quicksmart

Annual Numeracy Program Report

2021

The SiMERR National Research Centre
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Acknowledgements

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1.1 Introduction

Students who experience ongoing failure in upper-primary and lower-secondary school face a myriad of difficulties in pursuing post-school options and by contributing to society through employment and aware citizenship. Those who exhibit consistent weaknesses in basic skills, such as the recall of number facts, or who have trouble reading with comprehension are particularly vulnerable. Such students are usually caught in a cycle of continued failure, as it is particularly difficult to bring about sustainable change within usual classroom environments for students who by Year 4 are persistently at or below national or age-expected benchmarks.

Four issues confront Australian schools in regard to addressing the needs of at-risk students.

1. Too many Australian Indigenous and non-Indigenous students have shown to be resistant to improvements in learning despite large investments of funds to overcome problems they face. Longitudinal national data indicate that low-achieving students have **not** drawn lasting benefits from **most** current in-class and withdrawal instructional activities.
2. Teaching assistants are
   (i) underutilised,
   (ii) poorly supported, and
   (iii) a seldom recognised resource in school education.

   Based on *QuickSmart* experience of over 20 years, these adults, with appropriate training, are highly motivated, and offer cost-effective, long-term sustainable ways to close the achievement gap for low-achieving students.
3. In remote and rural areas, trained Indigenous teaching assistants (as *QuickSmart* Instructors) are a resource able to enrich their whole community.
4. Educational support programs need to be sustainable in the short- and long-term without large drains on the public purse. Sustainability means
   (i) cost-efficient,
   (ii) clear exit criteria,
   (iii) proven longitudinal results,
   (iv) documented ongoing benefits for students and instructors, and
   (v) replicability (including quality assurance) across all regions of Australia.

1.2 Overview of *QuickSmart*

The analyses presented in this report provide information about students' performance in the *QuickSmart* Numeracy program. In particular, the focus here is on the Cognitive Aptitude Assessment System, Australian version (OZCAAS) and on standardised test measures, specifically the Progressive Achievement Tests in Mathematics (ACER, 2016).

Some schools provided data for other independent tests, however, there was insufficient use of these tests for inclusion in this report. Further investigation of the data in this report examines the results in terms of gender and for participating Indigenous students.

Most data are obtained through the assessment files in the OZCAAS assessment program developed by Academic staff at the Massachusetts's Institute of Technology. The program offers a random number computer generated testing approach that measures the reaction time (speed) and the accuracy of basic arithmetic computation.

The results for the four operations offered at each of two levels indicate a very strong to substantial improvement for the *QuickSmart* students in terms of accuracy and response time. The evidence provided illustrates that *QuickSmart* students narrowed the achievement gap by

(i) improving to such an extent that there was either no substantial difference between them and the comparison students, or
(ii) they had reached a slightly better level of performance than their average-achieving comparison group peers.

Such growth is a critical requirement for these *QuickSmart* students as number facts are a vital skill underpinning mathematics functioning in general. This improvement provides the necessary foundation for students to improve in other areas of mathematics, particularly those linked to higher-order thinking, which are skills not directly targetted in *QuickSmart*.

1.3 Findings – Speed and Accuracy

In 2021, the *QuickSmart* team at the University of New England received matched data from 2,858 students who participated in *QuickSmart* Numeracy lessons and 763 average-achieving comparison peers. These students were drawn from schools from across Australia.

Some small differences between male and female students were observed and some of these results are statistically significant. However, the small effect sizes indicate that these statistical findings are not meaningful for practical purposes.

It is acknowledged that Indigenous students had improvements comparable to those of non-indigenous *QuickSmart* students with effect sizes rated very strong to substantial over all operations.

A further mark of the success of *QuickSmart* can be found in the post-test results of those students, who did not succeed in completing the pre-test. In such cases, (see Table 18) Instructors are advised not to continue collecting data in the pre-test as doing so would confront these students with the extent of their weaknesses at the beginning of

the program. Significantly, the fact that these students are now able to complete all OZCAAS assessments at the end of the program is an achievement in and of itself.

In addition and subtraction, the average response rates were below 4.2 seconds and above 94.5% accuracy. In multiplication and division, the average response times were below 5 seconds and accuracy over 76% at post-test. This improvement is most likely due to the fact that:

(i) there has been some mutually beneficial development of common areas of the brain that process the four operations;
(ii) students' overall improved levels of confidence may have led to a 'have a go attitude' that was not present at the beginning of the QuickSmart program; and
(iii) students have increased their ability to benefit from classroom instruction.

1.4 Findings – ACER tests

In the case of the ACER PATM tests, Norm Tables (2016) were used to convert raw scores from various forms of the PATM to consistent Scale scores, which were used for all subsequent calculations. Three analyses were undertaken on the PATM scores:

- The first analysis presents a calculation of a standard gain score and the significance of this result.
- The second analysis is an *Effect Size* calculated from the Means and Standard Deviations on PATM scores for each group. Effect Size statistics indicate the magnitude of the change in academic achievement for the *QuickSmart* and comparison students.
- The third analysis is the shift in national percentile performance.

The results indicate a very strong improvement for *QuickSmart* students. This improvement is greater than those recorded for the comparison group of their average-achieving peers.

The results of independent samples *t*-tests of *QuickSmart* students show that for the ACER PAT results the differences in male and female scores are statistically significant at the 0.01 significance level (p = 0.009). However, the small effect size (Cohen's d = 0.121) indicates that this statistical finding is not meaningful for practical purposes.

For Indigenous students, the results also report substantial improvements from those who participated in *QuickSmart*, although in the data presented this improvement is slightly smaller than that of the overall *QuickSmart* group. This is not typically the case.

Overall, in all analyses, the quantitative data aspects of the program report a narrowing of the achievement gap between *QuickSmart* students and their average-performing comparison group peers. Impressive Effect Sizes and shifts in national percentile

performance have been reported as well as highly significant gains on the part of individual students who, in some cases, could not complete the full suite of pre-test assessments.

1.5 Findings – Qualitative Data

Once again, as has been recorded in each year of the *QuickSmart* program, substantial qualitative data (reported in school presentations during professional workshops 2 and 3) indicate that *QuickSmart* students gained a new confidence in Mathematics as a consequence of their involvement on the program. Many stories, within the corpus of qualitative data, document improvements for *QuickSmart* students in relation to their:

(i) academic performance and participation in class,
(ii) attitudes to school and learning,
(iii) positive attendance rates, and
(iv) levels of academic confidence both inside and outside the classroom that manifest in a personal belief that with effort and persistence they can improve.

The data collected to date from many tens of thousands of *QuickSmar*t students indicate that

(i) *QuickSmart* has narrowed the achievement gap between *QuickSmart* and comparison students,
(ii) low-achieving students undertaking *QuickSmart* proceed with their studies more successfully by learning to 'trust their heads' in the same ways that effective learners do, and
(iii) *QuickSmart* students can maintain the gains made during the program for years after they completed the program,

1.6 Conclusion

Each year analyses of the QuickSmart program, results consistently identify impressive statistically significant end-of-program and longitudinal gains in terms of probability measures and effect sizes that mirror the qualitative improvements reported by teachers, paraprofessionals, parents and *QuickSmart* students themselves.

2 Background

2.1 Purpose of *QuickSmart*

The prime purpose of the *QuickSmart in Schools* program is to reverse the trend of ongoing poor academic performance for students who have been struggling at school and who are caught in a cycle of continued failure. The students targeted by the *QuickSmart* Program typically experience

(i) significant and sustained difficulties in basic mathematics and/or literacy,
(ii) have a profile of low progress in learning despite (often many) attempts to overcome their learning difficulties,
(iii) few, if any, lasting benefits from other in-class and withdrawal instructional activities.

A second purpose concerns the professional learning program designed for classroom teachers, special needs support teachers, and paraprofessionals to learn how to work with, and significantly improve, the learning outcomes in basic mathematics and/or literacy of under-achieving middle-school students. The program features:

(i) professional learning and support for working in a small-class instructional setting with two students, and
(ii) a specially constructed teaching program supported by extensive material and computer-based resources.

2.2 *QuickSmart* Program Description

The *QuickSmart* Numeracy and Literacy interventions were developed and applied nationally through the National Centre of Science, Information and Communication Technology and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England, Armidale. The *QuickSmart* programs have been under continuous development and improvement since 2001, based on the results of many tens of thousands of students over more than 20 years of operation.

The intervention is called *QuickSmart* to encourage students to become:

(i) *quick* in their response time, and
(ii) *smart* in their understanding and the strategic use of mental and other resources.

The aims of *QuickSmart* are to:

(i) improve students' information retrieval times and accuracy to appropriate levels that enable students to attain and demonstrate proficiency in classroom interactions,

(ii) free working-memory capacity from an excessive focus on mundane or routine tasks, and, as a result

(iii) engage in more meaningful tasks associated with more demanding cognitive activities.

In these interventions the words 'Quick' and 'Smart' are operationalised respectively by:

- fostering automaticity of basic and fundamental skills and knowledge, and
- time, accuracy and understanding are incorporated as key dimensions of learning.

Other implications for *QuickSmart* students, and for Schools that conduct the full program, include:

(i) students' ability to remain on-task is enhanced, resulting in an improvement to persist and maintain concentration in the material provided,

(ii) students become more knowledgeable about the way their brain learns, such as
    - the value of deliberately practice certain basic aspects,
    - the positive importance of mistakes and learning from them,
    - the benefits of persevering and how crucial it is to exert effort.

(iii) students practice the skill of setting realistic goals for themselves and using this idea to help them monitor their own academic learning and progress.

(iv) all the above skills can be acquired and with consistency within classroom these skills that can be transferred to classroom use.

3 *QuickSmart* Tests – 2021

3.1 Introduction

Three major sets of analyses help quantify the academic benefits of the *QuickSmart* program. These analyses are presented in this report and provide information about students' performance:

(i) on the Cognitive Aptitude Assessment System, Australian version (OZCAAS);
(ii) on standardised test measures, specifically the Progressive Achievement Tests in Mathematics (ACER, 2005); and
(iii) in terms of student gender and participating Indigenous students.

The first set of analyses examine data from response time and accuracy OZCAAS measures, related to the four arithmetic operations. These data are collected at the beginning and end of the *QuickSmart* program. These results are a direct measure of the work of *QuickSmart* instructors and reflect the primary focus of the *QuickSmart* lessons.

Eight tests are employed to measure students' response time and accuracy both before *QuickSmart* began and at the end of the program. The tests available are:

1. Basic Addition facts;
2. Addition facts;
3. Basic Subtraction facts;
4. Subtraction facts;
5. Basic Multiplication facts;
6. Multiplication facts;
7. Basic Division facts; and
8. Division facts.

The second set of analyses concerns the results of independent tests in Mathematics. Most schools utilise the Progressive Achievement Test Mathematics (PATM) assessment for this purpose. This is a standardised test developed by the Australian Council for Education Research (ACER). The PATM is an independent test taken prior to commencement of *QuickSmart* and at the completion of the program. Students' PATM results provide information about how the knowledge, skills and attitudes developed in *QuickSmart* are used, and how they transfer to other broad areas of mathematics, which **are not** the specific target of *QuickSmart* instruction.

The third set of analyses includes analyses of the data by gender, and participating Indigenous students.

The results from these three analysis groups are reported below in separate sections. (Note: Some schools provided data for other independent tests, however, there was insufficient national use of these tests for inclusion in this report.)

3.2 Background to Test Interpretation

For all tests in this study (OZCAAS and PATM) the comparison group represents average-achieving students selected from the same class (or Year/Grade) as *QuickSmart* students. The comparison students are expected to undertake the pre-intervention and post-intervention tests, but did not receive any *QuickSmart* small-class instruction. The initial difference in the two groups, comparison and QuickSmart students, is demonstrated in all tables of results in this Report with comparison students achieving better average pre-intervention scores than students in the *QuickSmart* group.

Note: The comparison students do not represent a 'true' control group because they do not share the same achievement starting points with the *QuickSmart* students. Typically, the comparison students are average-achieving students, while the *QuickSmart* students are low-achieving students. This clarification is not to say that some/many comparison students might benefit (some greatly) from the *QuickSmart* program themselves. Data from schools confirm that when these middle-performing students are given access to the *QuickSmart* program they make substantive gains, often in a shorter timeframe of less than 30 weeks. However, with limited resources available in schools, it is clearly the lower-achieving students who are most in need. The good news is that the benefits of *QuickSmart* thinking and practise is not limited to the lower-achieving students.

As is often the case in educational studies of this nature, to obtain a 'true' control group could be ethically problematic since this would potentially deprive a selected group of low-achieving students of the educational benefits that other low-achieving students, (often) in the same class would receive. Thus, even though the results in this report consistently show that the *QuickSmart* students improve more than the comparison students, it has to be borne in mind that, if the comparison group consisted of low-achieving students, it is most likely that the *QuickSmart* students would show a greater margin of improvement relative to that group than of our traditional comparison students.

Additionally, as *QuickSmart* programs become established in schools, sometimes even within the first year of operation, it becomes increasingly difficult to establish even a true 'comparison' group. This occurs as more and more *QuickSmart* practitioners share *QuickSmart* teaching practices, resources and activities throughout their schools. Our information from school reports is that a majority of Principals begin this school-wide implementation of *QuickSmart* in their schools within the first two-three years.

While this attests to the impact that *QuickSmart* is having in schools, it does not allow a straightforward interpretation of comparison students and *QuickSmart* student results. Specifically, in many schools average-achieving comparison students are receiving some experience with *QuickSmart* approaches, activities and resources in their classrooms, and, consequently, their scores are higher at post-test because of this exposure.

It should also be noted that to obtain the difference between the improvement of *QuickSmart* students and comparison students we analysed the data using paired-samples *t*-tests. To protect against the cascading Type I error associated with multiple *t*-tests we lowered the significance level from the customary 0.05 to 0.01.

The reason for this change to probability levels is to adjust for the situation where *t*-tests are repeated many times. This repetition means that, on average, the decision that the means of two groups are significantly different would be incorrect one time in every one hundred replications. The implication of the change means that in our analysis for any two means to be judged significantly different from each other, there has to be a less than 1% chance (as opposed to a 5% chance) that the result was obtained by chance.

4 Results on the OZCAAS Assessments

4.1 Introduction

In 2021, the *QuickSmart* team at the SiMERR National Research Centre at the University of New England received matched data from 2,858 students who participated in *QuickSmart* Numeracy lessons and 763 'average-achieving' comparison peers. These students were drawn from schools from across Australia.

To assist with interpretation of OZCAAS results, the tests are shown below in reverse order as often the most revealing results are shown in the operations which are at first weakest, in this case 'division'. A detailed analysis of division is also provided. It is important to note that interpretation of results in some other operations (e.g., basic addition) can be impacted by a 'ceiling effect' as many students record strong results in the pre-test and this does not leave much room for improvement.

The OZCAAS results recorded for average-achieving comparison students should also be interpreted with the knowledge that many of these students' results may have been constrained by a ceiling effect.

The results of our analyses of data related to OZCAAS are presented in Tables 1 to 8 below. A detailed discussion of Table 1 is provided for clarification purposes and as a model for understanding the results in Tables 2 to 8.

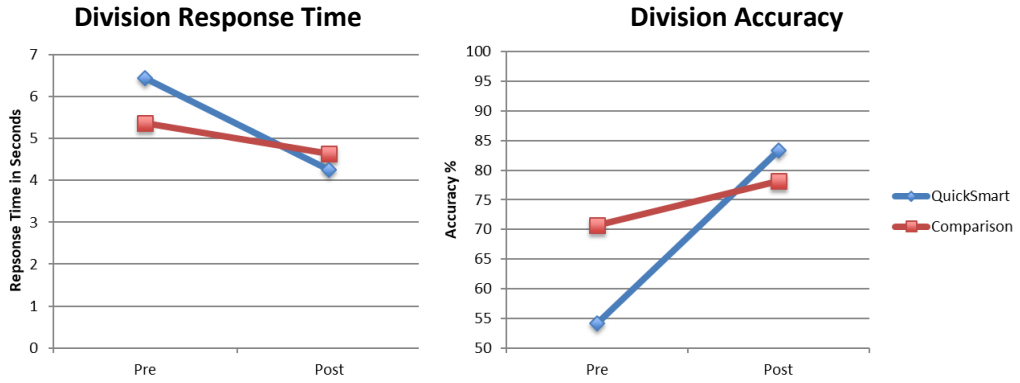
4.2 Combined OZCAAS Analysis

4.2.1 Division

Table 1 below summarises the data submitted for OZCAAS division.

Table 1: OZCAAS division – all students 2021

Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.431	2.987	4.248	2.53	-2.183	<0.001*	0.789
Res Time (secs) Comp	5.363	2.821	4.645	2.472	-0.718	<0.001*	0.271
Accuracy (%) QS	54.174	26.253	83.384	21.733	29.21	<0.001*	1.212
Accuracy (%) Comp	70.728	25.226	78.138	21.906	7.41	<0.001*	0.314



The desired criterion for response time on the OZCAAS assessments is between 1 and 2 seconds as an indication of automaticity. The decrease in time for *QuickSmart* students is 2.183 seconds, which is a strong result (Note: The negative number in the table means that the post-test time is lower than the pre-test time. This result is the desired pattern of improvement. The effect size for this result is 0.789, which indicates very strong improvement.

Effect size statistics can be understood based on the work of Hattie (Hattie, J. 2009. *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement.* London: Routledge) such that over an academic year for a student cohort:

- Effect sizes below 0.2 are considered **poor**;
- Effect sizes within the range of 0.2 to 0.4 are considered **appropriate**;
- Effect sizes within the range of 0.4 to 0.6 are considered **strong**;
- Effect sizes within the range of 0.6 and 0.8 are considered **very strong**; and
- Effect sizes above 0.8 are considered **substantial improvement** of the order of nearly two-to-three years' growth.

In terms of accuracy, the *QuickSmart* students' average scores have improved by almost 30 percentage points, which is a very strong result. The effect size for this result is 1.212, which indicates substantial improvement for the *QuickSmart* group.

Division is typically (but not always) the final focus operation of the *QuickSmart* program for students. As a result, a number of students may not reach the lessons that focus on division facts. This may have occurred because the school was slow to implement the program and there were not sufficient lessons available, or students required more deliberate practice on other operations before they could move forward.

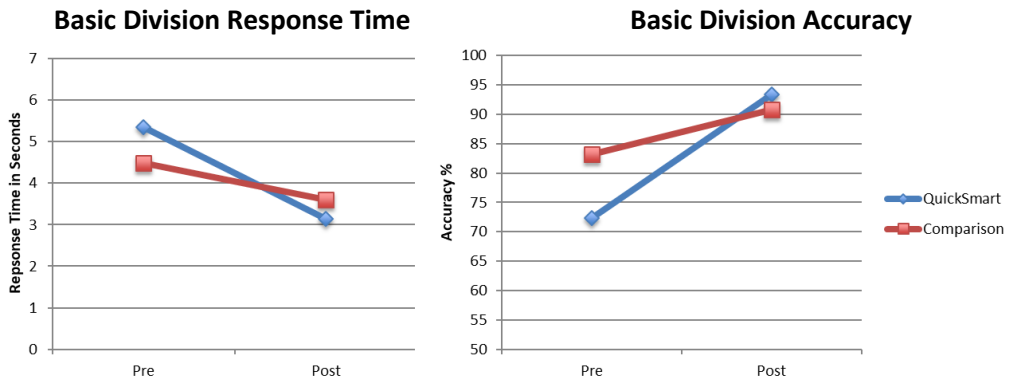
Interestingly, students still appear to make important gains even if lessons on division had not been undertaken. SiMERR has noted overtime that there is some residual benefit from work on automaticity with understanding on other operations and certain aspects of *QuickSmar*t learning has been transferred.

In summary, Table 1 shows that when compared to the scores of the comparison students, *QuickSmart* student scores indicate substantial improvement for both response time and accuracy. The diagrams illustrate that *QuickSmart* students improved to reach better levels than their comparison average-achieving peers.

4.2.2 Basic Division

Table 2: OZCAAS basic division – all students 2021

Basic Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.35	2.666	3.145	1.903	-2.205	<0.001*	0.952
Res Time (secs) Comp	4.481	2.649	3.594	2.287	-0.887	<0.001*	0.359
Accuracy (%) QS	72.347	26.573	93.348	12.972	21.001	<0.001*	1.004
Accuracy (%) Comp	83.166	22.283	90.817	16.833	7.651	<0.001*	0.387

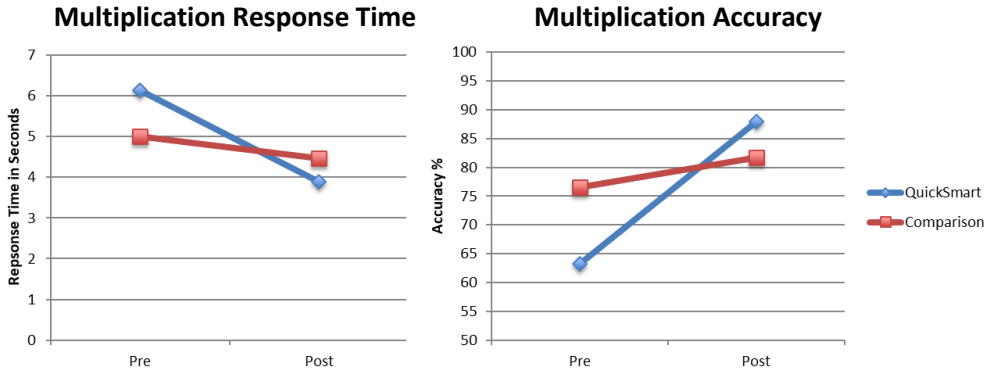


In summary, the results for basic division indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.3 Multiplication

Table 3: OZCAAS multiplication – all students 2021

Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.139	2.838	3.88	2.323	-2.259	<0.001*	0.871
Res Time (secs) Comp	5.004	2.672	4.457	2.463	-0.547	<0.001*	0.213
Accuracy (%) QS	63.301	21.41	87.883	17.874	24.582	<0.001*	1.246
Accuracy (%) Comp	76.577	20.388	81.66	18.064	5.083	<0.001*	0.264

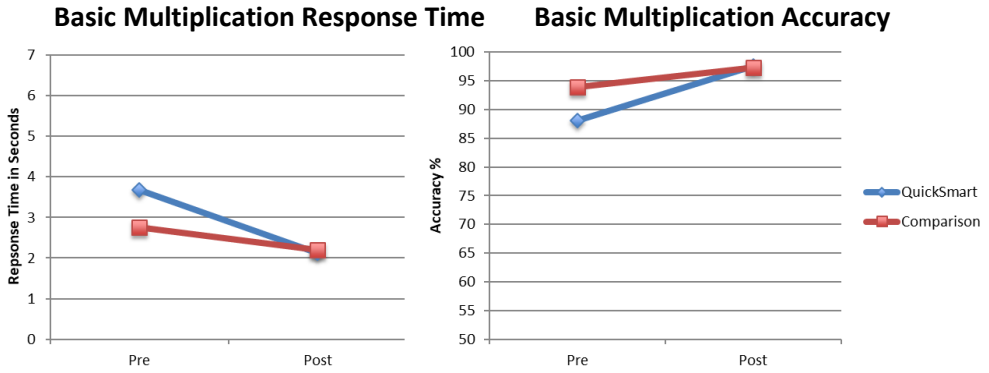


In summary, the results for multiplication indicate a substantial improvement in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a better level of performance than the comparison students.

4.2.4 Basic Multiplication

Table 4: OZCAAS basic multiplication – all students 2021

Basic Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.685	2.238	2.132	1.261	-1.553	<0.001*	0.855
Res Time (secs) Comp	2.753	1.651	2.201	1.13	-0.552	<0.001*	0.391
Accuracy (%) QS	88.073	16.128	97.581	6.757	9.508	<0.001*	0.769
Accuracy (%) Comp	93.987	13.134	97.304	7.23	3.317	<0.001*	0.313

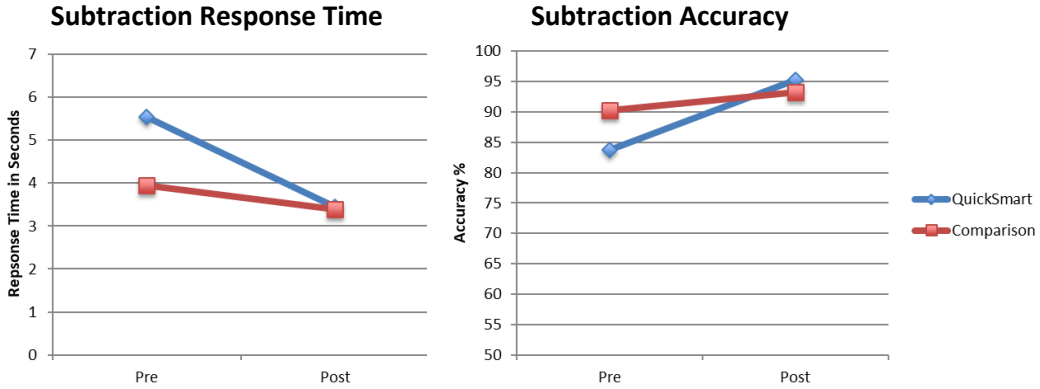


In summary, the results for basic multiplication indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.5 Subtraction

Table 5: OZCAAS subtraction – all students 2021

Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.533	2.823	3.457	2.083	-2.076	<0.001*	0.837
Res Time (secs) Comp	3.942	2.2	3.396	1.815	-0.546	<0.001*	0.271
Accuracy (%) QS	83.751	16.215	95.215	8.82	11.464	<0.001*	0.878
Accuracy (%) Comp	90.22	11.725	93.236	9.949	3.016	<0.001*	0.277

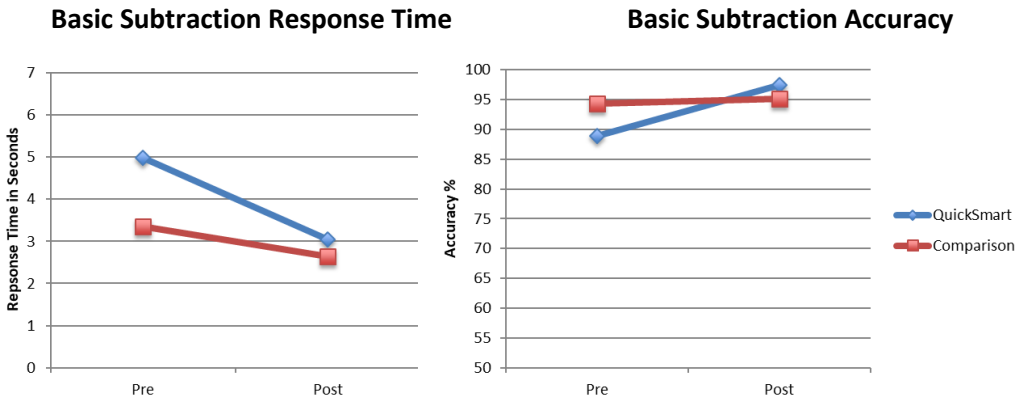


In summary, the results for subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that in response time the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students. In accuracy the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.6 Basic Subtraction

Table 6: OZCAAS basic subtraction – all students 2021

Basic Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	4.982	2.721	3.045	1.725	-1.937	<0.001*	0.85
Res Time (secs) Comp	3.357	1.601	2.637	1.161	-0.72	<0.001*	0.515
Accuracy (%) QS	88.901	13.544	97.393	6.036	8.492	<0.001*	0.81
Accuracy (%) Comp	94.309	7.87	95.186	7.999	0.877	0.262	0.111

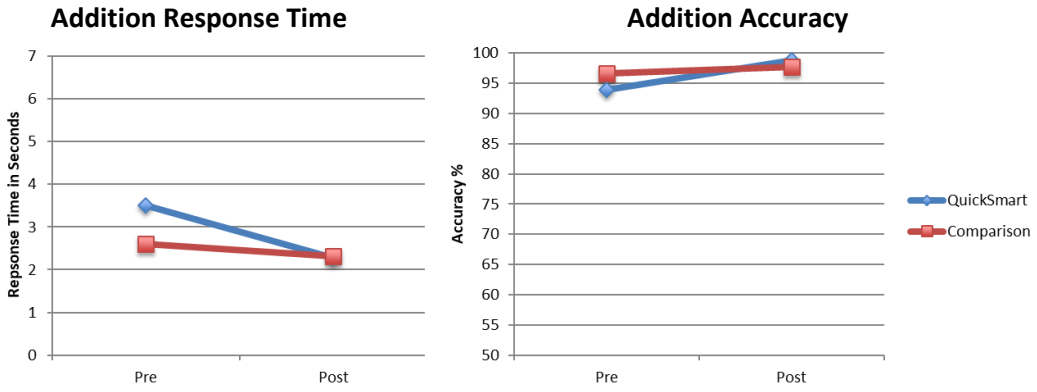


In summary, the results for basic subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students.

4.2.7 Addition

Table 7: OZCAAS addition – all students 2021

Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.508	1.738	2.284	1.09	-1.224	<0.001*	0.844
Res Time (secs) Comp	2.605	1.309	2.308	1.089	-0.297	<0.001*	0.247
Accuracy (%) QS	93.945	9.159	98.864	4.119	4.919	<0.001*	0.693
Accuracy (%) Comp	96.653	6.518	97.723	4.945	1.07	<0.001*	0.185

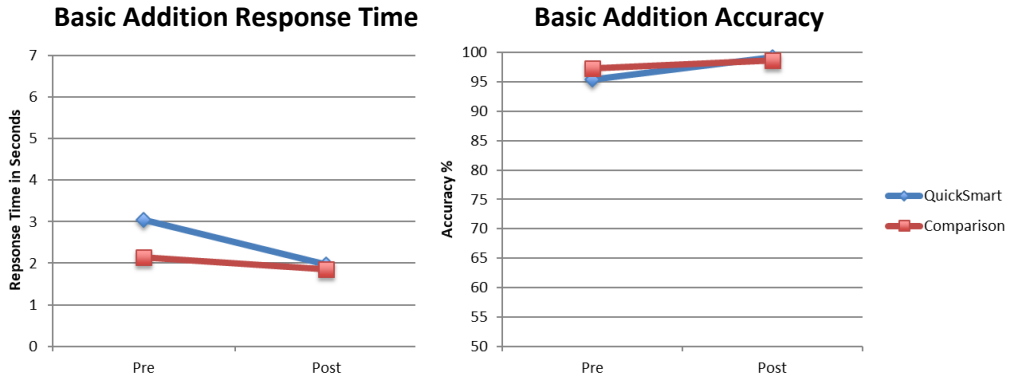


In summary, the results for addition indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students in accuracy and a similar level in response time. In accuracy, both *QuickSmart* and comparison students exhibit a strong ceiling effect.

4.2.8 Basic Addition

Table 8: OZCAAS Basic Addition results – all students 2021

Basic Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.052	1.609	1.962	0.899	-1.09	<0.001*	0.837
Res Time (secs) Comp	2.149	0.751	1.85	0.675	-0.299	<0.001*	0.419
Accuracy (%) QS	95.373	7.327	99.219	2.464	3.846	<0.001*	0.704
Accuracy (%) Comp	97.298	4.256	98.714	3.42	1.416	0.005	0.367



In summary, the results for basic addition indicate a very strong improvement for the *QuickSmart* students in accuracy and a substantial improvement in response time. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students. In accuracy, both *QuickSmart* and comparison students exhibit a strong ceiling effect.

4.3 OZCAAS By Demographics

4.3.1 Division by Gender

The following tables show an analysis of OZCAAS results for each operation by gender (Tables 9, 10, 11, 12, 13, 14, 15, 16) and for Indigenous students (Table 17).

Table 9: OZCAAS division results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	6.306	2.964	4.095	2.45	-2.211	<0.001*	0.813
Male Comparison	5.228	2.783	4.4	2.408	-0.828	<0.001*	0.318
Female *QuickSmart*	6.533	3.005	4.361	2.578	-2.172	<0.001*	0.776
Female Comparison	5.534	2.867	4.951	2.525	-0.583	<0.001*	0.216
Accuracy (%)							
Male *QuickSmart*	55.09	25.798	83.368	21.084	28.278	<0.001*	1.2
Male Comparison	72.539	24.195	80.093	20.154	7.554	<0.001*	0.339
Female *QuickSmart*	53.489	26.603	83.427	22.23	29.938	<0.001*	1.221
Female Comparison	68.683	26.175	75.984	23.356	7.301	<0.001*	0.294

These results indicate that males did marginally better than females in response time and females did slightly better than males in accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level (p = 0.891 for response time and 0.105 for accuracy).

4.3.2 Basic Division by Gender

Table 10: OZCAAS basic division results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	5.088	2.532	3.165	1.911	-1.923	<0.001*	0.857
Male Comparison	4.026	2.276	3.067	1.563	-0.959	<0.001*	0.491
Female *QuickSmart*	5.551	2.748	3.132	1.899	-2.419	<0.001*	1.024
Female Comparison	4.882	2.893	4.057	2.697	-0.825	<0.001*	0.295
Accuracy (%)							
Male *QuickSmart*	73.607	24.333	93.142	12.89	19.535	<0.001*	1.003
Male Comparison	87.024	16.263	94.5	8.035	7.476	<0.001*	0.583
Female *QuickSmart*	71.378	28.144	93.488	13.054	22.110	<0.001*	1.008
Female Comparison	79.769	26.098	87.575	21.356	7.806	<0.001*	0.327

These results indicate that females did slightly better than males in both accuracy and response time. The results of independent samples *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level (p = 0.059) but they are significant in response time (p = 0.006). However, the small effect size for response time (Cohen's d = 0.202) indicates that this statistical finding is not meaningful for practical purposes.

4.3.3 Multiplication by Gender

Table 11: OZCAAS multiplication results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	6.09	2.892	3.785	2.315	-2.305	<0.001*	0.88
Male Comparison	4.641	2.467	4.129	2.176	-0.512	<0.001*	0.22
Female *QuickSmart*	6.178	2.8	3.953	2.329	-2.225	<0.001*	0.864
Female Comparison	5.429	2.843	4.848	2.725	-0.581	<0.001*	0.209
Accuracy (%)							
Male *QuickSmart*	63.89	21.034	87.972	17.419	24.082	<0.001*	1.247
Male Comparison	79.347	19.202	84.25	16.049	4.903	<0.001*	0.277
Female *QuickSmart*	62.852	21.733	87.847	18.245	24.995	<0.001*	1.246
Female Comparison	73.371	21.254	78.695	19.714	5.324	<0.001*	0.26

These results indicate that males did slightly better than females in response time and females did slightly better than males in accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level (p = 0.648 in response time and 0.403 in accuracy).

4.3.4 Basic Multiplication by Gender

Table 12: OZCAAS Basic multiplication results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.636	2.281	2.133	1.375	-1.503	<0.001*	0.798
Male Comparison	2.561	1.359	2.134	1.026	-0.427	<0.001*	0.355
Female *QuickSmart*	3.722	2.21	2.134	1.171	-1.588	<0.001*	0.898
Female Comparison	2.937	1.877	2.264	1.225	-0.673	<0.001*	0.424
Accuracy (%)							
Male *QuickSmart*	88.821	13.8	97.414	6.158	8.593	<0.001*	0.804
Male Comparison	93.008	14.955	97.947	4.883	4.939	0.001	0.444
Female *QuickSmart*	87.392	17.743	97.721	7.207	10.329	<0.001*	0.763
Female Comparison	94.921	11.132	96.691	8.899	1.77	0.149	0.176

These results indicate that females did slightly better than males in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level (p = 0.523 in response time and 0.099 in accuracy).

4.3.5 Subtraction by Gender

Table 13: OZCAAS subtraction results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.994	2.706	3.128	1.861	-1.866	<0.001*	0.803
Male Comparison	3.498	1.968	3.043	1.661	-0.455	<0.001*	0.25
Female *QuickSmart*	5.956	2.846	3.714	2.209	-2.242	<0.001*	0.88
Female Comparison	4.467	2.347	3.815	1.906	-0.652	<0.001*	0.305
Accuracy (%)							
Male *QuickSmart*	84.34	15.488	95.247	8.97	10.907	<0.001*	0.862
Male Comparison	91.911	9.868	94.261	8.498	2.35	<0.001*	0.255
Female *QuickSmart*	83.266	16.758	95.209	8.674	11.943	<0.001*	0.895
Female Comparison	88.173	13.352	92.028	11.347	3.855	<0.001*	0.311

These results indicate that females did better than males in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.122$) but they are significant in response time ($p < 0.001$). However, the small effect size for response time (Cohen's $d = 0.144$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.6 Basic Subtraction by Gender

Table 14: OZCAAS Basic subtraction results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.559	2.488	2.835	1.592	-1.724	<0.001*	0.825
Male Comparison	2.997	1.265	2.356	0.915	-0.641	<0.001*	0.581
Female *QuickSmart*	5.302	2.847	3.205	1.806	-2.097	<0.001*	0.88
Female Comparison	3.717	1.82	2.919	1.313	-0.798	<0.001*	0.503
Accuracy (%)							
Male *QuickSmart*	87.839	13.999	96.796	6.483	8.957	<0.001*	0.821
Male Comparison	95.104	6.057	96.2	5.348	1.096	0.280	0.192
Female *QuickSmart*	89.706	13.151	97.845	5.64	8.139	<0.001*	0.804
Female Comparison	93.513	9.332	94.172	9.924	0.659	0.585	0.068

These results indicate that males did better than females in accuracy and females did better in response time. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level ($p = 0.095$ in response time and 0.493 in accuracy).

4.3.7 Addition by Gender

Table 15: OZCAAS addition results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.317	1.735	2.189	1.057	-1.128	<0.001*	0.785
Male Comparison	2.341	1.109	2.097	0.977	-0.244	<0.001*	0.234
Female *QuickSmart*	3.656	1.73	2.353	1.103	-1.303	<0.001*	0.898
Female Comparison	2.909	1.448	2.559	1.162	-0.35	<0.001*	0.267
Accuracy (%)							
Male *QuickSmart*	93.756	9.347	98.757	4.124	5.001	<0.001*	0.692
Male Comparison	97.099	6.333	98.213	4.296	1.114	0.003	0.206
Female *QuickSmart*	94.094	9.024	98.968	4.087	4.874	<0.001*	0.696
Female Comparison	96.142	6.706	97.13	5.578	0.988	0.018	0.16

These results indicate that females did better than males in response time and males did better than females in accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.714$) but they are significant in response time ($p = 0.030$). However, the small effect size for response time (Cohen's $d = 0.092$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.8 Basic Addition by Gender

Table 16: OZCAAS basic addition results – all students by gender 2021

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	2.918	1.713	1.895	0.916	-1.023	<0.001*	0.744
Male Comparison	2.034	0.733	1.748	0.59	-0.286	0.003	0.43
Female *QuickSmart*	3.151	1.519	2.004	0.877	-1.147	<0.001*	0.925
Female Comparison	2.263	0.759	1.953	0.742	-0.31	<0.001*	0.413
Accuracy (%)							
Male *QuickSmart*	95.357	8.079	99.083	2.501	3.726	<0.001*	0.623
Male Comparison	98.011	4.29	98.817	3.264	0.806	0.285	0.211
Female *QuickSmart*	95.457	6.518	99.408	2.015	3.951	<0.001*	0.819
Female Comparison	96.585	4.138	98.611	3.597	2.026	0.003	0.523

These results indicate that females did better than males in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in both response time and accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.336$ for response time and 0.707 for accuracy).

4.3.9 Indigenous Students

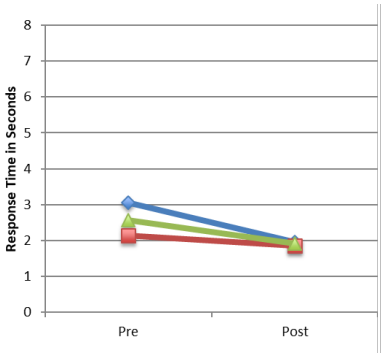
Table 17: OZCAAS results – Indigenous students 2021

Test	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Basic Addition							
Response time (seconds)	2.567	1.1	1.921	0.954	-0.646	<0.001*	0.628
Accuracy (%)	96.964	4.549	99.212	2.121	2.248	<0.001*	0.633
Addition							
Response time (seconds)	3.551	1.966	2.287	1.097	-1.264	<0.001*	0.794
Accuracy (%)	94.26	9.438	98.882	4.357	4.622	<0.001*	0.629
Basic Subtraction							
Response time (seconds)	4.573	2.18	2.931	1.677	-1.642	<0.001*	0.844
Accuracy (%)	92.903	8.35	98.453	3.955	5.55	<0.001*	0.849
Subtraction							
Response time (seconds)	5.675	2.859	3.47	2.076	-2.205	<0.001*	0.883
Accuracy (%)	84.908	15.057	95.191	9.877	10.283	<0.001*	0.808
Basic Multiplication							
Response time (seconds)	3.296	2.077	2.032	0.986	-1.264	<0.001*	0.778
Accuracy (%)	89.603	13.724	97.774	4.988	8.171	<0.001*	0.791
Multiplication							
Response time (seconds)	6.333	2.922	4.058	2.352	-2.275	<0.001*	0.858
Accuracy (%)	65.826	21.291	86.116	18.887	20.290	<0.001*	1.008
Basic Division							
Response time (seconds)	4.846	2.182	3.081	1.57	-1.765	<0.001*	0.928
Accuracy (%)	71.284	28.81	93.931	10.383	22.647	<0.001*	1.046
Division							
Response time (seconds)	6.289	2.835	4.483	2.548	-1.806	<0.001*	0.67
Accuracy (%)	56.324	26.663	80.252	23.49	23.928	<0.001*	0.952

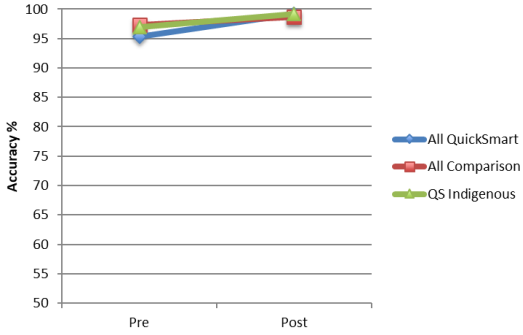
These results indicate that in most instances the Indigenous students' improvement was very similar to that of the overall *QuickSmart* group. For basic addition, addition, and basic subtraction the accuracy results exhibit the ceiling effect (the pre-intervention scores were so high that the students did not have much room for further improvement).

The following graphs illustrate how the Indigenous students (green) have performed in each operation compared to the whole *QuickSmart* group (blue) as well as the comparison students (red).

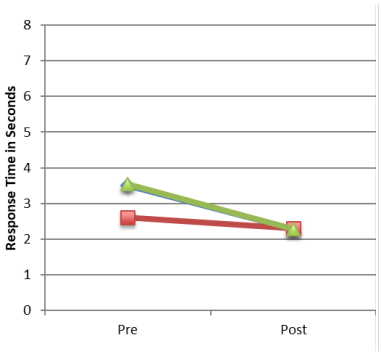
Basic Addition Response Time



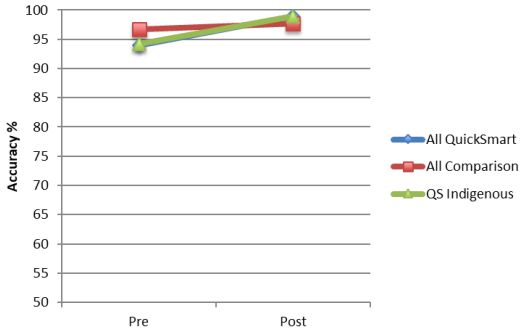
Basic Addition Accuracy



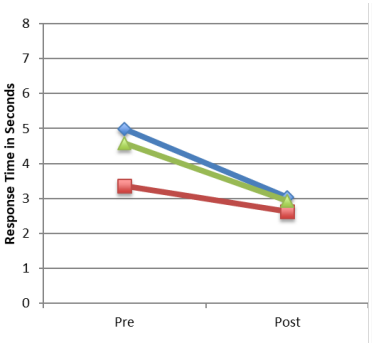
Addition Response Time



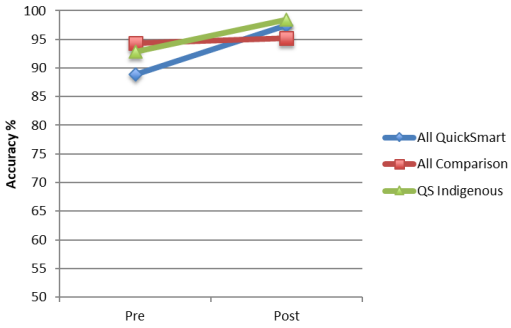
Addition Accuracy



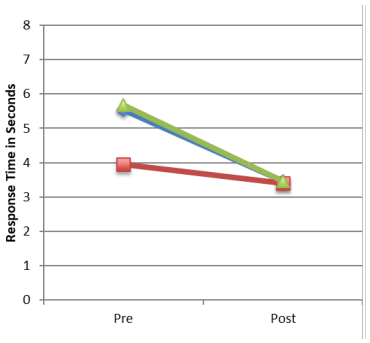
Basic Subtraction Response Time



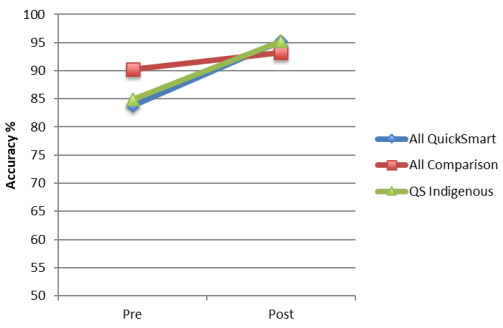
Basic Subtraction Accuracy



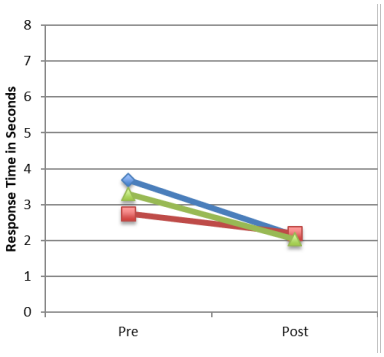
Subtraction Response Time



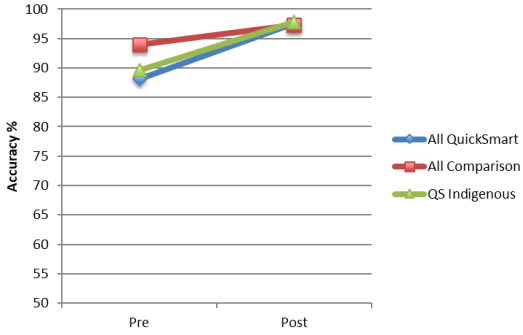
Subtraction Accuracy



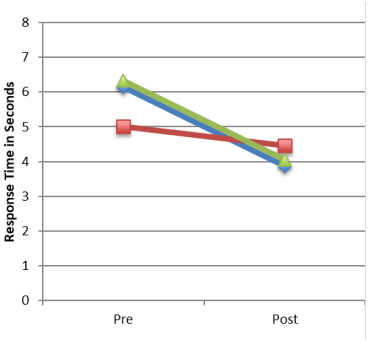
Basic Multiplication Response Time



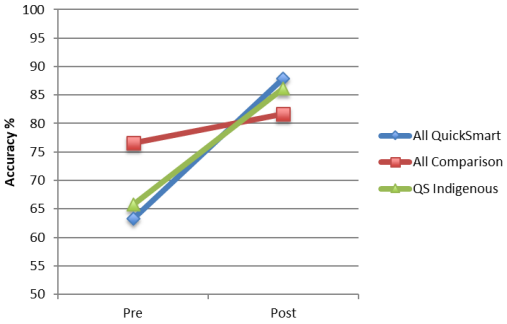
Basic Multiplication Accuracy



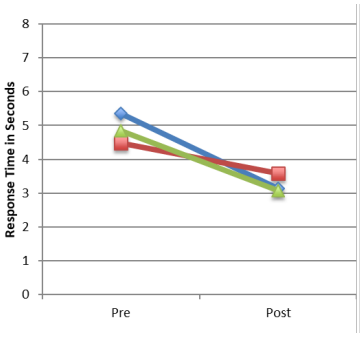
Multiplication Response Time



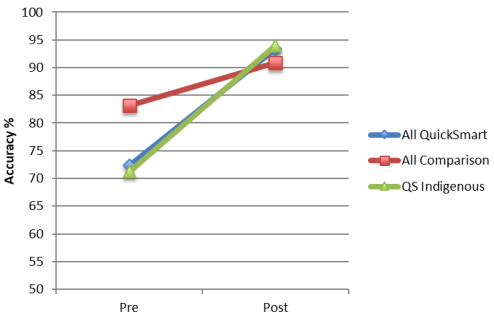
Multiplication Accuracy



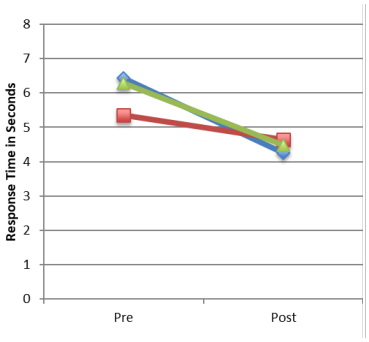
Basic Division Response Time



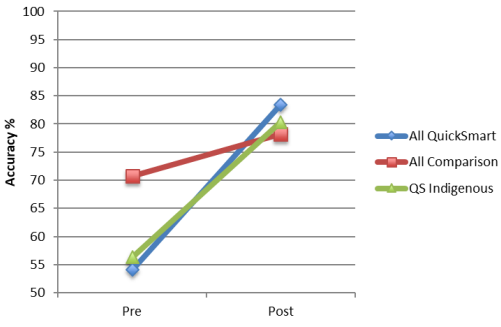
Basic Division Accuracy



Division Response Time



Division Accuracy



4.5 Students Who Were Unable to Complete the Pre-Intervention Test

There were students who instructors confirmed were not able to complete OZCAAS pre-tests. Our advice is not to continue collecting data as doing so would confront these students dramatically with their weaknesses at the beginning of the program.

A mark of the success of *QuickSmart* is that many of these students **did** complete all OZCAAS assessments at the end of the program. These students' results could not be included in the previous analyses and are presented in Table 18 below.

Table 18: OZCAAS results where no pre-test data was available – 2021

	Mean	Std. Deviation
Basic Addition		
Response time (seconds)	2.828	1.665
Accuracy (%)	97.79	4.961
Addition		
Response time (seconds)	2.427	1.15
Accuracy (%)	98.659	6.08
Basic Subtraction		
Response time (seconds)	3.914	2.375
Accuracy (%)	95.574	7.195
Subtraction		
Response time (seconds)	4.165	2.436
Accuracy (%)	94.949	9.325
Basic Multiplication		
Response time (seconds)	2.594	1.247
Accuracy (%)	97.072	4.371
Multiplication		
Response time (seconds)	4.086	2.404
Accuracy (%)	85.181	19.355
Basic Division		
Response time (seconds)	4.17	2.465
Accuracy (%)	93.024	11.237
Division		
Response time (seconds)	4.789	2.952
Accuracy (%)	76.085	25.33

The results in Table 18 are impressive given that these students did not have the skills or confidence to complete the OZCAAS pre-tests. In addition and subtraction, the average response rates were below 4.2 seconds and above 94.5% accuracy. In multiplication and division, the average response times were below 5 seconds and accuracy over 76% at post-test. Even though some of these students may not have progressed to multiplication and division during *QuickSmart* lessons, their results are encouraging. It is likely that part of this improvement may be since:

(i) there has been some mutually beneficial development of the common areas of the brain that process the four operations;

(ii) students' overall improved levels of confidence may have led to a 'have a go attitude' that was not present at the beginning of the *QuickSmart* program;

(iii) students have increased their ability to benefit from classroom instruction.

4.6 Conclusion on OZCAAS Testing

Overall, the *QuickSmart* students showed very strong growth in their understanding and use of number facts. In all four mathematical operations, they either closed the gap between them and the comparison group of average-achieving peers or narrowed this gap to a very small margin. Such growth is critical for these students in their progress in Mathematics as number facts are a vital skill underpinning mathematics functioning in general.

The improvement identified provides the necessary foundation for students to improve in other areas of Mathematics that are not specifically taught in *QuickSmart*. This is because of both direct and indirect aspects of *QuickSmart* lessons.

(i) The direct benefits of automating with understanding the basic arithmetic operations which can be found explicitly or implicitly in many topics in school Mathematics.

(ii) The indirect benefits of deliberate practice in persistence, concentrating on a particular area, working with a peer, clear attainable goals that can be achieved through demonstrated effort, recognising the power and usefulness of learning from mistakes, and the nurturing of an adult who cares and believes in the student and has appropriate high expectations that the student can succeed.

Some small differences between male and female students were observed and some of these results are statistically significant. However, the small effect sizes indicate that these statistical findings are not meaningful for practical purposes. As a result, these data do not warrant further investigation.

It is acknowledged that Indigenous students' improvements were comparable to those of the overall *QuickSmart* group with effect sizes rated very strong to substantial over all operations.

5 Independent Assessments

5.1 Why They are Used

The *QuickSmart* pre- and post-assessments include use of independent tests to demonstrate whether the students can take the basic facts and problem-solving strategies taught in *QuickSmart* and apply these to higher-level mathematical concepts.

5.2 Results on the PATM Assessments

Table 19 reports the paired-samples *t*-tests analysis of the PATM data for all students for whom paired data were available. PATM analyses for individual clusters are provided in an Appendix to this report. (**Note:** Students who were absent at the end of the year were not included in the analysis.)

The PATM Norm Tables were used to convert raw scores from various forms of the PATM to consistent Scale scores, which were used for all subsequent calculations. Two analyses are reported in Table 19. The first analysis presents a calculation of a standard gain score and the significance of this result. The second analysis is an Effect Size calculated from the Means and Standard Deviations on PATM scores for each group. Effect Size statistics indicate the magnitude of the change in academic achievement for the *QuickSmart* and comparison students.

Table 19: PATM results – (Scale scores) 2021

	Average Gain score	Significance	Effect size
All *QuickSmart*	5.951	<0.001*	0.67
All comparison	4.338	<0.001*	0.455

The results indicate a very strong improvement for *QuickSmart* students. This improvement is greater than those recorded for the comparison group of their average-achieving peers.

Table 20 reports the same information as Table 19 but shows a comparison of males and females included in the *QuickSmart* program.

Table 20: PATM results – By Gender (Scale scores) 2021

Gender	Average Gain score	Significance	Effect size
Male			
QuickSmart Students	6.516	<0.001*	0.716
Comparison Students	4.497	<0.001*	0.458
Female			
QuickSmart Students	5.519	<0.001*	0.633
Comparison Students	4.183	<0.001*	0.458

These results indicate that QuickSmart males did better than females in PATM assessment. The results of independent samples *t*-tests of *QuickSmart* students show

that for the ACER PAT results the differences are statistically significant at the 0.01 significance level (p = 0.009). However, the small effect size (Cohen's d = 0.121) indicates that this statistical finding is not meaningful for practical purposes.

Table 21 reports the same information as Table 19 but does so for the scores of Indigenous students included in the *QuickSmart* program.

Table 21: PATM results – Indigenous (Scale scores) 2021

Indigenous students	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	5.731	<0.001*	0.615
All *QuickSmart*	5.951	<0.001*	0.67

Once again, these results show very strong improvement for the Indigenous students who participated in *QuickSmart*. This improvement is slightly smaller than that of the overall *QuickSmart* group.

The following figure shows that the *QuickSmart* students consistently achieve the gains in PAT across the middle-school years targeted by the program, that is Year 4 through to Year 9. The tables of figures for these graphs are available in the Appendices. **Note:** Other grades were excluded from the analyses as they had fewer than 15 QuickSmart students.

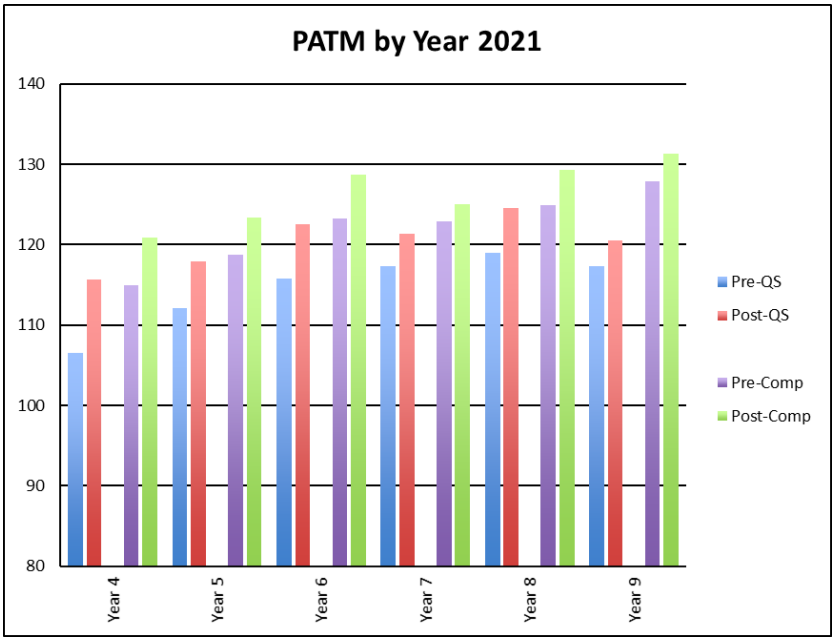


Figure 1: PAT by Year

The following table shows the percentage of *QuickSmart* students that achieved a gain on the PATM results

Table 22: Percentage students with PAT Gain

Student Type	No. of students with gain	No. of students with PATM	Percentage with Gain
QuickSmart	1505	1981	76.0
Indigenous *QuickSmart*	166	226	73.5
Comparison	409	572	71.5

These results show that in the *QuickSmart* group, a greater percentage of students achieved gain in PAT than in the comparison group of their average-achieving peers.

6 Conclusion to Report

The support provided by Schools and Clusters of Schools has been critical in making more positive the hopes and aspirations of students participating in the *QuickSmart* program. This report has focused on both the quantitative and qualitative aspects of the program. In all quantitative analyses, the data report a narrowing of the achievement gap between *QuickSmart* students and their average-performing comparison group peers. Impressive Effect Sizes have been reported with highly significant gains by individual students, some who could not complete the full suite of pre-test assessments.

Additionally, substantial qualitative data (reported in school presentations during professional workshops 2 and 3) indicate that *QuickSmart* students gained a new confidence in the area of Mathematics and learning. Many stories within the corpus of qualitative data document improvements for *QuickSmart* students not only in relation to their performance in class, but also about students' attitudes to their attendance and levels of academic confidence both inside and outside the classroom.

The data collected to date from many thousands of *QuickSmar*t students indicate that the narrowing of the achievement gap between *QuickSmart* and comparison students is more than possible and results record low-achieving students proceeding with their studies more successfully by learning to 'trust their heads' in the same ways that effective learners do. Importantly, previous *QuickSmart* studies (references at https://simerr.une.edu.au/quicksmart/publications/) demonstrate that *QuickSmart* students can maintain the gains made during the program for years after they completed the program, especially if ideas are reinforced in the classroom. Analyses have consistently identified impressive statistically significant end-of-program and longitudinal gains in terms of probability measures and effect sizes that mirror qualitative improvements reported by teachers, paraprofessionals, parents and *QuickSmart* students.

If you have any questions concerning this report or the *QuickSmart* Program please contact us at the SiMERR National Centre at UNE on (02) 6773 5067 or by email on QuickSmart@ une.edu.au.

Professor John Pegg

7 APPENDIX A: Independent Assessment Results

7.1 PAT Results by Region (Scale Scores) 2021

** not included as most students do not have a region defined.

7.2 PAT Results by Demographic (Scale Scores) 2021

Demographic	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**114.542**	**8.692**	**120.493**	**9.061**	**5.951**	**<0.001***	**0.67**
All comparison students	**121.566**	**9.207**	**125.904**	**9.839**	**4.338**	**<0.001***	**0.455**
Indigenous QS Students	113.94	8.907	119.671	9.72	5.731	<0.001*	0.615
Male QS Students	114.137	8.78	120.653	9.411	6.516	<0.001*	0.716
Male comparison students	122.307	9.531	126.804	10.083	4.497	<0.001*	0.458
Female QS Students	114.847	8.633	120.366	8.796	5.519	<0.001*	0.633
Female comparison Students	120.692	8.768	124.875	9.481	4.183	<0.001*	0.458
Male Indigenous QS Students	114.037	8.337	119.95	9.893	5.913	<0.001*	0.646
Female Indigenous QS Students	113.74	9.384	119.364	9.619	5.624	<0.001*	0.592

Note: only students who did both 'pre' and 'post' test are included in the table.

7.3 PAT Results by State (Scale Scores) 2021

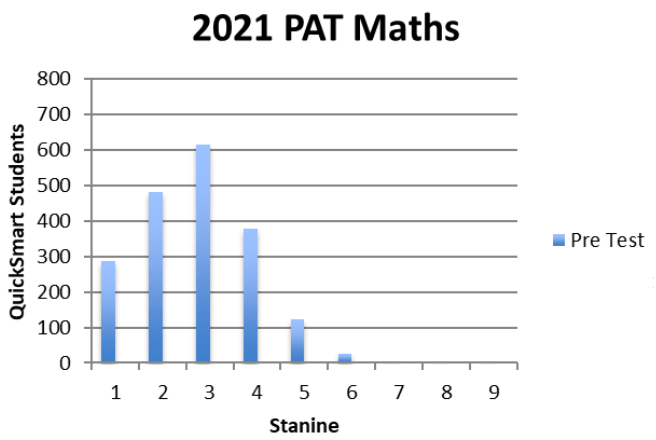
State	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
All *QuickSmart* Students	**114.542**	**8.692**	**120.493**	**9.061**	**5.951**	**<0.001***	**0.67**
All comparison students	**121.566**	**9.207**	**125.904**	**9.839**	**4.338**	**<0.001***	**0.455**
Australian Capital Territory							
QuickSmart							
Indigenous *QuickSmart*							
Comparison							
New South Wales							
QuickSmart	114.879	8.176	121.481	9.248	6.602	<0.001*	0.756
Indigenous *QuickSmart*	114.626	7.897	121.168	9.738	6.542	<0.001*	0.738
Comparison	122.863	10.479	127.049	10.716	4.186	<0.001*	0.395
Northern Territory							
QuickSmart	97.044	8.809	112.728	9.525	15.684	<0.001*	1.71
Indigenous *QuickSmart*							
Comparison							
Queensland							
QuickSmart	116.238	7.66	119.216	7.815	2.978	<0.001*	0.385
Indigenous *QuickSmart*	119.465	5.421	119.2	6.806	-0.265		no improvement
Comparison	122.317	8.104	123.504	9.637	1.187	0.299	0.133
South Australia							
QuickSmart	111.274	9.27	117.161	8.879	5.887	<0.001*	0.649
Indigenous *QuickSmart*	106.42	9.81	112.865	8.93	6.445	<0.001*	0.687
Comparison	118.625	8.136	123.938	8.611	5.313	<0.001*	0.634
Tasmania							
QuickSmart	115.889	9.427	122.593	6.951	6.704	<0.001*	0.809
Indigenous *QuickSmart*	124.967	7.305	122.867	7.22	-2.1		no improvement
Comparison	116.689	8.112	115.522	7.996	-1.167		no improvement
Victoria							
QuickSmart	118.244	6.767	123.486	7.832	5.242	<0.001*	0.716
Indigenous *QuickSmart*	119.617	5.825	123.008	6.235	3.391	0.112	0.562
Comparison	125.114	8.193	129.454	9.575	4.34	<0.001*	0.487
Western Australia							
QuickSmart	117.145	4.865	123.491	5.122	6.346	0.013	1.27
Indigenous *QuickSmart*							
Comparison	118.57	3.868	124.82	6.082	6.25	0.002	1.226

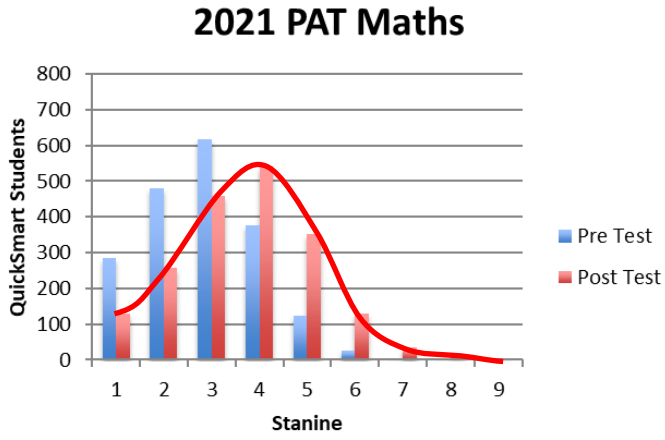
Note: only students who did both 'pre' and 'post' test are included in the table.

7.4 *QuickSmart* Students by Year (Scale Scores) 2021

Year	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
Year 4							
QuickSmart	106.541	8.526	115.652	8.681	9.111	<0.001*	1.059
Indigenous *QuickSmart*	104.762	8.033	116.004	10.624	11.242	<0.001*	1.194
Comparison	114.914	8.517	120.887	8.788	5.973	<0.001*	0.69
Year 5							
QuickSmart	112.066	6.986	117.894	8.877	5.828	<0.001*	0.73
Indigenous *QuickSmart*	112.844	6.978	116.619	9.176	3.775	0.002	0.463
Comparison	118.721	7.988	123.34	9.147	4.619	<0.001*	0.538
Year 6							
QuickSmart	115.803	7.837	122.542	7.569	6.739	<0.001*	0.875
Indigenous *QuickSmart*	114.531	8.677	118.994	10.158	4.463	0.010	0.472
Comparison	123.291	8.322	128.752	9.807	5.461	<0.001*	0.6
Year 7							
QuickSmart	117.33	7.025	121.362	8.26	4.032	<0.001*	0.526
Indigenous *QuickSmart*	117.636	6.135	121.703	7.647	4.067	<0.001*	0.587
Comparison	122.842	7.97	124.978	9.01	2.136	<0.001*	0.251
Year 8							
QuickSmart	118.952	6.525	124.564	7.891	5.612	<0.001*	0.775
Indigenous *QuickSmart*	118.598	7.049	124.033	8.883	5.435	<0.001*	0.678
Comparison	124.943	8.528	129.339	9.834	4.396	<0.001*	0.478
Year 9							
QuickSmart	117.329	9.107	120.539	9.977	3.21	0.027	0.336
Indigenous *QuickSmart*	117.055	7.119	119.373	7.877	2.318	0.456	0.309
Comparison	127.861	13.625	131.294	9.309	3.433	0.216	0.294
All Schools							
QuickSmart	**114.542**	**8.692**	**120.493**	**9.061**	**5.951**	**<0.001***	**0.67**
Indigenous *QuickSmart*	**113.94**	**8.907**	**119.671**	**9.72**	**5.731**	**<0.001***	**0.615**
Comparison	**121.566**	**9.207**	**125.904**	**9.839**	**4.338**	**<0.001***	**0.455**

7.5 PATM Stanine Improvement for *QuickSmart* Students





The Australian Council for Educational Research (ACER) PAT tests use a framework for describing results against national Australian norms. This technique applies stanine scores that divide the population using a scale of 1 to 9.

A stanine score of:

1 represents performance below the bottom 4% of the population
2 represents performance in the lower 5-11% of the population
3 represents performance in the lower 12-23% of the population
4 represents performance in the lower 24-40% of the population
5 represents performance in middle 41-60% of the population
6 represents performance in the higher 61-77% of the population
7 represents performance in the higher 78-88% of the population
8 represents performance in the higher 89-96% of the population
9 represents performance above the top 4% of the population.

It is particularly difficult to move students out of the lower stanine bands. The results above show that *QuickSmart* has been quite successful in moving students into higher bands, as measured by the various PAT.

7.6 PAT Results by Percentile

Demographic	Mean Percentile		
	Pre	Post	Gain
All *QuickSmart*	**18.09**	**30.05**	**11.96**
All Comparison	**33.81**	**43.82**	**10.01**
Indigenous *QuickSmart*	16.78	28.75	11.97
QuickSmart Female	18.81	29.98	11.17
Comparison Female	32.93	42.70	9.77
QuickSmart Male	16.98	30.03	13.05
Comparison Male	34.60	44.89	10.29
Year			
QuickSmart Year 4	23.33	39.89	16.56
Comparison Year 4	43.25	55.06	11.81
QuickSmart Year 5	21.09	33.75	12.66
Comparison Year 5	38.13	49.41	11.28
QuickSmart Year 6	21.19	35.96	14.77
Comparison Year 6	38.34	53.25	14.91
QuickSmart Year 7	15.04	23.58	8.54
Comparison Year 7	27.73	32.66	4.93
QuickSmart Year 8	13.09	24.43	11.34
Comparison Year 8	26.12	35.62	9.50
QuickSmart Year 9	10.70	15.33	4.63
Comparison Year 9	33.61	36.22	2.61
Lessons attended			
<20	19.65	30.55	10.90
21-40	15.88	26.15	10.27
41-60	18.36	30.59	12.23
61-80	18.88	32.19	13.31
80+	19.23	32.53	13.30