2017

2016 cluster report on the use of netbooks and student achievement

Jingyi Zhong and Louise Starkey

Victoria University of Wellington

8/16/2017

Contents

Acknowledgements.

We would like to acknowledge the people and groups that helped this report to be completed. Michele Whiting facilitated the collecting and collation of the data from the schools. It would not have been possible to do this work without her perseverance and problem-solving skills. Madeleine White helped with the data collation and statistical advice. Associate Professor Ivy Liu provided advice on statistical methodology. The staff in each of the schools who collated and made the results available are much appreciated. Also, Victoria University of Wellington Education and FHSS research committee provided funding for the research.

Introduction

The aim of this research project is to evaluate how the use of netbooks is making a difference (or not) on students' progress in their reading, writing and mathematics. In 2014 a voluntary netbook purchase scheme was established by a local trust with the aim of providing affordable access to netbooks for students to use at home and school. It was one of a number of initiatives in the area aimed at improving academic outcomes for the students. As part of this research project achievement data was used to compare the current state of achievement between the students who joined the netbook scheme ("netbook users") with those who did not.

Literacy and numeracy achievement data from 2015 and 2016 were collected to enable comparison of student progress. This longitudinal aspect of the research project means that students' progress in these curriculum areas can be measured. In particular, it allows for a comparison of the progress of those students who have dedicated netbooks for learning and those who do not. This will allow for an investigation on whether the two groups diverge in any way in any aspect of literacy and numeracy assessments as they progress through their schooling.

The focus in 2015 was primarily on testing for and investigating any apparent differences in achievement between the group of students who are using netbooks and those who are not. The results of this analysis were published in the first report. In 2016, analysis included a comparison of the users and non-users of netbooks in 2016 and an examination of the progress across years between the two groups of students using propensity score matching and linear regression. It is hoped that the information gathered on the achievement of students will help illustrate how the two groups might differ and highlight any trends that are of importance when considering netbooks for teaching and learning in schools.

Methodology

Ten schools in the cluster participated in this analysis in 2016 and contributed student demographic and end-of-year achievement data for their year 4 to 8 students. This reduced from 12 schools in 2015. Six of the participating schools were part of the netbook leasing scheme. Each of the schools in the analysis were allocated a letter from A to L in the first year of the study and the same letter was applied to the second year. The schools that were part of the netbook scheme and were able to participate in the research both years were schools A,B,C,E,F, and G.

Data collected

Both demographic and achievement data was collected from the schools and collated. Students' national student identifier (NSI), year level, gender, ethnicity and the date their netbook usage in the classroom started was collated and matched to achievement data. The NSI was used to crossmatch data between 2015 and 2016.

Student achievement data were gathered through the use of national literacy and numeracy assessment tools in term 4 2015, or term 3 if later results were not available and in term 3 or 4 in 2016. For students in years 4 to 8, the tools used included the Supplementary Test for Achievement in Reading (STAR), e-asTTle writing and PAT: Mathematics. In all cases where results were available, these were recorded for students and used in subsequent analysis.

Reclassification of e-asTTle curriculum levels

Students that had achieved at level one of the curriculum in e-asTTle tests were labelled as "<2B" in some of the data collected. To maintain consistency, any students who had achieved at level one of the curriculum and whose score remained listed as such was reclassified as "<2B".

Netbook usage information

For both those schools that are currently in partnership with the trust ("netbook schools") as well as in those schools that are not, there is netbook usage to varying degrees. It was therefore necessary to determine how 'netbook usage' would be classified. For the purpose of this research, a student was classified only as a "netbook user" when they were using a netbook for learning in the classroom, and there was a device at home which would allow for home learning. This was almost exclusively determined through identifying those students who were leasing a netbook through the local trust.

A further aspect of netbook usage that needed classification was the extent of netbook usage. This was considered in terms of a length of time. This is because an important factor in the examination of student achievement when comparing between students with netbooks and those without is the length of time that the netbook has been used for learning. To determine how long students with netbooks had been using a device prior to each assessment, the term that each test was administered in each school and the approximate start dates for each netbook user was recorded.

The usage period for each test was defined as the number of complete school terms (0,1,2,3,4,5,6) that had elapsed between the term netbook usage began, and the term in which end-of-year testing in each year was done. In cases where the start date was a date in the holidays, students were reassigned a start date that was the first day of the following term.

For example:

Student A

Started using a netbook in term 3 of 2014

Sat STAR test in term 4 of 2015 – 4 complete terms

Sat PAT: Mathematics test in term 4 of 2015 – 4 complete terms

Sat e-asTTle test in term 3 of 2015 – 3 complete terms

Student B

Started using netbook in term 3 of 2015

Sat all tests in term 4 of 2015 – 0 complete terms

This information about how long a student has been using a netbook for is particularly useful for investigating differences between students using netbooks and those who are not, as well as for potentially investigating differences between students within the netbook cohort.

Student ethnicities

Students' ethnicities were recorded in accordance with the Ministry of Education's Level 1 Ethnic Groups. Only one ethnicity was recorded for each student, with priority rankings used for students who were recorded as identifying with more than one ethnic group.

The two ethnic groups of MELAA (priority ranking 4) and Other (priority ranking 5) were combined for cluster-wide analysis due to the small number of students in each of these groups. As such, five priority ethnicities were recorded: Asian, NZ European, NZ Maori, Other and Pasifika.

Assessment information

What follows is a description of the various assessment tools used by the schools across the cluster to assess literacy and numeracy skills. It also includes an explanation of various considerations made when collecting and interpreting this data.

For each of the assessed curriculum areas, students' scale scores were collected. These scale scores account for differences between versions of tests, and allow for comparison of a student's performance to a nationally representative score distribution. The scale scores also allow for a measure of a student's progress through time, as it is expected that with every additional year of schooling a student's scale score will increase. For this reason, these scores can be used in subsequent years to track progress and identify any accelerated learning that might be occurring.

Supplementary Test of Achievement in Reading (STAR)

Students' achievement in reading in years 4 to 8 has been measured by STAR. STAR questions are broken down to fall within sub-tests that assess different aspects of a student's reading ability. For years 4-6, these are Word Recognition, Sentence Comprehension, Paragraph Comprehension and Vocabulary Knowledge. In year 7-8 testing there are an additional two: Language of Advertising, and Reading of Different Text Types. A student's relative performance in each category is taken as an indication of their command of the three different aspects of reading outlined in *The New Zealand Curriculum Reading and Writing Standards for years 1-8* (Ministry of Education, 2009):

Learning the code of written language
Making meaning of texts
Thinking critically about texts

These categories, or sub-tests, are in and of themselves of varying difficulty. Individual questions also differ in their complexity such that an overall raw STAR score must first be converted to a scale score before anything can be said about a student's achievement in the test. This scale score allows for comparison of a student's performance to a nationally representative score distribution. The score range for this test extends from approximately 10-175 *star* units.

As discussed, the subtests that constitute STAR assess different competency areas in a student's reading. However, there is no tool that allows for a comparison of a student's performance in a given subtest with the achievement of students in nationally representative reference groups. For this reason, no data analysis could be done to investigate and compare student achievement at the subtest level.

Progressive Achievement Test (PAT): Mathematics

The PAT: Mathematics test is used as an indicator of student achievement in the knowledge, skills and understandings of mathematics outlined by the New Zealand curriculum. It was used across the cluster to assess year 4 to 8 students.

The content categories of the PAT: Mathematics test are:

Number Knowledge
Number Strategies
Algebra
Geometry and Measurement
Statistics

Algebra is first included as a separate content category in test numbers 5-7 designed for year 7-8 students, however algebraic concepts and thinking are included in those test numbers designed for younger students.

Every question in the PAT test has been calibrated on the PAT: Mathematics scale by its relative difficulty. The conversion of a raw score to a scale score accounts for the varying difficulty of the test version that was sat, as well as the varying complexity of each question. This ensures that achievement can be compared regardless of the test version that was administered. These scale scores can be used to qualitatively describe the level of a student's performance in mathematics with regards to the expected range of performance for that year group.

Although at an individual level it is possible to see how students are performing in different content categories of the PAT: Mathematics test, there is no metric available that readily allows for comparisons between students. For this reason, analysis of a student's achievement in mathematics was restricted to considering their overall scale score.

E-asTTle writing assessment

The assessment tools that constitute e-asTTle were used across the cluster to assess students' ability in the different curriculum areas of writing. The e-asTTle writing tool was used to assess writing across all year levels (4-8). In each of the tests, scale scores and corresponding curriculum levels were obtained for both the test at an overall level, and for the different domains measured. This meant that differences between students with netbooks and those without could also be investigated at each different sub-test level.

Curriculum levels range from 1-8 across all levels of New Zealand schooling. Within each curriculum level, different levels of competency in e-asTTle can be differentiated by using 'Beginning' ('B'), 'Proficient' ('P) and 'Advanced' ('A').

E-asTTle is a tool for assessing writing competence, specifically writing-to-communicate as a student progresses through years 1-10. This tool was used across the whole cohort as a measure of students' ability in writing. A student's piece of writing in e-asTTle is marked using a rubric that identifies different levels of performance in seven different elements of writing. The overall level of achievement is given by the e-asTTle writing scale score. This scale score results from the conversion of the constituent rubric scores for each of the different domains.

The following descriptions of the skill focus for each of the seven measured domains of e-asTTle writing were taken from the e-asTTle writing marking rubric:

Ideas: the relevance, quantity, quality, selection and elaboration of ideas for the topic

Structure and language: the presence and development of structural and language features appropriate to the specified purpose

Organisation: the organisation of ideas into a coherent text

Vocabulary: the range, precision and effectiveness of word choices appropriate to the topic

Sentence structure: the quality, effectiveness and correctness of sentences

Punctuation: the accurate use of sentence punctuation markers and the range and accuracy of other punctuation to aid understanding of the text and to enhance meaning

Spelling: the difficulty of words used and the accuracy of the spelling

Data analysis

Student demographic information and achievement data were collated in Microsoft Excel. All subsequent analysis was done in the statistical programming language R.

For initial statistical analysis at a cohort-wide level, scale score ranges and curriculum levels of achievement were used to generate an index of relative performance. For reclassification of e-asTTle achievement, the student's curriculum level result was used. For both STAR and PAT, scale score ranges for each level of achievement were constructed. This was done using the STAR and PAT: Mathematics scales that relate the stanine levels of achievement for a given year level to the scale score.

The range of achievement in each test that constituted "low achievement", "expected level of achievement" and "high achievement" differed for each year level. This resulted in classifications for students that were comparable across all year levels. As a result, it was then possible to compare at a cluster-wide level the levels of achievement in each netbook cohort (netbook users and non-netbook users). This system of classification also meant that students achieving very similar scale scores could be considered as one cohort which reflects the fact that small differences between scale scores often appear to suggest students are performing at different levels, but in reality are not significant. The scale scores give a student a fixed location on the scale score but in reality their score could is much like that of somebody further up or below the scale score range; any difference in scale scores is likely due only to testing conditions, and not any true difference in actual ability.

Determining performance for e-asTTle tools

The e-asTTle writing tool was sat by all year 4-8 students. Students' curriculum level of achievement at an overall level, and also in each of the measured domains of these tests was reclassified as being 'Low', 'Expected' or 'High' achievement for that year level. The Ministry of Education (2007) curriculum levels by year level (see Appendix 1) were used to construct the classification system.

Table: Classification criteria for e-asTTle writing curriculum levels

Year	Low achievement	Expected achievement	High achievement
4	<2B	2B, 2P, 2A	>2A
5	<2A	2A, 3B, 3P	>3P
6	<3B	3B, 3P, 3A	>3A
7	<3A	3A, 4B, 4P	>4P
8	<4B	4B, 4P, 4A	>4A
9	<4A	4A,5B,5P	>5P
10	<5B	5B,5P,5A	>5A

Determining performance level for STAR and PAT: Mathematics

Stanines were also used to determine the performance level for each of STAR and PAT: Mathematics. The stanines established by the New Zealand Council for Educational Research (NZCER) were used to relate a given scale score to a particular level of achievement. These stanines were initially constructed by looking at the performance of students in a national reference sample. These students' performance can be considered representative of that given year level, and in this way stanines can be used to assess any student's performance with regards to the rest of their age cohort. A stanine between 1 and 3 would suggest a student is performing at a relatively low level for their age group ("Low achievement"), while stanines 4,5 and 6 correspond to an expected level of achievement ("Expected achievement"); stanines 7-9 represent comparatively high achievement for a given year group ("High achievement").

For both STAR and PAT: Mathematics scales, it is possible to see which scale scores delimit these stanine boundaries. These scale scores were then used to establish the three different levels of performance and to determine how a given student achieved in that test compared to others in their year.

Reference samples for each year level were collected at the beginning of the year. The results are therefore more likely to resemble the achievement expected by students in the year level below when assessed in term 4. This quality makes the reference samples a suitable reference group for students in this cluster because students that sat STAR and PAT were tested at the end of the year. For this reason, achievement data for the cluster was benchmarked against scale score ranges that were established from the of the year level above them.

Table: Classification criteria for STAR			
Year	Low achievement	Expected l achievement	High achievement
	Stanines 1-3	*Stanines 4-6*	*Stanines 7-9*
4	<86	86-108	>108
5	<98	98-120	>120
6	<107	107-129	>129
7	<114	114-136	>136
8	<124	124-144	>144

Table: Classification criteria for PAT: Mathematics test			
Year	Low achievement	Expected level of achievement	High achievement
	Stanines 1-3	*Stanines 4-6*	*Stanines 7-9*
4	<31	31-49	>49
5	<32	32-55	>55
6	<42	42-59	>59
7	<46	46-65	>65
8	<57	57-76	>76

Findings.

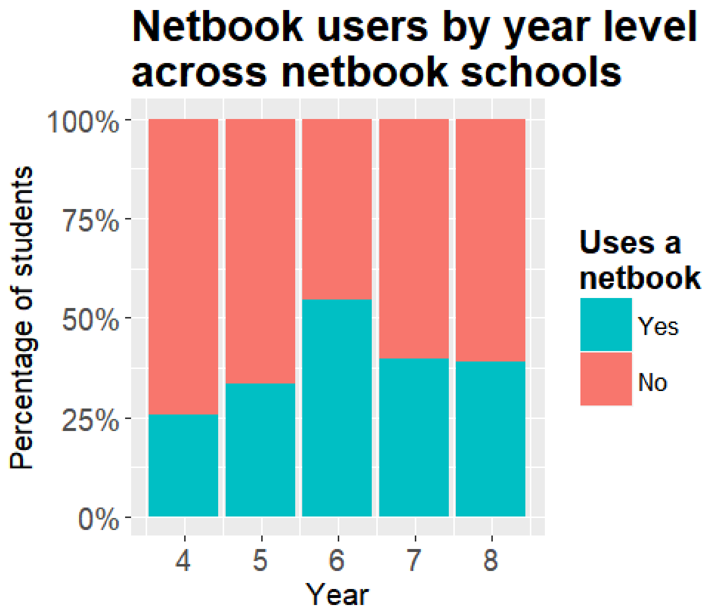
Six schools in the study were participating in the netbook scheme. A summary and analysis of the 2016 data follows, beginning with an analysis of the users and non-users within the 2016 data.

Usage by school

The overall uptake of netbooks across the six schools varied.

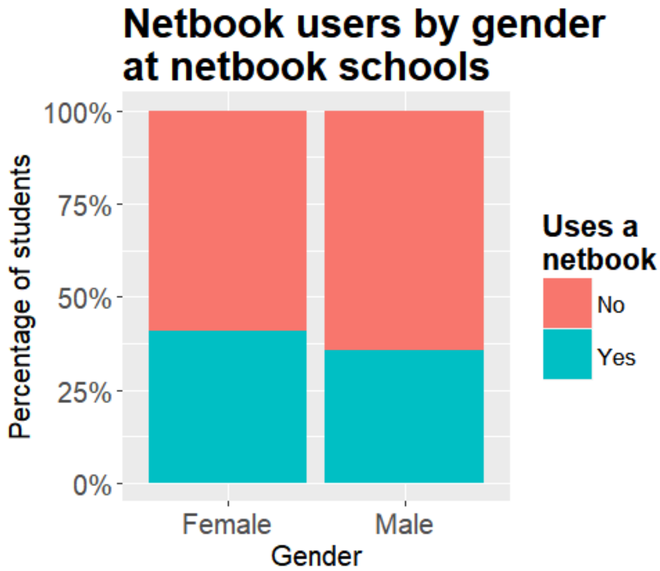
Year level usage

Netbooks were available for purchase for students in year 4-8 in the schools in the study.



There is a highly significant relationship between year level at school and participation in the netbook leasing scheme (p-value≤0.001). The participating schools included contributing primary schools (year 1-6), full primary (years 1-8) and an intermediate school (year 7-8). This is reflected in the differing patterns between years 4-6 and 7-8. The Intermediate school draws students from a range of contributing schools, including schools that do not have a netbook scheme in place.

Gender and usage



Fisher's Exact test was used to see whether gender and usage of a netbook are independent. A p-value of 0.1823 indicates that there is no difference between genders in the uptake of the netbook leasing scheme (p-value>0.05).

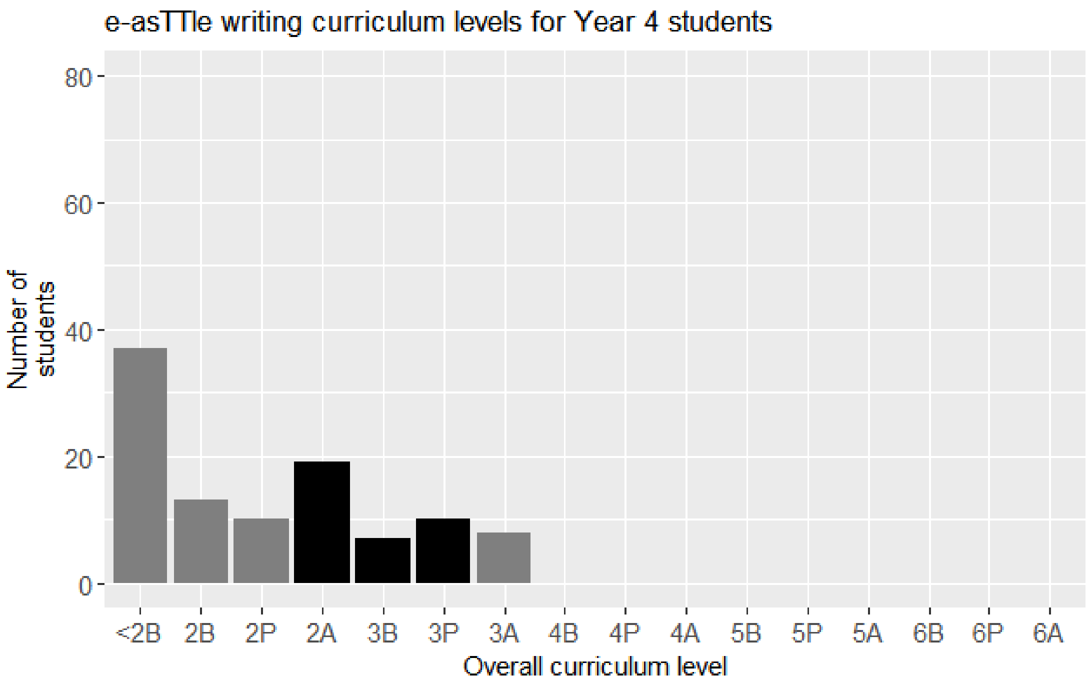
This result differed to that of the previous year when there was a statistically significant difference with more girls than boys in the netbook user group.

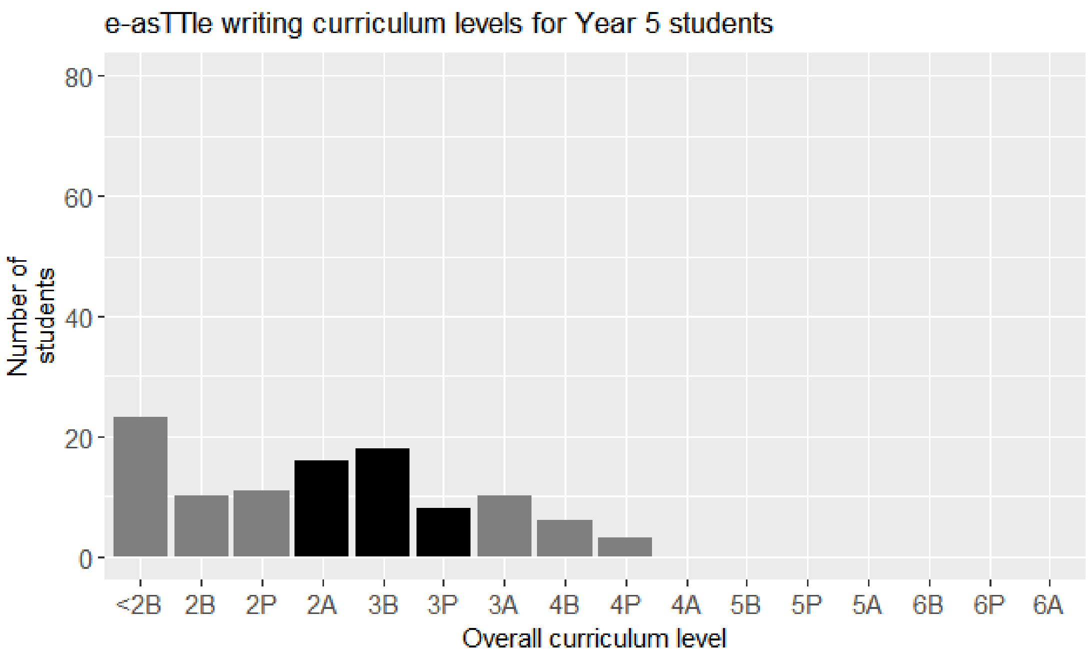
Student achievement results, 2016

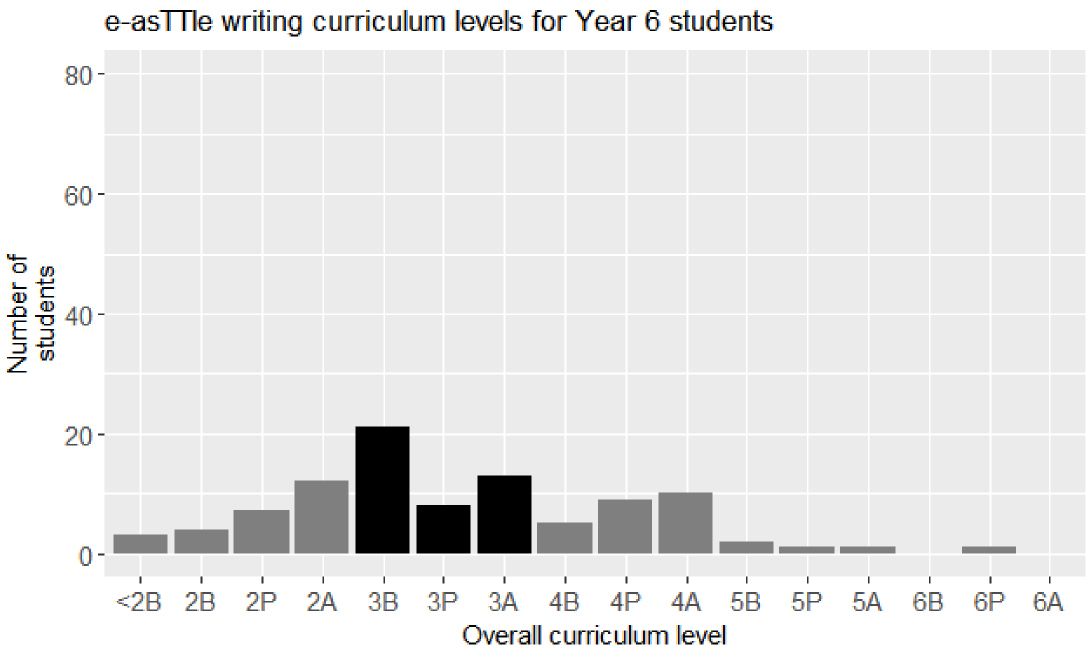
Across the six schools the students who were users and non-users of netbooks were compared using the STAR, PAT and e-asTTLe achievement results. Only the data for the students who sat each of the tests were used in this analysis (Tables 1-3).

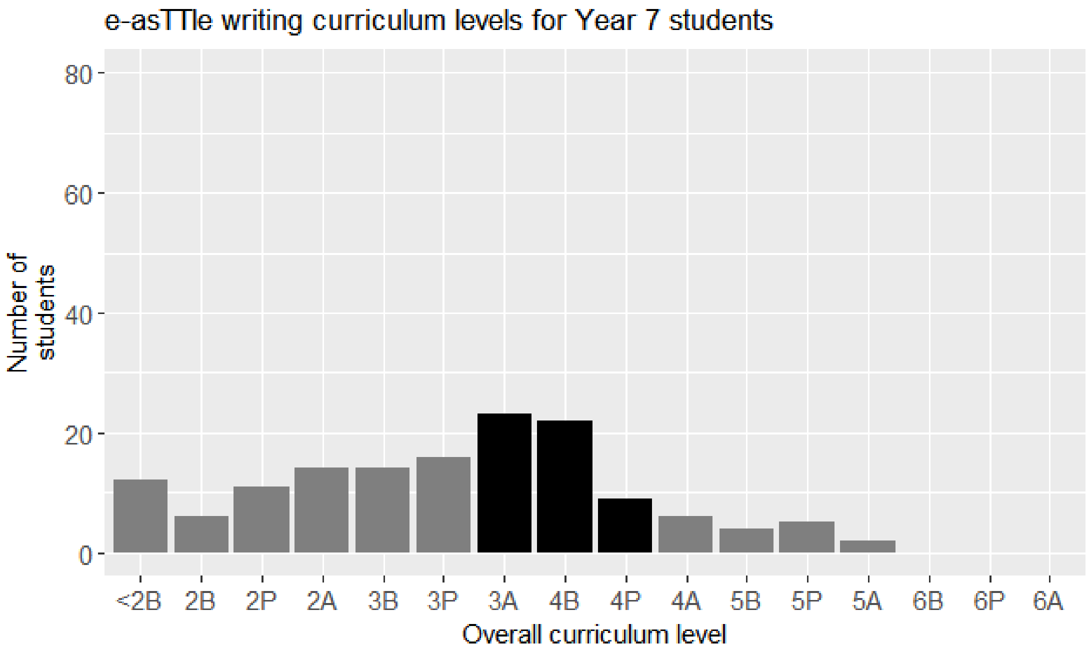
Writing

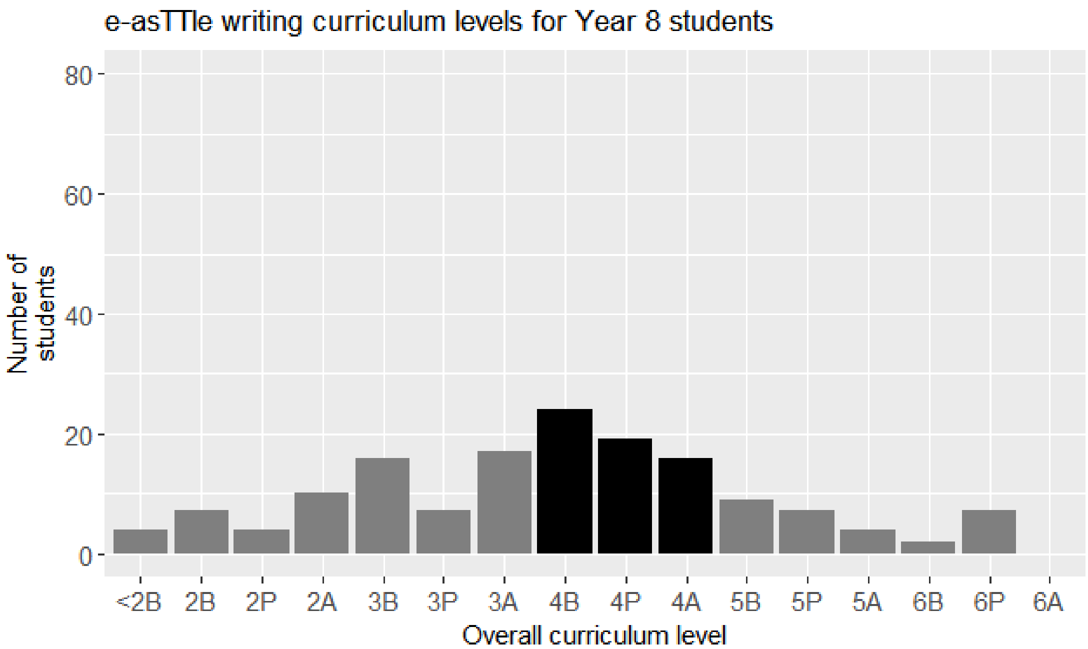
The following graphs present the spread of student achievement in e-asTTle writing for each year level. The expected level of curriculum achievement for each year level are highlighted black.


e-asTTle writing curriculum levels for Year 4 students
Number of students
0
20
40
60
80
<2B
2B
2P
2A
3B
3P
3A
4B
4P
4A
5B
5P
5A
6B
6P
6A
Overall curriculum level


e-asTTle writing curriculum levels for Year 5 students
Number of students
0
20
40
60
80
<2B
2B
2P
2A
3B
3P
3A
4B
4P
4A
5B
5P
5A
6B
6P
6A
Overall curriculum level


e-asTTle writing curriculum levels for Year 6 students
Number of students
0
20
40
60
80
<2B
2B
2P
2A
3B
3P
3A
4B
4P
4A
5B
5P
5A
6B
6P
6A
Overall curriculum level


e-asTTle writing curriculum levels for Year 7 students
Number of students
0
20
40
60
80
<2B
2B
2P
2A
3B
3P
3A
4B
4P
4A
5B
5P
5A
6B
6P
6A
Overall curriculum level

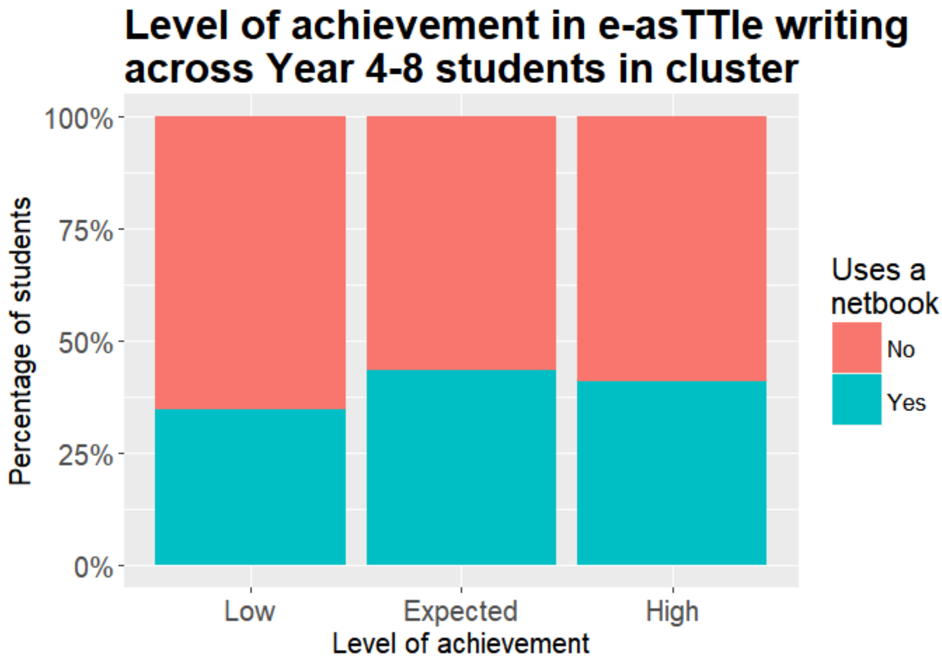


Whether the use of netbooks was correlated with achievement outcomes in 2016 was explored. The sample sizes for this investigation are summarized in the following Table:

Table:Sample size of students who sat e-asTTle		
	students who use a chromebook	students who do not use a chromebook
4	32	93
5	40	80
6	58	48
7	64	97
8	68	107

Analysis of the levels of achievement identified students who were at the expected level of achievement for their year level, above and below this level. The expected level is the highlighted level in the previous graphs. The cohorts or netbook users and non-users were compared.

Table:Levels of achievement in e-asTTle across year 4-8 in cluster		
	use a chromebook	do not use a chromebook
Low	35.7%	43.8%
Expected	43.7%	37.0%
High	20.6%	19.2%



A Pearson's Chi-square test was used to test for evidence of a relationship between the distributions of student achievement in e-asTTle and netbook usage. No evidence of dependency between the two variables was found (p-value=0.1274).

Analysis of each of the seven measured domains of e-asTTle writing identified no significant difference for six of these. However, one test domain (structure and language) did appear to have significantly different distributions of student performance between the netbook cohorts (p-value=0.0321). The students using a netbook had a significant higher level of achievement in this domain compared to their non-using peers.

Table:Levels of achievement in easttle Structure across Year 4-8 in cluster		
	Use chromebook	Do not use chromebook
Low	31.9%	40%
Expected	32.4%	33.7%
High	35.7%	26.3%

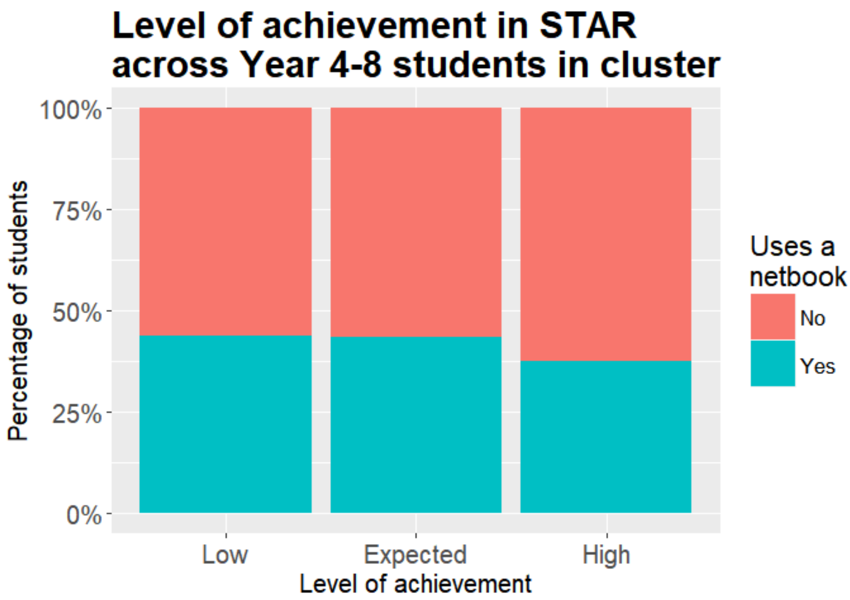
Reading

The reading achievement results measured through STAR data were analysed to explore if there were any significant difference between students who were netbook users and those who did not have a netbook for their personal use.

Table:Sample size of students who sat STAR		
	students who use a chromebook	students who do not use a chromebook
4	27	56
5	35	47
6	49	21
7	62	86
8	62	95

Across the six schools in the sample the achievement in reading was compared for at an expected achievement level for the year level, above this and below this.

Table:Levels of achievement in STAR across year 4-8 in cluster		
	use a chromebook	do not use a chromebook
Low	45.5%	44.9%
Expected	51.9%	51.8%
High	2.6%	3.3%

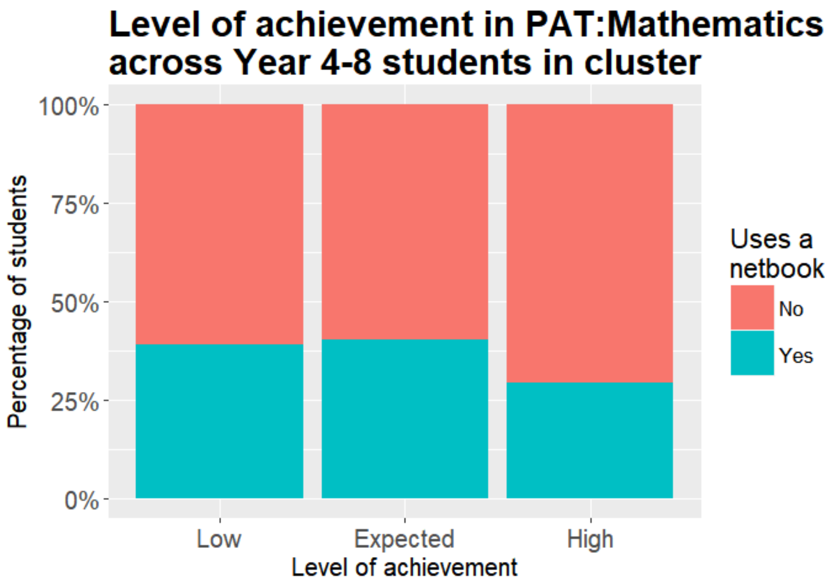


A Pearson's Chi-square test was used to test for evidence of a relationship between the distributions of student achievement in STAR and netbook usage. No evidence of dependency between the two variables was found p-value=0.8837.

Mathematics

The mathematics achievement results measured through PAT data were analysed to explore if there were any significant differences between students who were netbook users and those who did not have a netbook for their personal use.

Table:Sample size of students who sat PAT		
	students who use a chromebook	students who do not use a chromebook
4	29	76
5	38	73
6	57	47
7	63	91
8	66	101



A Pearson's Chi-square test was done to test for any evidence of a relationship between the distributions of student achievement in PAT and netbook usage. No evidence of dependency between the two variables was found (p-value=0.6647).

Table:Levels of achievement in PAT across year 4-8 in cluster		
	use a chromebook	do not use a chromebook
Low	55.7%	56.2%
Expected	42.3%	40.7%
High	2.0%	3.1%

Stepwise regression analysis

Stepwise regression is a method of selecting models using a sequence of statistical tests. Use R programming to select the best model.

In an attempt to isolate any true differences in achievement that may exist between those students using netbooks and those not using netbooks, multiple linear regression was done. This also made it possible to quantify if the students using netbooks differed in any ways from other students 'controlling' for other variables. The objective of this was not to predict a student's achievement, but instead to assess the impact that netbook usage might be having on educational attainment, when other factors are taken into account. It was done using overall scale scores in each of the assessments.

For each of the assessment tools used across the cluster, e-asTTle, STAR and PAT: Mathematics, a stepwise regression was used. A number of initial variables were included in the model for testing whether they were associated with changes in score results. These variables were those demographic identifiers collected for each student:

- Year level
- Gender
- Ethnicity
- Netbook user
- School

Schools may differ in how netbooks are integrated into the classroom learning environment, so it was thought this would be important to include.

Reading comprehension

The final model for STAR includes Year level, Gender and School for 2016 data. Year level and Gender are highly significant (p-value<0.001), and School is moderately significant (p value is between 0.05 and 0.10). Since Netbook user has not been selected for the final model, the relationship between whether or not the student was a netbook user was not significant after controlling for the other variables.

Mathematics

Similarly, the final model for PAT includes Year level, Gender and School for 2016 data. In this model, Year level is most significant (p-value<0.001), Gender and School are also significant (p-value<0.05). Since Netbook user has not been selected for the final model, the relationship between whether or not the student was a netbook user was again not significant.

Writing

After model selection, the final model contains Year level, Gender, Netbook use and School for 2016 data. In this model, Year level and Gender were found to be highly significant (p-value<0.001), and netbook use was not significant (p-value=0.11).

Propensity score matching.

Propensity score matching is a statistical technique used to evaluate the effect of a treatment or intervention. The matching is through comparing one unit with the intervention (in this case a student with a netbook) with one or more unit without the intervention (a student without a netbook), with other variables minimised to reduce bias. The achievement data in the six schools was analysed through matching one student with a netbook with one student without a netbook. Matching was carried out independently for each set of achievement data. To reduce possible bias from the learning environment students were matched with students from the same school, the same year level and with similar 2015 achievement outcome (difference within 5 points). In order to match the number of those who use a netbook and those who do not were identified and the smaller group was used to match to the other group. Only those able to be matched within these parameters were included in the analysis. The aim was to analyse the progress in achievement between 2015 and 2016 for students using netbooks compared with matched students who did not use netbooks.

A t-test was used to calculate whether the difference between 2015 and 2016 scores is significantly different to 0 for Netbook users and non-users.

Reading

Netbook users were matched with non-users within schools and year levels with a STAR score difference within 5 points in 2015. For example, 22 of the matched pairs:

	star15.cb	star15.ncb	star16.cb	star16.ncb	school	year	usage
1	106.5	106.5	109.0	121.9	1	8	9
2	78.9	75.4	92.8	100.3	3	5	5
3	100.4	99.3	110.2	100.6	3	7	4
4	109.5	110.9	106.0	117.8	3	8	8
5	99.6	99.6	109.0	110.8	3	8	5
6	93.9	96.5	108.4	103.7	4	5	3
7	91.2	87.0	99.2	89.5	4	5	7
8	97.1	96.1	115.0	109.8	4	6	3
9	108.4	104.8	122.1	120.8	4	6	3
10	88.3	84.8	109.8	98.2	4	6	3
11	83.6	82.5	104.8	89.5	10	5	4
12	109.7	109.7	113.9	122.1	10	6	3
13	100.3	101.4	102.6	98.2	10	6	3
14	99.2	102.5	103.6	94.6	10	6	4
15	108.7	109.8	125.5	118.3	10	7	4
16	115.0	116.1	117.0	122.2	10	7	3
17	122.1	120.8	117.0	120.9	10	7	4
18	137.8	133.9	145.7	144.7	10	8	4
19	129.8	129.8	140.3	137.2	10	8	4
20	122.2	126.2	128.4	111.0	10	8	4
21	81.3	80.1	91.7	102.5	11	5	3
22	86.1	86.1	89.5	97.1	11	5	5

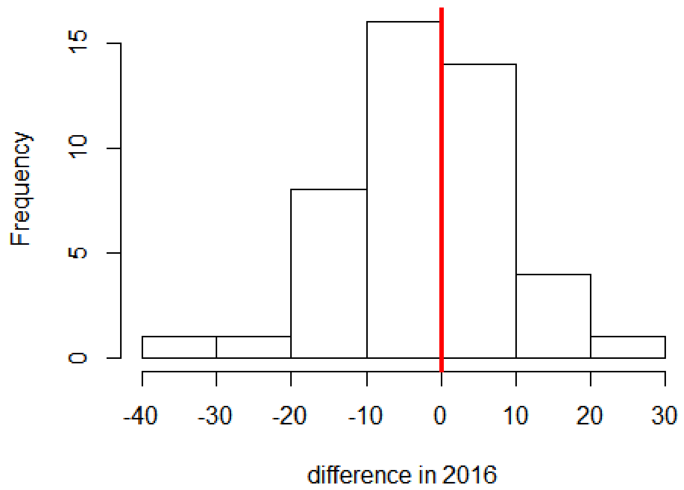
Each row is a matched pair of students.

Star15.cb: STAR scores for students who had a netbook in 2015.

Star15.ncb: STAR scores for students who did not have a netbook in 2015.

Star16.cb: STAR scores for students who had a netbook in 2016.
Star16.ncb: STAR scores for students who did not have a netbook in 2016.
School: a representative number for each netbook school.
Year: year level for each group of students
Usage: The number of complete terms that the netbook user had a netbook prior to the 2015 test.

A graph of the difference in matched pairs between 2015 and 2016:



Difference in 2016 is STAR score of netbook user in 2016 minus STAR score of non-netbook user in 2016 for each group. The histogram shows that the distribution of the differences seems like a normal distribution. In order to test the mean of the differences, t test is used.

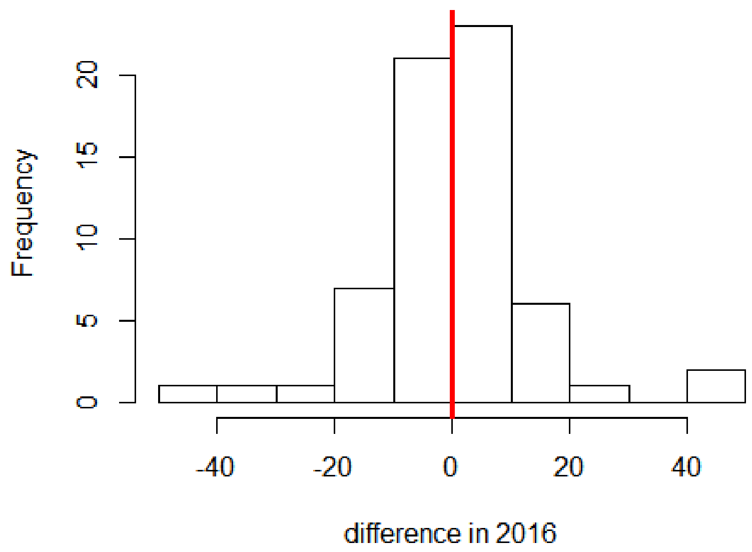
$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=-0.7579796
Since the p value is 0.453085 which is larger than 0.05, the null hypothesis is not rejected. This means that the difference in STAR score improvement between netbook users and non-users between 2015 and 2016 is not significant.

Mathematics

Netbook users were matched with non-users within schools and year levels with a PAT raw score difference within 5 points in 2015. For example:

	pat15.cb	pat15.ncb	pat16.cb	pat16.ncb	school	year	usage
1	39.9	38.4	28.2	49.7	1	8	9
2	33.8	32.4	33.8	29.2	3	5	6
3	22.5	24.0	41.9	36.6	3	5	6
4	47.6	48.7	52.0	59.6	3	8	9
5	40.6	39.2	45.0	42.6	4	6	3
6	47.6	49.2	53.4	63.4	4	6	3
7	40.6	41.9	50.9	41.4	4	6	3
8	47.6	44.7	49.7	42.6	4	6	7
9	39.2	36.6	54.6	48.5	9	6	2
10	46.1	46.1	61.7	58.7	9	6	2
11	44.7	43.3	52.1	61.7	9	6	2
12	32.4	35.2	44.7	47.1	10	5	4
13	31.0	32.4	40.6	37.9	10	5	4
14	47.6	46.1	48.5	40.1	10	6	3
15	37.9	36.6	41.4	48.5	10	6	4
16	39.2	35.2	28.2	38.9	10	6	3
17	50.9	49.7	61.3	58.8	10	7	4
18	37.6	40.1	38.4	36.8	10	7	4
19	43.8	45.0	51.0	52.1	10	7	4
20	41.4	40.1	41.4	44.0	10	7	3
21	31.7	33.3	45.2	42.7	10	7	4
22	58.8	55.4	56.3	57.4	10	8	5

pat15.cb: PAT scores for students who had a netbook in 2015.
pat15.ncb: PAT scores for students who did not have a netbook in 2015.
pat16.cb: PAT scores for students who had a netbook in 2016.
pat 16.ncb: PAT scores for students who did not have a netbook in 2016.



Difference in 2016 is PAT score of netbook user in 2016 minus STAR score of non-netbook user in 2016 for each group. The histogram here also shows that the distribution of the differences seems to follow a normal distribution. In order to test the mean of the differences, t test is used.

$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=0.1302858
Since the p value is 0.89683 is larger than 0.05, the null hypothesis is not rejected which means that the difference of PAT score improvement between netbook users and non-users is not significant

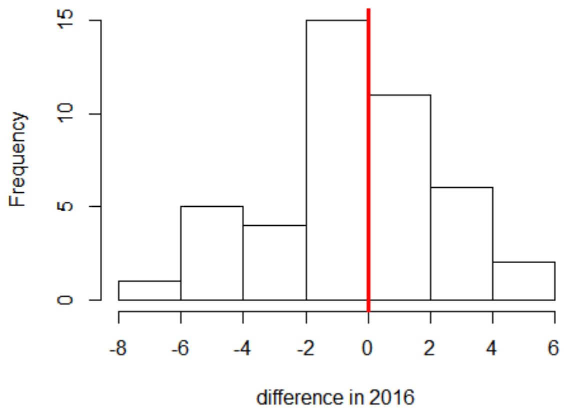
Writing

In order to choose matching data and control the bias, students in two groups that in the same school, in the same year level and with the same scale score in 2015 were matched together. Their scale score in 2016 will be used in the analysis.
For example, sentence data of e-asTTle:

	level15	level16.cb	level16.ncb	school	year	usage	level15.n	level16.cb.n	level16.ncb.n
1	<2B	3A	2A	3	7	6	1	7	4
2	2A	3A	5B	3	8	7	4	7	11
3	<2B	2A	3A	3	8	6	1	4	7
4	3A	3A	3A	4	5	7	7	7	7
5	2A	5A	2A	4	6	7	4	13	4
6	2A	2A	5A	4	6	6	4	4	13
7	2A	3A	3A	4	6	6	4	7	7
8	3A	4A	3A	9	6	2	7	10	7
9	3A	4A	4A	9	6	2	7	10	10
10	2A	4A	4A	9	6	2	4	10	10
11	<2B	3A	3A	9	6	2	1	7	7
12	2A	3A	2A	10	5	4	4	7	4
13	<2B	2A	2A	10	5	4	1	4	4
14	2A	2A	3A	10	5	4	4	4	7
15	2A	3A	2A	10	5	5	4	7	4
16	2A	2A	2A	10	6	4	4	4	4
17	3A	2A	3A	10	6	3	7	4	7
18	2A	3A	3A	10	6	3	4	7	7
19	3A	5B	3A	10	7	4	7	11	7
20	3A	3A	3A	10	7	4	7	7	7
21	2A	3A	2A	10	7	4	4	7	4
22	2A	2A	3A	10	7	4	4	4	7

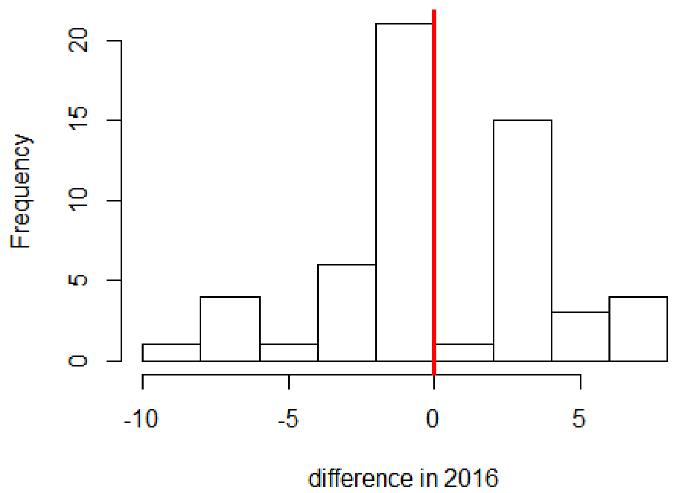
To compare difference in progression between 2015 and 2016 the achievement levels were allocated a numerical value with <2B=1, 2B=2, 2P=3, 2A=4 etc. Thus in the above table the difference in scores for the first matched pair is +3.
Level15: the sentence scale level of each group in 2015.
Level16.cb: the sentence scale level of netbook student in 2016.
Level16.ncb: the sentence scale level of non-netbook student in 2016.
Level15.n: the sentence numerical scale level of each group
Level16.cb.n: the sentence numerical scale level of netbook student in 2016.
Level16.ncb.n: the sentence numerical scale level of non-netbook student in 2016.

Overall E-asTTle results.



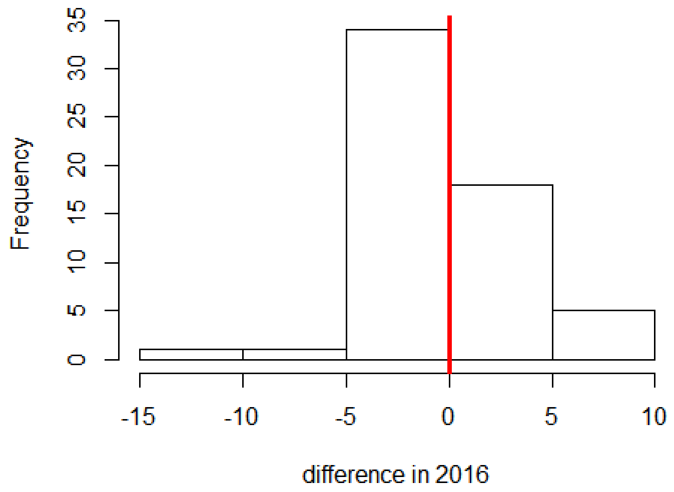
$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=0.2671104
The p value of this test is 0.790669 which is larger than 0.05. Therefore, null hypothesis is not rejected which means that the difference of e-asTTle overall improvement between netbook users and non-users is not significant

E-asTTle ideas



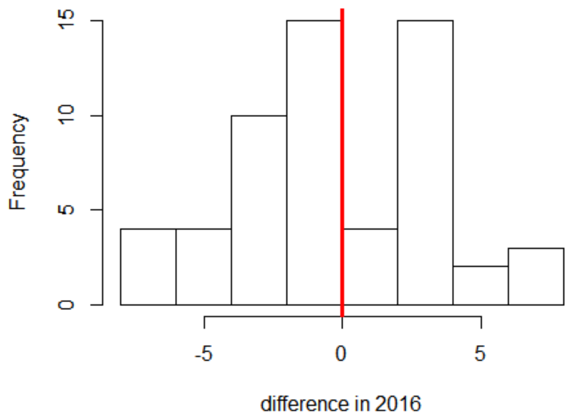
$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=1.670398
P value of this test is 0.100542 which is larger than 0.05. Therefore, null hypothesis is not rejected. it means that the difference of e-asTTle ideas score between netbook users and non-users is not significant.

Structure (e-asTTle)



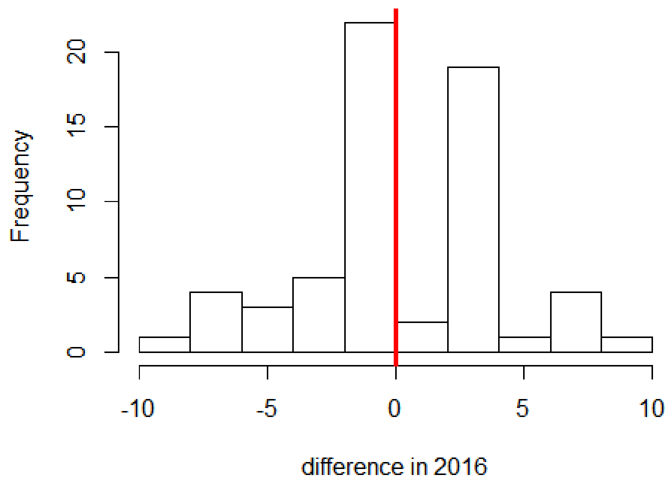
$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=1.176934
Since the p value is 0.244043 and it is larger than 0.05, null hypothesis is not rejected. It means that the difference of e-asTTle structure and language ideas score between netbook users and non-users is not significant.

Organisation (e-asTTle)



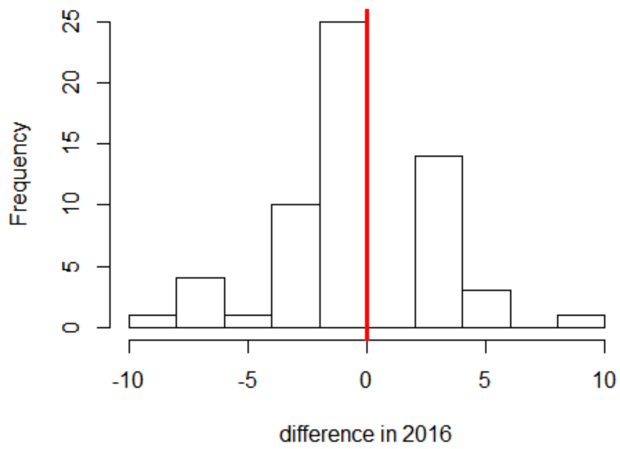
$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=0.8903294
Similarly, since the p value is 0.377114 which is larger than 0.05, null hypothesis is not rejected which means that the difference of e-asTTle organization ideas score between netbook users and non-users is not significant.

Vocabulary (e-asTTle)



$H_0: \mu = 0$
$H_1: \mu \neq 0$
t=1.778553
Since the p value is 0.080305 which is larger than 0.05, the null hypothesis is not rejected. This means that the difference in improvement in the vocabulary subtest of e-asTTle between netbook users and non-users between 2015 and 2016 is moderately significant (p-value is between 0.05 and 0.1). Therefore, the students using a netbook have made a greater improvement in their vocabulary compared to those not using a netbook which is moderately statistically significant.

Sentence structure (e-asTTle).

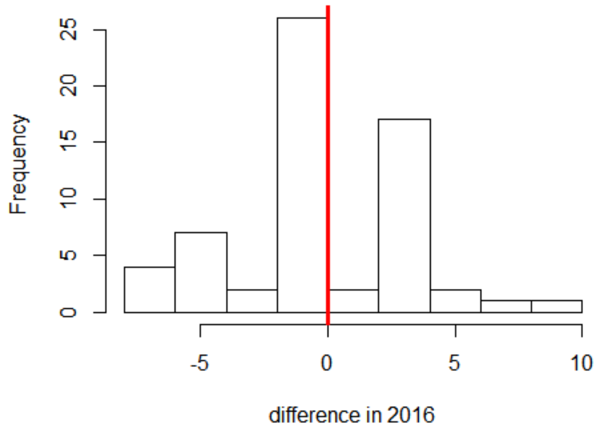


$H_0: \mu = 0$
$H_1: \mu \neq 0$

t=0.1164135

Since the p value is 0.907738 which is larger than 0.05, null hypothesis is not rejected which means that the difference of e-asTTle sentence structure improvement score between netbook users and non-users is not significant.

Punctuation (e-asTTle)



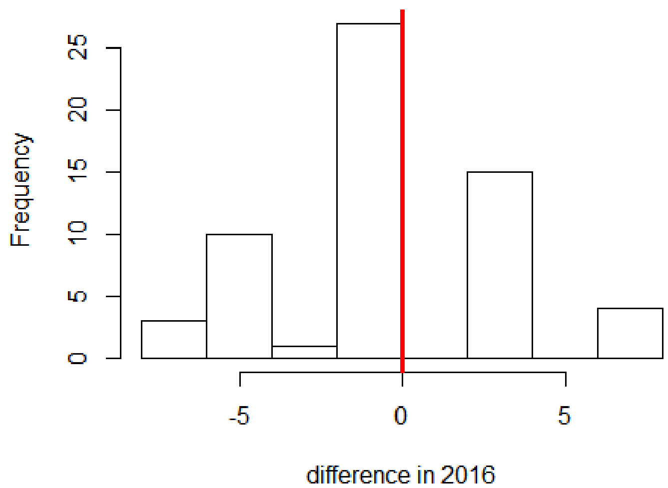
$H_0: \mu = 0$

$H_1: \mu \neq 0$

t=1.061881

Since the p value is 0.292512 which is larger than 0.05, null hypothesis is not rejected which means that the difference of e-asTTle punctuation improvement between netbook users and non-users is not significant.

Spelling (e-asTTle)



$H_0: \mu = 0$

$H_1: \mu \neq 0$

t=0.7373327

Since the p value is 0.463862 which is larger than 0.05, null hypothesis is not rejected which means that the difference of e-asTTle spelling improvement between netbook users and non-users is not significant.

Regression analysis

Since the differences in improvement scores between the two groups of students are non-significant, we applied a regression model to study the effect of other variables within the dataset.

Model 1

In order to analyse whether the use of a Netbook is useful for students that have different scores in 2015 (lower-level score and higher-level score), we calculated the mean score in 2015 for every group (each group contains a pair of students). Therefore, the independent variable is their mean score in 2015 and the dependent variable is the score of Netbook user minus the score of non-user for each group. The model for reading (STAR results) is below:

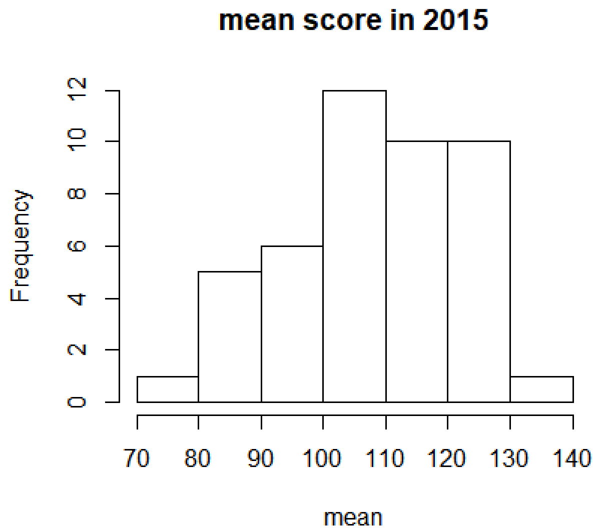
```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  20.6312    12.7382    1.62   0.1126
mean15       -0.2016     0.1165   -1.73   0.0908 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 10.66 on 43 degrees of freedom
Multiple R-squared:  0.06506,    Adjusted R-squared:  0.04332
F-statistic: 2.992 on 1 and 43 DF,  p-value: 0.09084
```

In this model, the mean in 2015 is moderately significant (p-value is between 0.05 and 0.1). The coefficient (-0.2016) is a negative value. This means that students who had lower STAR achievement results in 2015 made greater improvement when they were netbook users compared to those who were not netbook users. If the mean score in 2015 increased by 1, the value of Netbook user's score in 2016 minus non-user's score decreased by 0.2016 of a scale score point, on average. Although the p value of the model is larger than 0.05, it is between 0.05 and 0.1, so this model can be taken into account as it is moderately significant.

Model 2

Since the score level was found to be statistically significant in model 1, the data was further analysed by grouping students according to their mean STAR score in 2015. The distribution of the mean score in 2015 is below:



The students were then divided into 3 groups: those who in 2015 attained less than 100; those with scores between 100 and 120; and those with scores larger than 120. The model is below:

```
Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)            2.342      3.102   0.755   0.4545
as.factor(mean15.f)2  -3.292      3.856  -0.854   0.3982
as.factor(mean15.f)3  -8.033      4.485  -1.791   0.0805 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 10.75 on 42 degrees of freedom
Multiple R-squared:  0.07155,   Adjusted R-squared:  0.02733
F-statistic: 1.618 on 2 and 42 DF,  p-value: 0.2104
```

From this model, group 3, which corresponds to having a mean score in 2015 larger than 120, is different to group 1 [mean score in 2015 less than 100]. The p-value is between 0.05 and 0.1 which is moderately significant. The coefficient is -8.033. This means that the difference between Netbook students' STAR score in 2016 and non-Netbook students' STAR score in group 3 will decrease 8.033 compared to students in group 1.

Other models

Other variables were tested and the results indicate that there is no evidence that school, year level or usage period have a significant effect on students' STAR score.

Mathematics

For PAT, a linear model was applied to explore the effect of variables including mean PAT score in 2015, school, year level and usage period on 2016 results. All of the variables and models were found to be not significant on student learning progress (p-value>0.05).

Writing

Similarly, for each test of e-asTTle, there is no evidence that the variables have a significant effect on the differences between two groups; all the p-values of the models were larger than 0.05.

Cumulative Logit Model

Since the e-asTTle achievement results are level scores, a cumulative logit model was applied. Let the response be Y=1,2,..., J, then there is a cumulative probability $\mathrm{P}(\mathrm{Y} \leq \mathrm{j}) = \pi_1 + \cdots + \pi_j$ where $\mathrm{j} \leq \mathrm{J}$.

$$\log\left(\frac{P(Y \leq j)}{1 - P(Y \leq j)}\right) = \log\left(\frac{\pi_1 + \cdots + \pi_j}{\pi_{j+1} + \ldots + \pi_J}\right) = \alpha_j + \underline{\beta}'\underline{x}, j = 1, \ldots, J - 1$$

This model satisfies

$$\mathrm{logit}\left[\mathrm{P}\left(\mathrm{Y} \leq \mathrm{j} \middle| \underline{x_1}\right)\right] - \mathrm{logit}\left[\mathrm{P}\left(\mathrm{Y} \leq \mathrm{j} \middle| \underline{x_2}\right)\right] = \underline{\beta}'(\underline{x_1} - \underline{x_2})$$

In the first model for overall level score, the independent variable is the students' achievement level in 2015. The dependent variable is Netbook user’s level in 2016 minus non-user’s level in 2016 in each matched pair. The result of this analysis found that the model is not significant. The p-values of the variables are larger than 0.05 which means they are not significant. Therefore, there is no evidence that the variables (school, year level and usage period) have a greater effect on the academic progress of Netbook users compared to and non-users.

Conclusion

The student achievement data collected across the six schools participating in the netbook scheme were analysed to investigate any differences in those using a netbook for learning and those not. In 2016, as in 2015, there were a greater percentage of girls than boys using netbooks, however in 2016 this result was not statistically significant.

Analysis of the 2016 achievement data identified that year level and gender were variables that correlated the strongest to student achievement results in reading, writing and mathematics, and netbook use was not a significant variable influencing the outcomes. In the 2015 e-asTTle results punctuation was found to have a statistically significant difference with those students not using netbooks achieving higher results. Using the 2016 data, the same result was not identified for ‘punctuation’. However, a similar statistically significant but negligible difference was identified for ‘structure and language’ where students who were netbook users achieved higher results than their peers.

Propensity score matching was applied to compare the academic progress of students with and without netbooks between 2015 and 2016. Nearly all of the analytical approaches applied to the data found no evidence in the assessments that the children who are netbook users are progressing in their learning faster or slower than their peers. However, there were two notable statistically significant exceptions. Firstly, between 2015 and 2016 students with netbooks made greater gains in their vocabulary than their peers without netbooks. Secondly, the regression analysis identified that netbook-using students who were achieving at a lower level in the STAR test in 2015 progressed more than their peers without netbooks or those achieving at a higher level. This aspect warrants further investigation as it suggests that the use of netbooks accelerates the learning progress of students reading at a lower level.

Appendix

Regression Model

STAR

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.8079     5.3619   0.151    0.881
usage        -0.5014     1.2553  -0.399    0.692

Residual standard error: 11 on 43 degrees of freedom
Multiple R-squared:  0.003696,  Adjusted R-squared:  -0.01947
F-statistic: 0.1595 on 1 and 43 DF,  p-value: 0.6916
```

This model is to see whether usage of netbook has significant effect on students' achievement. Since the p-value is larger than 0.05, it is not significant.

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   15.250     10.844   1.406    0.167
year          -2.400      1.562  -1.537    0.132

Residual standard error: 10.73 on 43 degrees of freedom
Multiple R-squared:  0.05206, Adjusted R-squared:  0.03001
F-statistic: 2.361 on 1 and 43 DF,  p-value: 0.1317
```

Similarly, year level is not significant (p-value > 0.05).

```
Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)          -12.900     10.488  -1.230   0.2261
as.factor(school)3    10.025     11.726   0.855   0.3978
as.factor(school)4    19.400     11.489   1.689   0.0993 .
as.factor(school)9     9.200     12.846   0.716   0.4781
as.factor(school)10   16.910     11.000   1.537   0.1323
as.factor(school)11    8.717     10.714   0.814   0.4208
---
  Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 10.49 on 39 degrees of freedom
Multiple R-squared:  0.1786,  Adjusted R-squared:  0.07333
F-statistic: 1.696 on 5 and 39 DF,  p-value: 0.1584
```

In this model, school 4 has significant difference compared to school 1, however, since in STAR data, school 4 only has one group, the sample size is too small, therefore, this model is not significant either.

PAT

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.8401     8.2160   0.589    0.558
mean15       -0.1142     0.1987  -0.575    0.568

Residual standard error: 13.81 on 61 degrees of freedom
Multiple R-squared:  0.005385,  Adjusted R-squared:  -0.01092
F-statistic: 0.3303 on 1 and 61 DF,  p-value: 0.5676
```

From this model, PAT score level in 2015 is not significant.

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  -1.1762     5.9513  -0.198    0.844
usage         0.2993     1.2152   0.246    0.806

Residual standard error: 13.84 on 61 degrees of freedom
Multiple R-squared:  0.0009936,	Adjusted R-squared:  -0.01538
F-statistic: 0.06067 on 1 and 61 DF,  p-value: 0.8063
```

Usage of netbook is not significant in the result.

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   12.052     12.054   1.000    0.321
year          -1.745      1.760  -0.991    0.325

Residual standard error: 13.73 on 61 degrees of freedom
Multiple R-squared:  0.01586,	Adjusted R-squared:  -0.0002758
F-statistic: 0.9829 on 1 and 61 DF,  p-value: 0.3254
```

Year level is not significant in this model either.

```
Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)           -21.50      14.00  -1.536    0.130
as.factor(school)3     22.27      16.16   1.378    0.174
as.factor(school)4     23.75      15.65   1.518    0.135
as.factor(school)9     23.98      15.33   1.564    0.123
as.factor(school)10    20.84      14.62   1.425    0.159
as.factor(school)11    21.99      14.17   1.552    0.126

Residual standard error: 14 on 57 degrees of freedom
Multiple R-squared:  0.04501,	Adjusted R-squared:  -0.03876
F-statistic: 0.5373 on 5 and 57 DF,  p-value: 0.7471
```

There is no difference between different schools.

Overall Level (e-asTTle)

```
Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)               -4.04568    4.03078  -1.004    0.322
E.oa1$level15.n            0.27056    0.22787   1.187    0.243
as.factor(E.oa1$school)11  1.43654    1.16205   1.236    0.224
as.factor(E.oa1$school)3  -2.57834    2.87257  -0.898    0.375
as.factor(E.oa1$school)4   1.06354    1.89361   0.562    0.578
as.factor(E.oa1$school)9   1.75120    1.89567   0.924    0.362
E.oa1$year                 0.08601    0.54237   0.159    0.875
E.oa1$usage                0.34130    0.52173   0.654    0.517

Residual standard error: 2.859 on 36 degrees of freedom
Multiple R-squared:  0.1405,	Adjusted R-squared:  -0.02663
F-statistic: 0.8406 on 7 and 36 DF,  p-value: 0.5613
```

From the model above, all the variables are not significant.

Ideas (e-asTTle)

```
Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 1.46826    4.53241   0.324    0.747
E.ideas1$level15.n          0.29680    0.20693   1.434    0.158
as.factor(E.ideas1$school)11 0.79828   1.39809   0.571    0.571
as.factor(E.ideas1$school)3 2.09162    3.00843   0.695    0.490
as.factor(E.ideas1$school)4 0.01365    2.32647   0.006    0.995
as.factor(E.ideas1$school)9 0.96933    2.28569   0.424    0.673
E.ideas1$year              -0.35434    0.63234  -0.560    0.578
E.ideas1$usage             -0.12569    0.57711  -0.218    0.829

Residual standard error: 3.922 on 48 degrees of freedom
Multiple R-squared:  0.05029, Adjusted R-squared:  -0.08821
F-statistic: 0.3631 on 7 and 48 DF,  p-value: 0.9191
```

In the result, all the variables are not significant.

structure (e-asTTle)

```
Coefficients:
                               Estimate Std. Error t value Pr(>|t|)
(Intercept)                    -0.05066    4.12020  -0.012    0.990
E.structure1$level15.n         -0.01282    0.21436  -0.060    0.953
as.factor(E.structure1$school)11 1.07604   1.25797   0.855    0.396
as.factor(E.structure1$school)3 -2.21257   2.88590  -0.767    0.447
as.factor(E.structure1$school)4 -1.19759   2.25595  -0.531    0.598
as.factor(E.structure1$school)9  2.61466   2.12718   1.229    0.225
E.structure1$year              -0.28191    0.57276  -0.492    0.625
E.structure1$usage              0.49416    0.53914   0.917    0.364

Residual standard error: 3.879 on 51 degrees of freedom
Multiple R-squared:  0.06453, Adjusted R-squared:  -0.06386
F-statistic: 0.5026 on 7 and 51 DF,  p-value: 0.8282
```

From the model above, all the variables are not significant.

Organisation (e-asTTle)

```
Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                 2.5571     4.1402   0.618    0.540
E.org1$level15.n            0.2612     0.1827   1.430    0.159
as.factor(E.org1$school)11  1.9076     1.2530   1.522    0.134
as.factor(E.org1$school)3   2.7792     3.0795   0.902    0.371
as.factor(E.org1$school)4   0.6356     1.9602   0.324    0.747
as.factor(E.org1$school)9   1.1512     2.0299   0.567    0.573
E.org1$year                -0.5669     0.5285  -1.073    0.289
E.org1$usage               -0.2654     0.5167  -0.514    0.610

Residual standard error: 3.631 on 49 degrees of freedom
Multiple R-squared:  0.09515, Adjusted R-squared:  -0.03411
F-statistic: 0.7361 on 7 and 49 DF,  p-value: 0.6424
```

In this result, all the variables are not significant.

Vocabulary (e-asTTle)

```
Coefficients:
                              Estimate Std. Error t value Pr(>|t|)
(Intercept)                    -4.5876     4.1436  -1.107    0.273
E.vocab1$level15.n              0.1251     0.1979   0.632    0.530
as.factor(E.vocab1$school)11    1.0707     1.3546   0.790    0.433
as.factor(E.vocab1$school)3    -0.7930     2.6856  -0.295    0.769
as.factor(E.vocab1$school)4    -1.6802     2.1648  -0.776    0.441
as.factor(E.vocab1$school)9     3.2778     2.0803   1.576    0.121
E.vocab1$year                   0.2145     0.5823   0.368    0.714
E.vocab1$usage                  0.6804     0.5580   1.219    0.228

Residual standard error: 3.922 on 54 degrees of freedom
Multiple R-squared:  0.08434, Adjusted R-squared:  -0.03435
F-statistic: 0.7106 on 7 and 54 DF,  p-value: 0.6632
```

For vocabulary, the variables are not significant either.

Sentence (e-asTTle)

```
Coefficients:
                             Estimate Std. Error t value Pr(>|t|)
(Intercept)                   0.01486    4.34878   0.003    0.997
E.sent1$level15.n            -0.04074    0.20538  -0.198    0.844
as.factor(E.sent1$school)11 -0.36392    1.26700  -0.287    0.775
as.factor(E.sent1$school)3  -2.30998    3.10456  -0.744    0.460
as.factor(E.sent1$school)4  -1.06984    2.64176  -0.405    0.687
as.factor(E.sent1$school)9   1.01165    1.99613   0.507    0.614
E.sent1$year                 -0.08392    0.55203  -0.152    0.880
E.sent1$usage                 0.26631    0.65065   0.409    0.684

Residual standard error: 3.536 on 51 degrees of freedom
Multiple R-squared:  0.02338, Adjusted R-squared:  -0.1107
F-statistic: 0.1744 on 7 and 51 DF,  p-value: 0.9894
```

From the result above, the variables are not significant for sentence test in e-asTTle.

Punctuation (e-asTTle)

```
Coefficients:
                             Estimate Std. Error t value Pr(>|t|)
(Intercept)                  -0.06555    4.19958  -0.016    0.988
E.punc1$level15.n            -0.03187    0.22722  -0.140    0.889
as.factor(E.punc1$school)11  1.36701    1.32851   1.029    0.308
as.factor(E.punc1$school)3  -0.48476    2.87798  -0.168    0.867
as.factor(E.punc1$school)4   3.63323    2.34516   1.549    0.127
as.factor(E.punc1$school)9   1.83954    2.21684   0.830    0.410
E.punc1$year                 -0.02176    0.58075  -0.037    0.970
E.punc1$usage                -0.08500    0.56110  -0.151    0.880

Residual standard error: 3.927 on 54 degrees of freedom
Multiple R-squared:  0.06798, Adjusted R-squared:  -0.05283
F-statistic: 0.5627 on 7 and 54 DF,  p-value: 0.7827
```

Similarly, for punctuation, the variables are not significant.

Spelling (e-asTTle)

```
Coefficients:
                              Estimate Std. Error t value Pr(>|t|)  
(Intercept)                  -7.968548   3.873923  -2.057   0.0447 *
as.factor(E.spell1$school)11  0.071107   1.304197   0.055   0.9567  
as.factor(E.spell1$school)3  -2.939266   3.122572  -0.941   0.3509  
as.factor(E.spell1$school)4   3.706169   1.976777   1.875   0.0664 .
as.factor(E.spell1$school)9   0.756052   1.948952   0.388   0.6997  
E.spell1$year                 1.215885   0.532003   2.285   0.0264 *
E.spell1$usage               -0.008539   0.493719  -0.017   0.9863  
E.spell1$level15.n           -0.031163   0.163054  -0.191   0.8492  
---
  Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.637 on 52 degrees of freedom
Multiple R-squared:  0.1377,   Adjusted R-squared:  0.02159 
F-statistic: 1.186 on 7 and 52 DF,  p-value: 0.3271
```

In this model, year level is significant, the coefficient is positive, which means netbook is more useful for students in a higher year level. In order to find a best model, use stepwise to choose model. The model is below:

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    -3.8929     3.0354  -1.283    0.205
E.spell1$year   0.6429     0.4543   1.415    0.162

Residual standard error: 3.646 on 58 degrees of freedom
Multiple R-squared:  0.03337, Adjusted R-squared:  0.0167 
F-statistic: 2.002 on 1 and 58 DF,  p-value: 0.1624
```

From this model, the year level is not significant either.

Cumulative Logit Model

	Value	Std. Error	t value	p value
E.oa1$level15.n	0.13771742	0.1116236	1.23376664	2.172899e-01
-7|-5	-3.13187917	1.1274336	-2.77788336	5.471425e-03
-5|-4	-1.97843080	0.7822559	-2.52913509	1.143440e-02
-4|-3	-1.19969041	0.6753209	-1.77647450	7.565474e-02
-3|-2	-0.85266608	0.6488236	-1.31417247	1.887882e-01
-2|-1	-0.56587014	0.6355631	-0.89034460	3.732809e-01
-1|0	0.01345049	0.6248327	0.02152654	9.828256e-01
0|1	0.95734779	0.6307920	1.51769163	1.290922e-01
1|2	1.34052901	0.6374787	2.10286082	3.547794e-02
2|3	2.19653011	0.6858390	3.20269076	1.361501e-03
3|4	3.32520861	0.8323162	3.99512666	6.465967e-05
4|6	3.75784738	0.9284058	4.04763469	5.173781e-05

The coefficient is 0.138. This means that if students' overall e-asTTle level increase by 1, the odds of making the difference between two groups less than or equal to a fixed level will increase 0.138. For example, let the fixed level equal-1, when their level in 2015 increases by 1, the odds of the probability of the difference between two groups being less than or equal to-1 will increase by 0.138. This also means that using a Netbook has greater impact for students that have lower score levels. However, because the p value is larger than 0.05, this model is not significant.