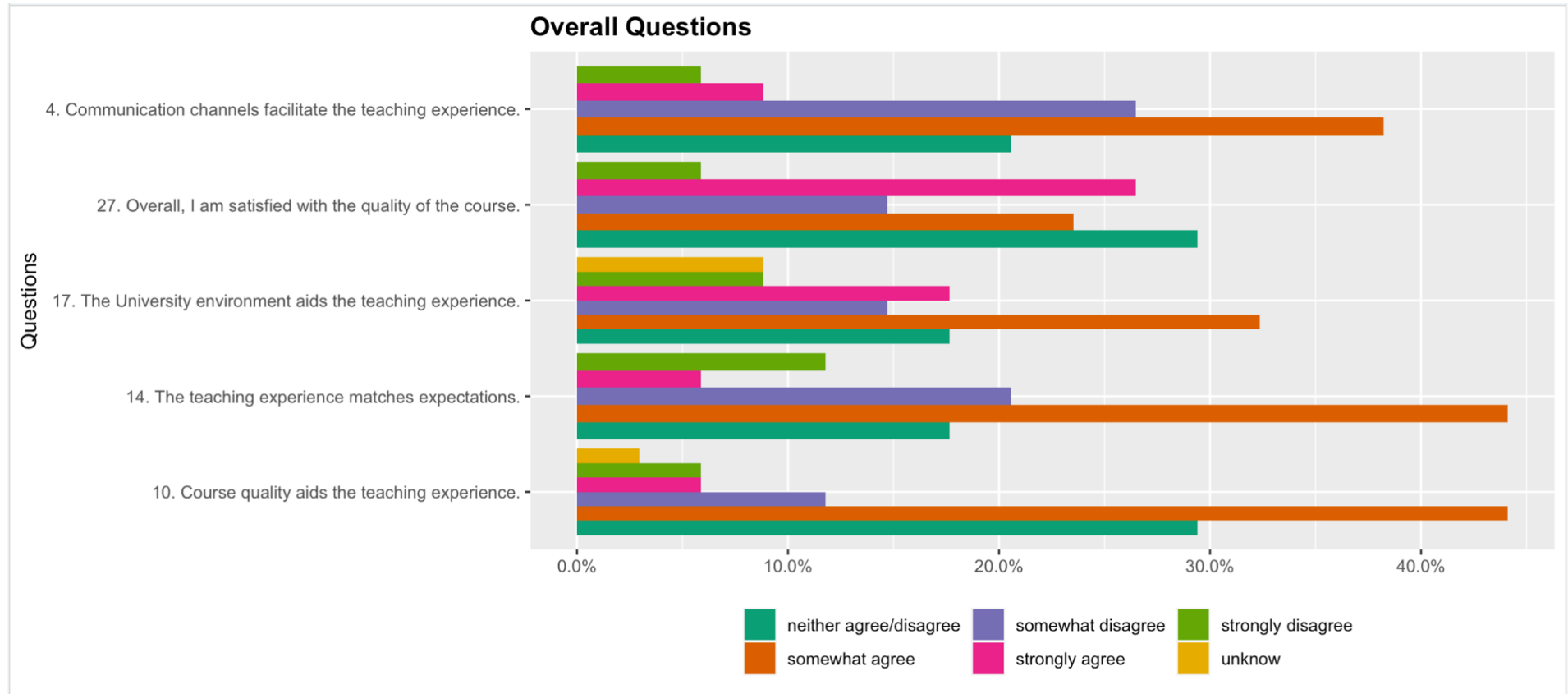
```

The model only explains 52.42%, with a p-value in F-statistic is 0.0001346. The p-values in coefficients show a minimal number at question 13, and a significant number at question 26 is about student opinion. It shows that to improve the teaching quality, teachers and the University need to put more effort into listening to student opinions.



The normality assumption may be satisfied with outliers at numbers 30 and 9.

6. Overall Question



Positive Responses

Negative Responses

Neutral Responses

84

43

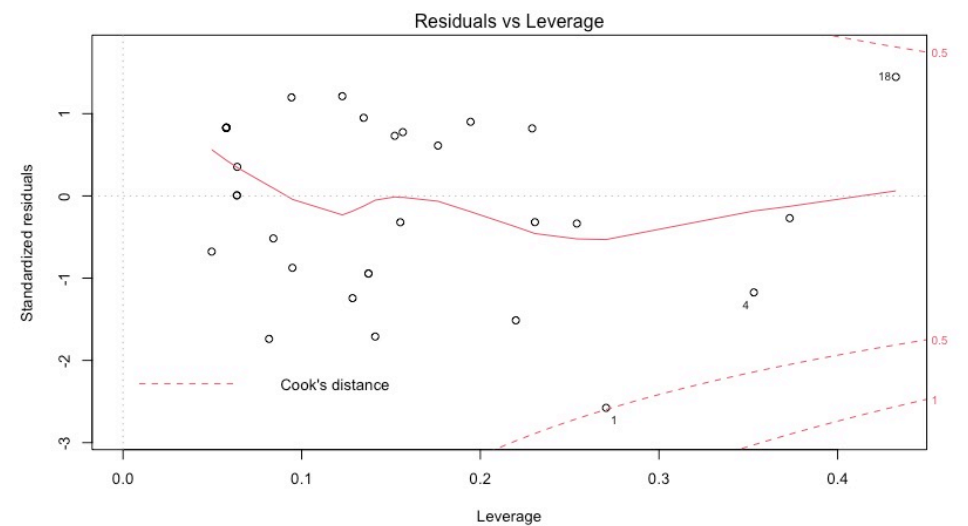
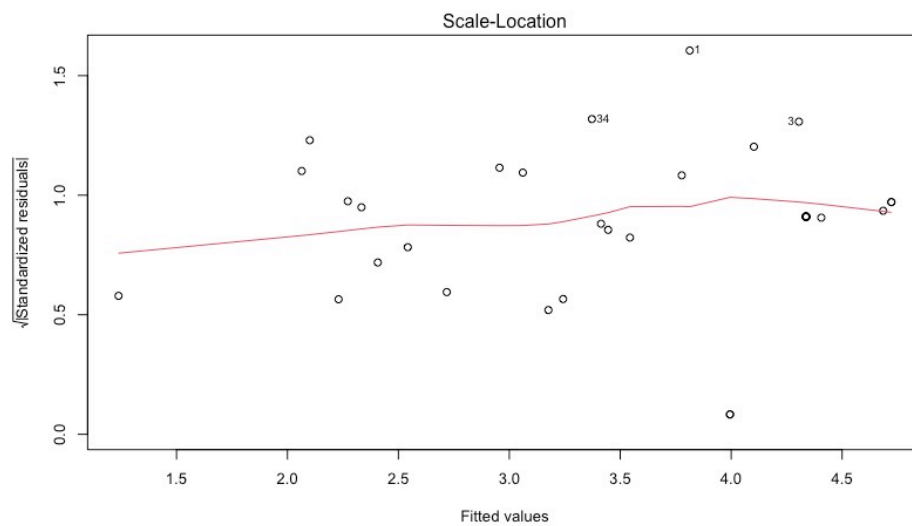
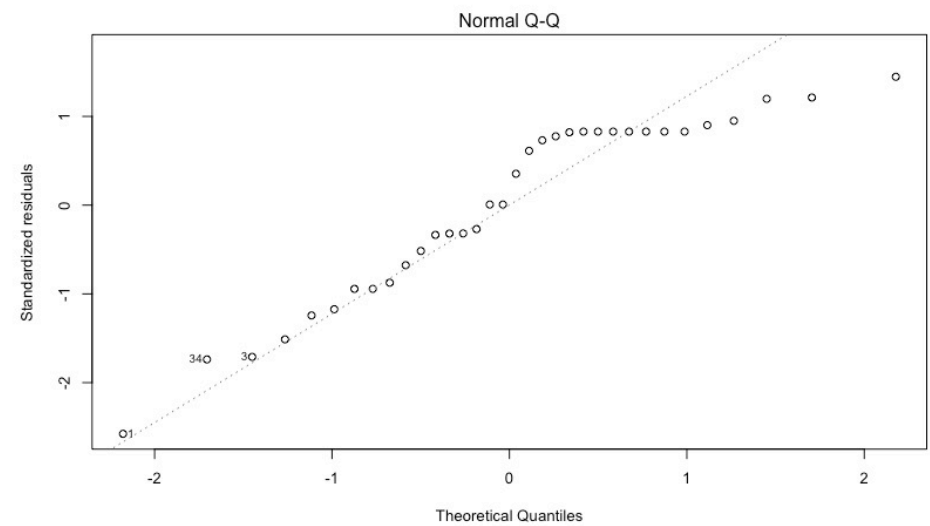
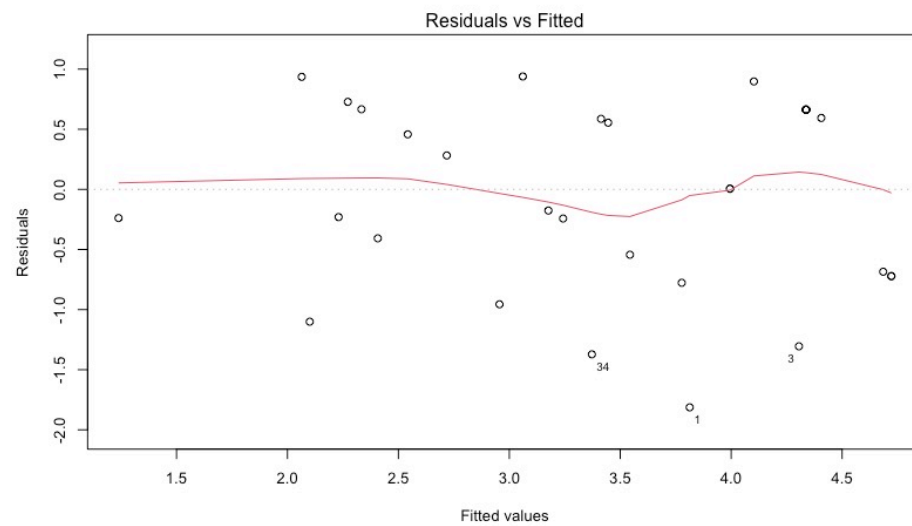
43

The overall question about the quality of the course (27) has good responses, 50% of positive responses and only about 20% of negative responses.

```
# Summary
summary(overall.model)

##
## Call:
## lm(formula = Q27 ~ Q4 + Q10 + Q14 + Q17, data = overall)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.8130 -0.6497  0.1437  0.6626  0.9391
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.20884    0.64941  -0.322  0.75007
## Q4          -0.03678    0.16521  -0.223  0.82539
## Q10           0.34288    0.15587   2.200  0.03594 *
## Q14           0.48278    0.15363   3.142  0.00384 **
## Q17           0.34767    0.13584   2.559  0.01596 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8238 on 29 degrees of freedom
## Multiple R-squared:  0.5942, Adjusted R-squared:  0.5383
## F-statistic: 10.62 on 4 and 29 DF,  p-value: 2.009e-05
```

p-value is small (2.009e-05), the model explains 53.83%. The p-values in coefficients show that teaching experience is the most contributor to course satisfaction, followed by course quality and the university environment.



In Normal Q-Q, outliers are points at the beginning of the line, distance from the bulk of the observations. The points form a curve that deviates markedly from a straight line showing the data may be non-normal. However, look at other plots, all the points stick around the center. We can conclude that the normality assumption may be satisfied. The outlier is point number 01.

```
# Check outlier
outlierTest(overall.model)

## No Studentized residuals with Bonferroni p < 0.05
## Largest |rstudent|:
##      rstudent unadjusted p-value Bonferroni p
## 1 -2.883256      0.0074825      0.2544
```

7. Collaborative learning event

<i>Have you participated in a collaborative learning event before starting at Oxford Brookes?</i>	Yes	5
	No	13
	Not sure/Do not remember	16
<hr/>		
<i>Would you be interested in participating in a collaborative learning event?</i>	Yes	12
	No	5
	I need more information	17

There are very few students who have participated in a collaborative learning event, but they are open to the events and looking for more information.

What should a collaborative learning event involve that would interest you?

Socializing opportunities	23
Exposure to new knowledge	18
Prizes	8
Opportunity to promote/publish my work	11

Most students are willing to join a collaborative learning event for socializing opportunities and exposure to new knowledge.

8. Conclusion

Three elements that help to improve student satisfaction are Teaching Experience, Course Quality, and the University Environment.

The key is:

- Considering the student feedback and opinions to improve teaching quality
- The student views on teaching should be represented by the student union
- Lecturers facilitate a good learning experience
- The course is run smoothly

50% of students are satisfied with the course, only about 20% are not happy. Most of the students agreed that the course engaged them to work on their ability. Details can be found in Appendix B. There are some positive responses about:

- (2) Lecturers: 61.76% of students agreed that lecturers have tried to engage students with the content
- (11) Marking criteria: 67.65% agreed that marking is criteria clearly
- (9) Opportunity to provide feedback during the academic year: 58.82% agreed

Some questions that have low response scores (average lower than 3) are questions 8, 12, 13, 19, 20, 25, which should be improved. Most of it about students should receive clear indications of what they need to do to improve:

- (25) Guiding to study difficult topics: 23.53% agree
- (8) A deeper discussion of topics: 58.82% disagree
- (12) Providing feedback on time: only 17.65% agree

Appendix A

Question	Responses
1. Course changes have been communicated effectively.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
2. Lecturers have tried to engage students with the content.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
3. The course enables discussion of ideas from many sources.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
4. Communication channels facilitate the teaching experience.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
5. The course is intellectually stimulating.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
6. I have been able to work to my ability.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
7. Lecturers have facilitated a good learning experience.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
8. The course allows deeper discussion of topics than is normally possible.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
9. There has been opportunity to provide feedback on the teaching aspects of the course	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
10. Course quality aids the teaching experience.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
11. Marking criteria is made clear.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
12. Lecturers have provided feedback in a timely fashion.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
13. It is clear where student feedback has improved teaching quality.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
14. The teaching experience matches expectations.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
15. Student views on teaching are represented by the student union.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
16. The course is run smoothly.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
17. The University environment aids the teaching experience.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
18. Module timetabling work well with my schedule.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
19. I have had valuable support from the IT department.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
20. I have had valuable support from the librarians.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
21. Moodle facilitates a good learning experience	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
22. Zoom facilitates a good learning experience.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
23. The university community makes a good learning environment.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
24. Working with other students, the teaching experience becomes more interesting.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
25. There has been guidance on how best to study difficult topics.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
26. Lecturers value student opinion.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
27. Overall, I am satisfied with the quality of the course.	0 = No Response; 1 = strongly disagree; 2 = somewhat disagree; 3 = neither agree/disagree; 4 somewhat agree; 5 = strongly agree
28. Have you participated in a collaborative learning event before starting at the Uni?	Yes; No; Not sure/Do not remember
29. Would you be interested in participating in a collaborative learning event?	Yes; No; I need more information about these events
30. What should a collaborative learning event involve, that would interest you?	Socializing opportunities; Exposure to new knowledge; Prizes; Opportunity to promote/publish my work; Other: ...

Appendix B

Questions	Agree	Disagree	Difference
Course changes have been communicated effectively. 1	47.06	23.53	23.53
Lecturers have tried to engage students with the content. 2	61.76	11.76	50
The course enables discussion of ideas from many sources. 3	38.24	20.59	17.65
Communication channels facilitate the teaching experience. 4	47.06	32.35	14.71
The course is intellectually stimulating. 5	50.00	17.65	32.35
I have been able to work to my ability. 6	67.65	5.88	61.77
<i>Lecturers have facilitated a good learning experience. 7</i>	58.82	44.12	14.7
The course allows deeper discussion of topics than is normally possible. 8	32.35	58.82	-26.47
There has been opportunity to provide feedback on the teaching aspects of the course. 9	58.82	5.88	52.94
Course quality aids the teaching experience. 10	50.00	17.65	32.35
Marking criteria is made clear. 11	67.65	11.76	55.89
Lecturers have provided feedback in a timely fashion. 12	17.65	29.41	-11.76
<i>It is clear where student feedback has improved teaching quality. 13</i>	23.53	26.47	-2.94
The teaching experience matches expectations. 14	50.00	32.35	17.65
<i>Student views on teaching are represented by the student union. 15</i>	55.88	11.76	44.12
<i>The course is run smoothly. 16</i>	50.00	23.53	26.47
The University environment aids the teaching experience. 17	50.00	23.53	26.47
Module timetabling work well with my schedule. 18	50.00	20.59	29.41
I have had valuable support from the IT department. 19	29.41	14.71	14.7
I have had valuable support from the librarians. 20	35.29	11.76	23.53
Moodle facilitates a good learning experience. 21	44.12	5.88	38.24
Zoom facilitates a good learning experience. 22	44.12	29.41	14.71
The university community makes a good learning environment. 23	47.06	20.59	26.47
Working with other students, the teaching experience becomes more interesting. 24	61.76	14.71	47.05
There has been guidance on how best to study difficult topics. 25	23.53	35.29	-11.76
<i>Lecturers value student opinion. 26</i>	58.82	17.65	41.17
Overall, I am satisfied with the quality of the course. 27	50.00	20.59	29.41

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