quicksmart

Annual Numeracy Program Report

2019

The SiMERR National Research Centre
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1 *QuickSmart* Executive Summary in 2019

Students who experience ongoing failure in upper-primary and lower-secondary school face a myriad of difficulties in pursuing post-school options and 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 experience difficulty with reading and comprehension are particularly vulnerable. These students are usually caught in a cycle of continued failure, as it is particularly difficult to bring about sustainable change within the usual classroom environments for students who by Year 4 are persistently at or below national benchmarks.

Three issues confront schools in Australia with 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 their problems. 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 an underutilised, poorly supported, and seldom recognised resource in school education. With appropriate training these adults are highly motivated, and offer cost-effective, long-term sustainable ways to close the achievement gap for low-achieving students. In remote and rural areas, trained Indigenous teaching assistants (as *QuickSmart* Instructors) are a resource able to enrich their whole community.
3. Educational support programs need to be sustainable in the short- and long-term without large drains on the public purse. Sustainability means cost-efficient, clear exit criteria, proven longitudinal results, documented ongoing benefits for students and instructors, and replicability (including quality assurance) across all regions of Australia.

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.

In 2019, the *QuickSmart* team at the University of New England received matched data from 3,827 students who participated in *QuickSmart* Numeracy lessons and 1,088 average-achieving comparison peers. These students were drawn from schools from 30 regions around Australia.

In terms of the OZCAAS (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 improving to such an extent that there was either no substantial difference between them and the comparison students or 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, that are not specifically taught in *QuickSmart*.

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 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 4.1 seconds and above 93% accuracy. In multiplication and division, the average response times were below 4.1 seconds and accuracy over 87% at post-test. This improvement is most likely due to the fact that:

1. there has been some mutually beneficial development of common areas of the brain that process the four operations;
2. 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
3. students have increased their ability to benefit from classroom instruction.

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. Two 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 not statistically significant at the 0.01 significance level ($p = 0.993$).

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

Overall, the focus of this report is on the quantitative aspects of the program. In all analyses, the data 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.

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. Many stories within the corpus of qualitative data document improvements for *QuickSmart* students not only in relation to their performance in class, but also with regard to students' attitudes to school, their attendance rates and levels of academic confidence both inside and outside the classroom.

The data collected to date from many tens of thousands of *QuickSmar*t students indicate that the narrowing of the achievement gap between *QuickSmart* and comparison students results in 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 demonstrate that *QuickSmart* students can maintain the gains made during the program for years after they completed the program. Analyses have consistently identified 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.

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. These targeted students experience significant and sustained difficulties in basic mathematics and/or literacy, and have a profile of low progress despite attempts to overcome their learning problems. Many such students have not drawn 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 professional learning and support for working in a small-class instructional setting with two students, using 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 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.

The intervention is called *QuickSmart* to encourage students to become *quick* in their response time and *smart* in their understanding and the strategic use of mental and other resources. In *QuickSmart*, the aim is to improve students' information retrieval times to levels that free working-memory capacity from an excessive focus on mundane or routine tasks. In this way, students are able to engage meaningfully with more demanding cognitive activities. In these interventions, automaticity is fostered; time, accuracy and understanding are incorporated as key dimensions of learning; and an emphasis is placed on ensuring maximum student on-task time. *QuickSmart* lessons develop learners' abilities to monitor their academic learning and set realistic goals for themselves.

3 *QuickSmart* Tests — 2019

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, 2016); and
(iii) in terms of gender and participating Indigenous students.

The first set of analyses examine data from response time and accuracy OZCAAS measures, related to arithmetic operations, 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 measured students' response time and accuracy both before *QuickSmart* began and at the end of the program. The tests were:

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 target of *QuickSmart* instruction.

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

The results from these analyses are reported below in separate sections. (Note: Some schools provided data for other independent tests, however, there was insufficient 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 as *QuickSmart* students. The comparison students did the pre-intervention and post-intervention tests but did not receive any *QuickSmart* small-class instruction. It is important to note that the comparison students do not represent a 'true' control group because they do not share the same achievement starting points with the *QuickSmart* students. The former were average-achieving students, the latter were low-achieving students. This point 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.

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 of 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 are sharing *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 years. While this attests to the impact that *QuickSmart* is having in schools, it does not allow a straightforward interpretation of 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 in order 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 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.) This 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 that the result was obtained by chance.

4 Results on the OZCAAS Assessments

4.1 Introduction

In 2019, the *QuickSmart* team at the SiMERR National Research Centre at the University of New England received matched data from 3,827 students who participated in *QuickSmart* Numeracy lessons and 1,088 'average-achieving' comparison peers. These students were drawn from schools from 30 regions around 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 at 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 were 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.

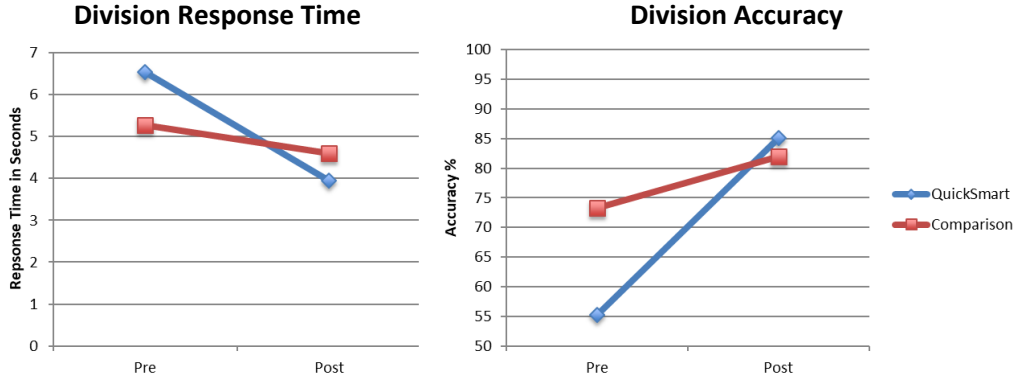
4.2 Combined OZCAAS Analysis

4.2.1 Division

Table 1 below summarises the data submitted for OZCAAS division.

Table 1: OZCAAS division – all students 2019

Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.544	3.074	3.951	2.391	-2.593	<0.001*	0.942
Res Time (secs) Comp	5.277	2.833	4.603	2.488	-0.674	<0.001*	0.253
Accuracy (%) QS	55.247	26.276	85.051	20.197	29.804	<0.001*	1.272
Accuracy (%) Comp	73.290	24.044	81.994	19.128	8.704	<0.001*	0.401



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 2.593 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 which is the desired pattern of improvement.) The effect size for this result is 0.942, which indicates substantial 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 over 29 percentage points, which is a very strong result. The effect size for this result is 1.272, which again indicates substantial improvement for the *QuickSmart* group.

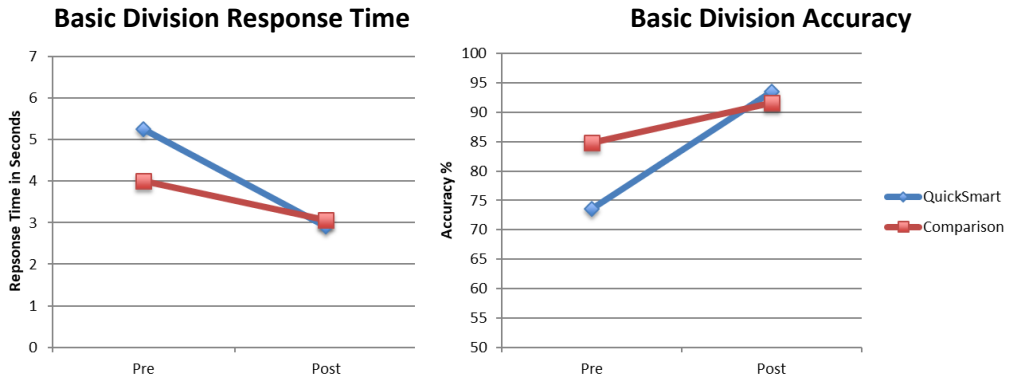
Division is typically (but not always) the final focus of the *QuickSmart* program for students. As a result, a number of students may not reach the lessons that focus on division facts. Interestingly, students still appear to make important gains even if lessons on division had not been undertaken. It appears that there is some residual benefit from other earlier aspects of *QuickSmar*t learning that has been transferred.

In summary, Table 1 shows that when compared to the scores of the comparison students, *QuickSmart* students' 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 2019

Basic Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.254	2.658	2.902	1.853	-2.352	<0.001*	1.027
Res Time (secs) Comp	3.999	2.163	3.058	1.799	-0.941	<0.001*	0.473
Accuracy (%) QS	73.575	24.470	93.553	12.004	19.978	<0.001*	1.037
Accuracy (%) Comp	84.803	20.018	91.575	14.339	6.772	<0.001*	0.389

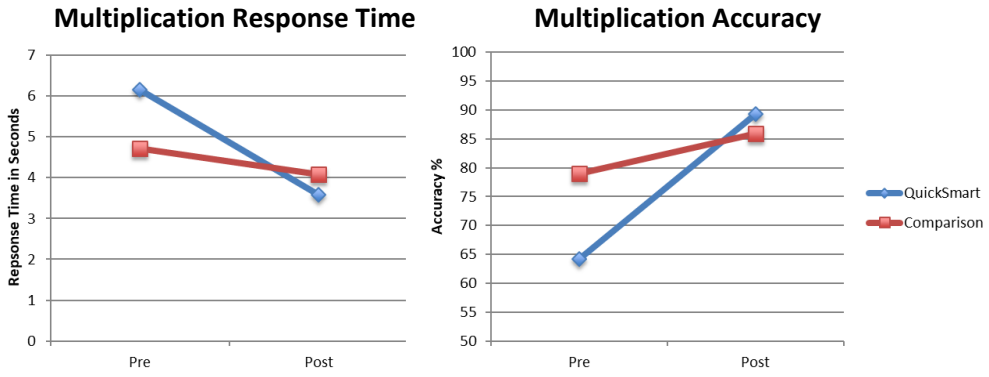


In summary, the results for basic division indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.3 Multiplication

Table 3: OZCAAS multiplication – all students 2019

Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.150	2.815	3.580	2.306	-2.570	<0.001*	0.999
Res Time (secs) Comp	4.716	2.592	4.086	2.260	-0.630	<0.001*	0.259
Accuracy (%) QS	64.267	21.212	89.306	15.871	25.039	<0.001*	1.337
Accuracy (%) Comp	78.934	20.272	85.973	15.965	7.039	<0.001*	0.386

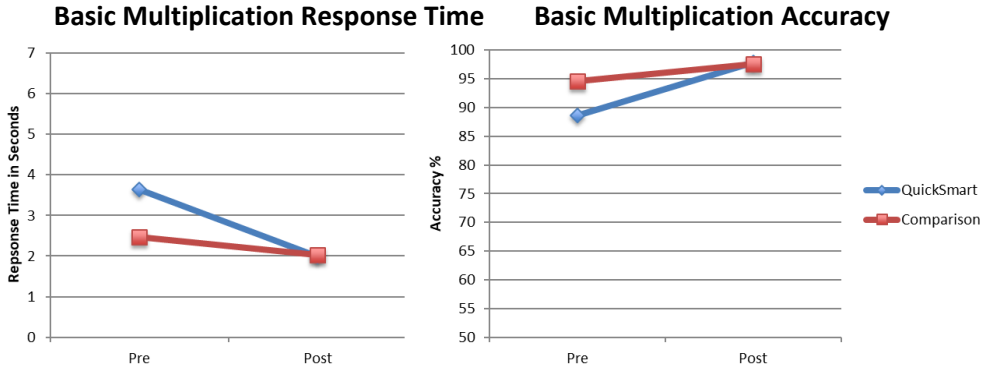


In summary, the results for multiplication indicate a substantial improvement in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a better level of performance than the comparison students.

4.2.4 Basic Multiplication

Table 4: OZCAAS basic multiplication – all students 2019

Basic Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.642	2.179	1.992	1.231	-1.650	<0.001*	0.932
Res Time (secs) Comp	2.469	1.360	2.038	1.483	-0.431	<0.001*	0.303
Accuracy (%) QS	88.610	16.041	97.811	6.305	9.201	<0.001*	0.755
Accuracy (%) Comp	94.643	11.332	97.595	7.253	2.952	<0.001*	0.310

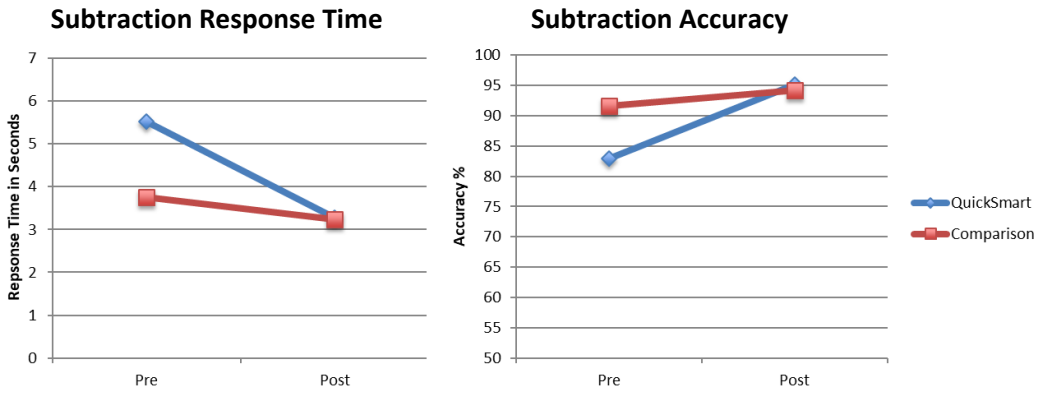


In summary, the results for basic multiplication indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison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

4.2.5 Subtraction

Table 5: OZCAAS subtraction – all students 2019

Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.519	2.746	3.271	1.950	-2.248	<0.001*	0.944
Res Time (secs) Comp	3.758	1.985	3.228	1.639	-0.530	<0.001*	0.291
Accuracy (%) QS	82.959	16.837	95.188	8.846	12.229	<0.001*	0.909
Accuracy (%) Comp	91.663	10.949	94.129	8.458	2.466	<0.001*	0.252

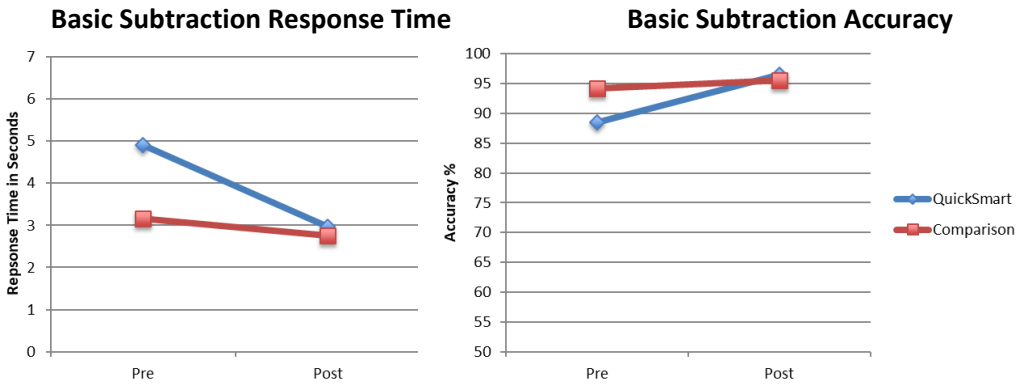


In summary, the results for subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students in accuracy and a similar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

4.2.6 Basic Subtraction

Table 6: OZCAAS basic subtraction – all students 2019

Basic Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	4.910	2.485	2.977	1.791	-1.933	<0.001*	0.892
Res Time (secs) Comp	3.157	1.732	2.762	1.594	-0.395	<0.001*	0.237
Accuracy (%) QS	88.538	13.187	96.517	7.099	7.979	<0.001*	0.753
Accuracy (%) Comp	94.179	9.248	95.484	9.518	1.305	0.042	0.139

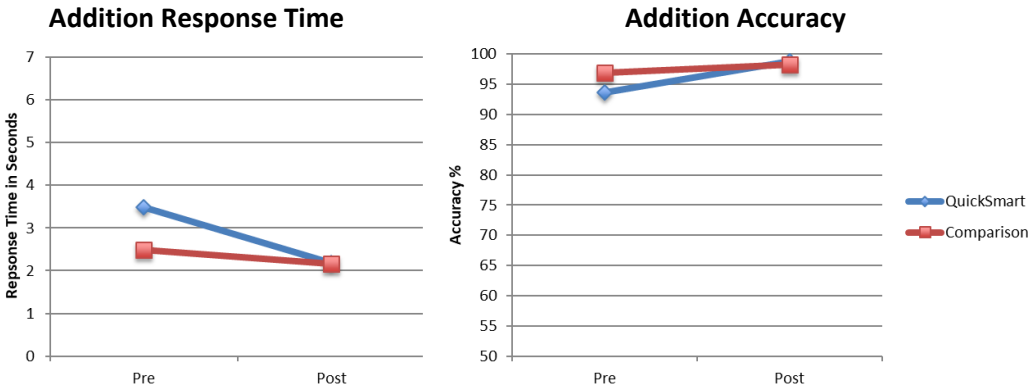


In summary, the results for basic subtraction indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison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

4.2.7 Addition

Table 7: OZCAAS addition – all students 2019

Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.482	1.714	2.178	1.079	-1.304	<0.001*	0.911
Res Time (secs) Comp	2.488	1.289	2.163	1.044	-0.325	<0.001*	0.277
Accuracy (%) QS	93.615	9.768	98.797	3.521	5.182	<0.001*	0.706
Accuracy (%) Comp	96.973	6.276	98.226	4.121	1.253	<0.001*	0.236

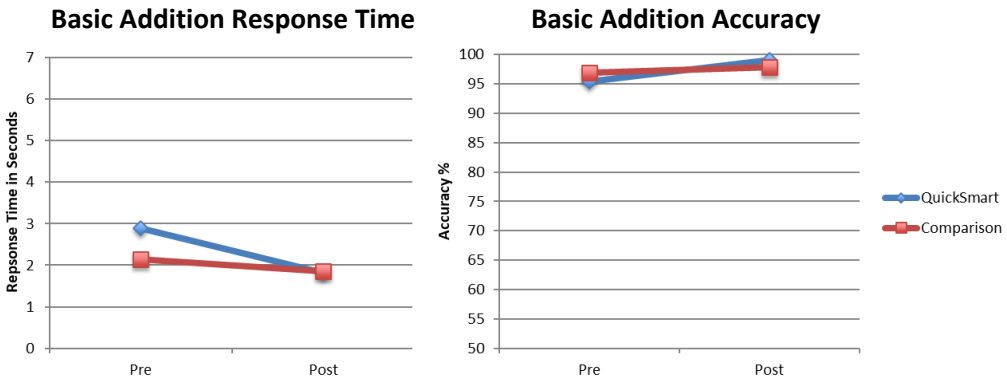


In summary, the results for addition indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students 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 2019

Basic Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	2.901	1.455	1.816	0.824	-1.085	<0.001*	0.918
Res Time (secs) Comp	2.144	1.042	1.856	0.753	-0.288	<0.001*	0.317
Accuracy (%) QS	95.460	7.232	99.109	2.824	3.649	<0.001*	0.665
Accuracy (%) Comp	96.936	6.876	97.895	5.513	0.959	0.021	0.154



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 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	6.434	3.033	3.821	2.308	-2.613	<0.001*	0.970
Male Comparison	5.197	2.609	4.602	2.419	-0.595	<0.001*	0.237
Female *QuickSmart*	6.637	3.106	4.062	2.454	-2.575	<0.001*	0.920
Female Comparison	5.363	3.056	4.603	2.563	-0.760	<0.001*	0.269
Accuracy (%)							
Male *QuickSmart*	56.004	25.605	85.266	19.991	29.262	<0.001*	1.274
Male Comparison	71.305	24.684	81.116	19.757	9.811	<0.001*	0.439
Female *QuickSmart*	54.601	26.826	84.868	20.377	30.267	<0.001*	1.271
Female Comparison	75.411	23.184	82.932	18.410	7.521	<0.001*	0.359

These results indicate that females did better than males in accuracy and males 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 = 0.776 for response time and 0.307 for accuracy).

4.3.2 Basic Division by Gender

Table 10: OZCAAS basic division results – all students by gender 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.989	2.619	2.746	1.731	-2.243	<0.001*	1.011
Male Comparison	4.155	2.283	3.132	2.033	-1.023	<0.001*	0.473
Female *QuickSmart*	5.477	2.672	3.033	1.941	-2.444	<0.001*	1.047
Female Comparison	3.837	2.026	2.982	1.523	-0.855	<0.001*	0.477
Accuracy (%)							
Male *QuickSmart*	75.848	23.536	93.627	12.542	17.779	<0.001*	0.943
Male Comparison	80.572	23.093	90.596	16.577	10.024	<0.001*	0.499
Female *QuickSmart*	71.663	25.087	93.490	11.541	21.827	<0.001*	1.118
Female Comparison	89.192	15.099	92.589	11.547	3.397	0.007	0.253

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 response time the differences are not statistically significant at the 0.01 significance level (p = 0.156) but they are significant in accuracy (p = 0.002). However, the small effect size for accuracy (Cohen's d = 0.178) 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 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	6.050	2.771	3.524	2.329	-2.526	<0.001*	0.987
Male Comparison	4.749	2.540	4.149	2.285	-0.600	<0.001*	0.248
Female *QuickSmart*	6.236	2.851	3.628	2.285	-2.608	<0.001*	1.009
Female Comparison	4.680	2.648	4.020	2.234	-0.660	<0.001*	0.270
Accuracy (%)							
Male *QuickSmart*	64.527	20.860	89.413	15.767	24.886	<0.001*	1.346
Male Comparison	77.571	20.796	84.948	16.811	7.377	<0.001*	0.390
Female *QuickSmart*	64.043	21.514	89.214	15.964	25.171	<0.001*	1.329
Female Comparison	80.377	19.623	87.059	14.961	6.682	<0.001*	0.383

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 = 0.453 in response time and 0.705 in accuracy).

4.3.4 Basic Multiplication by Gender

Table 12: OZCAAS Basic multiplication results – all students by gender 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.467	2.053	1.939	1.194	-1.528	<0.001*	0.910
Male Comparison	2.531	1.486	2.066	1.837	-0.465	0.001*	0.278
Female *QuickSmart*	3.784	2.268	2.035	1.259	-1.749	<0.001*	0.954
Female Comparison	2.406	1.219	2.009	1.003	-0.397	<0.001*	0.355
Accuracy (%)							
Male *QuickSmart*	89.496	15.323	97.737	6.876	8.241	<0.001*	0.694
Male Comparison	93.297	13.399	97.378	9.089	4.081	<0.001*	0.356
Female *QuickSmart*	87.896	16.574	97.871	5.807	9.975	<0.001*	0.803
Female Comparison	96.030	8.539	97.819	4.691	1.789	0.022	0.260

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 these differences are statistically significant at the 0.01 significance level (p = 0.032 for response time and p = 0.046 for accuracy). However, the small effect sizes (Cohen's d = 0.123 for accuracy and 0.114 for response time) indicate that these statistical findings are not meaningful for practical purposes.

4.3.5 Subtraction by Gender

Table 13: OZCAAS subtraction results – all students by gender 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	5.025	2.606	3.074	1.898	-1.951	<0.001*	0.856
Male Comparison	3.456	1.879	2.947	1.536	-0.509	<0.001*	0.297
Female *QuickSmart*	5.920	2.791	3.430	1.977	-2.490	<0.001*	1.029
Female Comparison	4.078	2.045	3.525	1.693	-0.553	<0.001*	0.295
Accuracy (%)							
Male *QuickSmart*	84.043	16.107	95.432	8.544	11.389	<0.001*	0.883
Male Comparison	91.421	11.550	94.319	8.233	2.898	<0.001*	0.289
Female *QuickSmart*	82.079	17.363	94.989	9.082	12.910	<0.001*	0.932
Female Comparison	91.918	10.284	93.929	8.694	2.011	<0.001*	0.211

These results indicate that females did better than males in both response time and accuracy. The independent samples *t*-tests of *QuickSmart* students show that these results are statistically significant at the 0.01 significance level ($p < 0.001$ for response time and 0.008 for accuracy). However, the small effect sizes (Cohen's $d = 0.232$ for response time and 0.094 for accuracy) indicate that these statistical findings are not meaningful for practical purposes.

4.3.6 Basic Subtraction by Gender

Table 14: OZCAAS Basic subtraction results – all students by gender 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.570	2.285	2.846	1.793	-1.724	<0.001*	0.839
Male Comparison	3.185	1.807	2.618	1.406	-0.567	<0.001*	0.350
Female *QuickSmart*	5.200	2.612	3.089	1.783	-2.110	<0.001*	0.944
Female Comparison	3.127	1.653	2.923	1.775	-0.204	0.093	0.119
Accuracy (%)							
Male *QuickSmart*	89.340	13.051	96.440	7.720	7.100	<0.001*	0.662
Male Comparison	92.653	11.360	94.949	11.330	2.296	0.012	0.202
Female *QuickSmart*	87.854	13.276	96.582	6.530	8.728	<0.001*	0.834
Female Comparison	95.895	5.643	96.086	6.957	0.191	0.831	0.030

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 ($p = 0.057$) but they are significant in speed of response ($p = 0.002$). However, the small effect size for response time (Cohen's $d = 0.194$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.7 Addition by Gender

Table 15: OZCAAS addition results – all students by gender 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.332	1.705	2.127	1.140	-1.205	<0.001*	0.831
Male Comparison	2.391	1.355	2.080	1.084	-0.311	<0.001*	0.253
Female *QuickSmart*	3.602	1.713	2.219	1.027	-1.383	<0.001*	0.979
Female Comparison	2.591	1.208	2.251	0.994	-0.340	<0.001*	0.307
Accuracy (%)							
Male *QuickSmart*	93.426	10.249	98.667	4.013	5.241	<0.001*	0.673
Male Comparison	96.791	7.142	98.320	4.170	1.529	<0.001*	0.261
Female *QuickSmart*	93.767	9.363	98.901	3.066	5.134	<0.001*	0.737
Female Comparison	97.165	5.204	98.126	4.071	0.961	<0.001*	0.206

These results indicate that females did better than males in response time and males did better 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 ($p = 0.861$) but they are significant in response time ($p < 0.001$). However, the small effect size for response time (Cohen's $d = 0.122$) 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 2019

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	2.833	1.396	1.805	0.879	-1.028	<0.001*	0.881
Male Comparison	2.211	1.128	1.851	0.801	-0.360	<0.001*	0.368
Female *QuickSmart*	2.959	1.502	1.825	0.774	-1.134	<0.001*	0.949
Female Comparison	2.072	0.943	1.862	0.703	-0.210	0.016	0.252
Accuracy (%)							
Male *QuickSmart*	95.602	7.392	99.128	2.772	3.526	<0.001*	0.632
Male Comparison	95.814	8.748	97.703	6.907	1.889	0.002*	0.240
Female *QuickSmart*	95.339	7.098	99.093	2.870	3.754	<0.001*	0.693
Female Comparison	98.136	3.699	98.101	3.480	-0.035	0.948	0.010

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 ($p = 0.180$ for response time and 0.644 for accuracy).

4.3.9 Indigenous Students

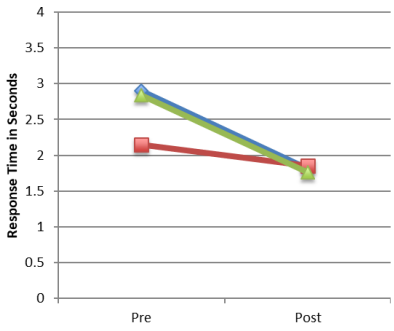
Table 17: OZCAAS results – Indigenous students 2019

Test	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Basic Addition							
Response time (seconds)	2.841	1.127	1.767	0.882	-1.074	<0.001*	1.061
Accuracy (%)	96.699	5.864	99.151	2.462	2.452	<0.001*	0.545
Addition							
Response time (seconds)	3.575	1.854	2.376	1.472	-1.198	<0.001*	0.716
Accuracy (%)	93.612	9.582	97.686	5.633	4.074	<0.001*	0.518
Basic Subtraction							
Response time (seconds)	4.937	2.308	2.938	1.516	-1.998	<0.001*	1.023
Accuracy (%)	89.320	11.888	96.360	7.944	7.040	<0.001*	0.696
Subtraction							
Response time (seconds)	5.751	2.857	3.788	2.226	-1.963	<0.001*	0.767
Accuracy (%)	82.280	15.569	94.165	9.870	11.885	<0.001*	0.912
Basic Multiplication							
Response time (seconds)	3.272	1.659	2.111	1.372	-1.161	<0.001*	0.763
Accuracy (%)	91.088	14.284	97.436	8.584	6.348	<0.001*	0.539
Multiplication							
Response time (seconds)	5.843	2.477	3.895	2.313	-1.948	<0.001*	0.813
Accuracy (%)	65.013	21.075	88.407	14.124	23.394	<0.001*	1.304
Basic Division							
Response time (seconds)	5.278	2.817	2.832	1.660	-2.446	<0.001*	1.058
Accuracy (%)	74.838	20.445	93.477	10.289	18.639	<0.001*	1.152
Division							
Response time (seconds)	6.537	2.949	4.161	2.235	-2.376	<0.001*	0.908
Accuracy (%)	56.790	26.467	84.077	19.530	27.287	<0.001*	1.173

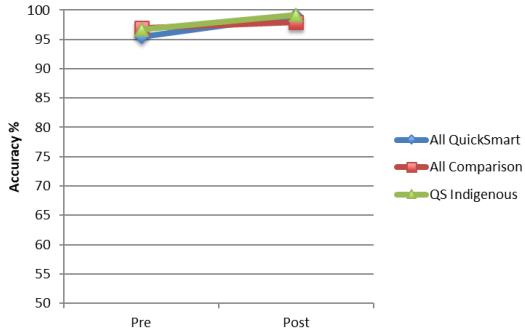
These results indicate that in most instances the Indigenous students' improvement was very similar to that of the overall *QuickSmart* group. For basic addition, addition, and basic multiplication, the accuracy results exhibit the ceiling effect (the pre-intervention scores were so high that the students 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).

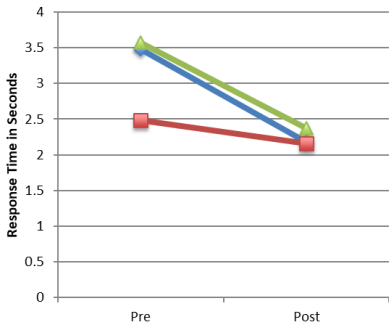
Basic Addition Response Time



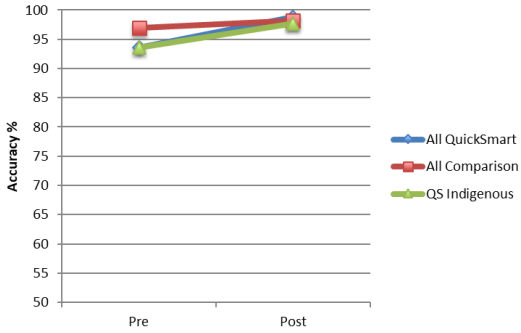
Basic Addition Accuracy



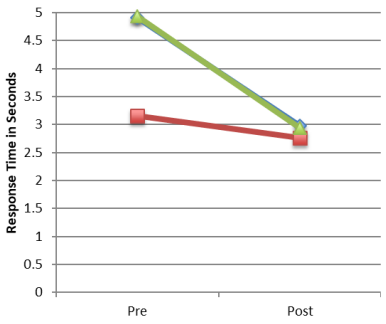
Addition Response Time



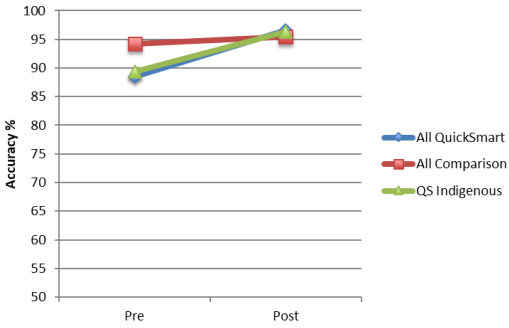
Addition Accuracy



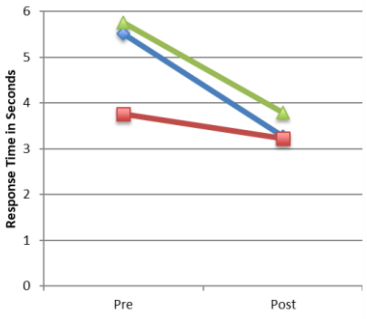
Basic Subtraction Response Time



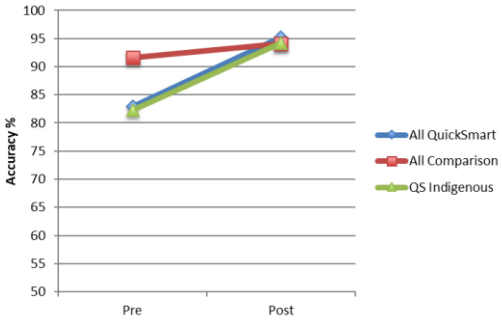
Basic Subtraction Accuracy



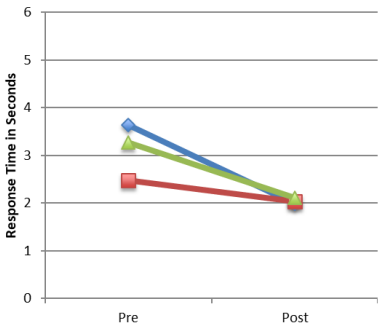
Subtraction Response Time



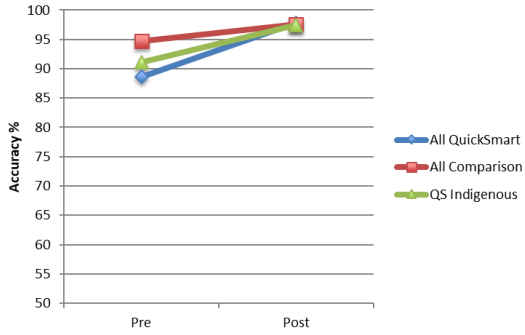
Subtraction Accuracy



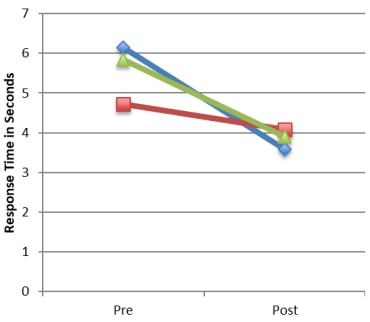
Basic Multiplication Response Time



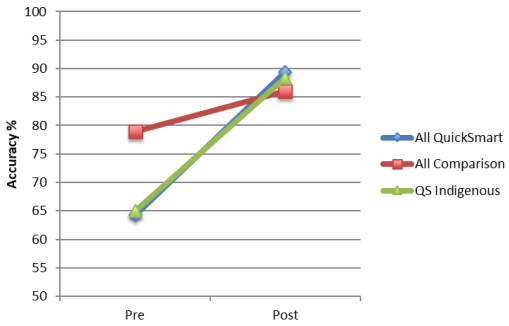
Basic Multiplication Accuracy



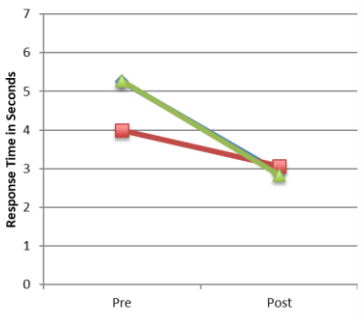
Multiplication Response Time



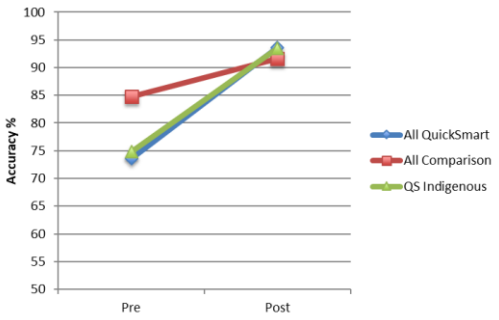
Multiplication Accuracy



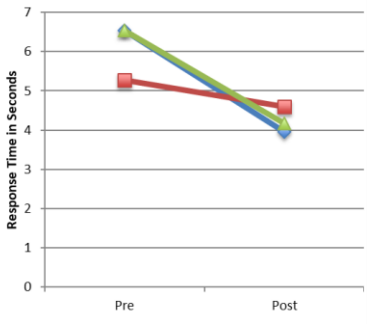
Basic Division Response Time



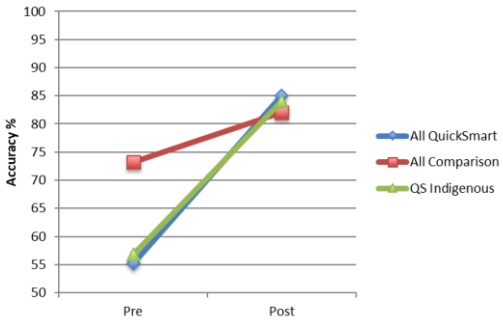
Basic Division Accuracy



Division Response Time



Division Accuracy



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

To complete this section on OZCAAS results, it is important to note that there were students who the instructors confirmed were not able to complete all the OZCAAS pre-tests. In such cases Instructors were advised not to continue collecting data as doing so would have confronted 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 were able to 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 – 2019

	Mean	Std. Deviation
Basic Addition		
Response time (seconds)	2.019	1.013
Accuracy (%)	100	<0.001*
Addition		
Response time (seconds)	2.517	1.086
Accuracy (%)	99.203	2.235
Basic Subtraction		
Response time (seconds)	3.303	1.742
Accuracy (%)	97.818	5.098
Subtraction		
Response time (seconds)	4.093	2.852
Accuracy (%)	93.571	10.775
Basic Multiplication		
Response time (seconds)	2.568	1.612
Accuracy (%)	96.410	7.445
Multiplication		
Response time (seconds)	4.050	2.291
Accuracy (%)	89.274	12.704
Basic Division		
Response time (seconds)	3.246	1.976
Accuracy (%)	93.576	11.012
Division		
Response time (seconds)	3.776	2.288
Accuracy (%)	87.677	18.962

The results in Table 18 are impressive given that these students did not have the skills or confidence to complete the OZCAAS pre-tests initially. In addition and subtraction, the average response rates were below 4.1 seconds and above 93% accuracy. In multiplication and division, the average response times were below 4.1 seconds and accuracy over 87% 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 due to the fact that:

1. there has been some mutually beneficial development of the common areas of the brain that process the four operations;
2. 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
3. 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 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 that are not specifically taught in *QuickSmart*.

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 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 in order to demonstrate whether the students are able to 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) 2019

	Students with paired data	Average Gain score	Significance	Effect size
All *QuickSmart*	2762	6.767	<0.001*	0.704
All comparison	794	4.009	<0.001*	0.416

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) 2019

Gender	Students with paired data	Average Gain score	Significance	Effect size
Male				
QuickSmart Students	1231	6.765	<0.001*	0.700
Comparison Students	399	4.386	<0.001*	0.446
Female				
QuickSmart Students	1531	6.768	<0.001*	0.707
Comparison Students	395	3.629	<0.001*	0.385

These results indicate that QuickSmart females did marginally better than males in PATM assessment. However, the results of independent samples *t*-tests of *QuickSmart* students show that for the ACER PAT results the differences are not statistically significant at the 0.01 significance level ($p = 0.993$).

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) 2019

Indigenous students	Students with paired data	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	267	6.326	<0.001*	0.660
All *QuickSmart*	2762	6.767	<0.001*	0.704

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.

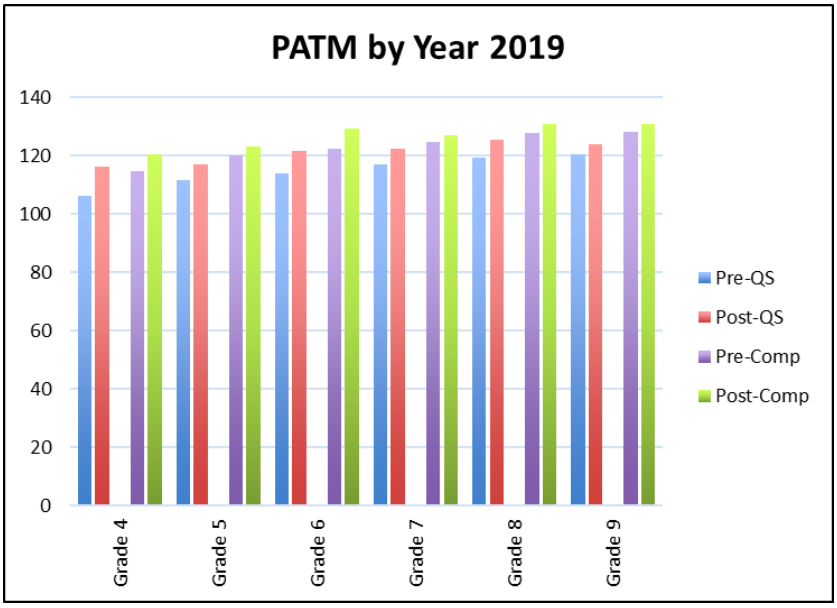


Figure 1: PAT by Year

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	N with gain	N with PATM	Percentage with Gain
QuickSmart	2186	2762	79.1
Indigenous *QuickSmart*	197	267	73.8
Comparison	563	794	70.9

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 the Schools and Clusters has been critical in making more positive the hopes and aspirations of students participating in the *QuickSmart* program. This report has focused on the quantitative aspects of the program. In all 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 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.

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. Many stories within the corpus of qualitative data document improvements for *QuickSmart* students not only in relation to their performance in class, but also with regard to students' attitudes to school, their attendance rates and levels of academic confidence both inside and outside the classroom.

The data collected to date from thousands of *QuickSmar*t students indicate that the narrowing of the achievement gap between *QuickSmart* and comparison students results in 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 http://www.une.edu.au/simerr/quicksmart/pages/qsresearchpublications.php) demonstrate that *QuickSmart* students can maintain the gains made during the program for years after they completed the program. Analyses have consistently identified 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.

If you have any questions concerning this report or *QuickSmart* please contact us at the SiMERR National Centre at UNE on (02) 6773 5067.

Professor John Pegg

7 APPENDIX A: Independent Assessment Results

7.1 PAT Results by Region (Scale Scores) 2019

School Region	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
Adelaide QS Students	110.686	9.699	117.286	8.922	6.600	<0.001*	0.708
Ballarat QS Students	119.908	8.023	125.418	9.346	5.510	<0.001*	0.633
Eyre Peninsula QS Students	108.387	6.787	115.044	8.553	6.657	<0.001*	0.862
Geelong QS Students	121.092	7.124	127.051	10.004	5.959	<0.001*	0.686
Gippsland QS Students	119.350	1.367	123.292	6.561	3.942	0.080	0.832
Goulbourn QS Students	115.252	6.539	118.554	6.806	3.302	0.002	0.495
Horsham QS Students	117.423	7.793	117.957	6.922	0.534	0.660	0.072
Hunter QS Students	112.149	9.678	119.767	12.208	7.618	<0.001*	0.692
Limestone Coast QS Students	110.309	8.321	118.972	9.346	8.663	<0.001*	0.979
Melbourne QS Students	115.108	10.214	122.802	10.754	7.694	<0.001*	0.734
Mid-West QS Students	119.132	7.819	122.573	9.707	3.441	<0.001*	0.390
Mornington QS Students	123.850	2.616	127.100	<0.001*	3.250	0.329	1.757
Murray/Mallee QS Students	112.655	7.743	122.709	8.442	10.054	<0.001*	1.241
New England QS Students	116.972	6.384	126.372	7.070	9.400	<0.001*	1.395
North Coast QS Students	112.259	8.464	121.756	11.059	9.497	<0.001*	0.964
North Tas QS Students	118.086	7.279	121.564	6.013	3.478	0.010	0.521
North West QS Students	113.713	6.136	124.540	10.996	10.827	<0.001*	1.216
Perth QS Students	120.080	3.627	123.560	5.805	3.480	0.058	0.719
Port Augusta QS Students	112.935	7.015	115.341	7.427	2.406	0.173	0.333
Port Pirie QS Students	114.951	7.347	121.531	9.635	6.580	<0.001*	0.768
Queensland QS Students	115.941	6.003	121.760	10.876	5.819	<0.001*	0.662
Remote QS Students	110.624	5.748	113.212	9.373	2.588	0.271	0.333
Riverina QS Students	114.717	8.316	121.667	7.909	6.950	<0.001*	0.856
Southern Sydney QS Students	117.882	5.142	125.794	5.086	7.912	<0.001*	1.547
Sydney QS Students	112.123	9.674	118.912	8.989	6.789	<0.001*	0.727
Warrnambool QS Students	117.766	9.264	123.883	9.756	6.117	<0.001*	0.643
Western QS Students	111.767	9.567	117.558	9.255	5.791	<0.001*	0.615
Western Syd QS Students	110.185	9.713	117.888	8.948	7.703	<0.001*	0.825
Yorke Peninsula/Mid North QS Students	114.580	4.600	119.110	8.557	4.530	0.108	0.659

Note 1: only students who did both 'pre' and 'post' test are included in the table.

7.2 PAT Results by Demographic (Scale Scores) 2019

Demographic	Pre-Intervention		Post-Intervention				
	Mean	**SD**	**Mean**	**SD**	**Gain**	***p***	**Effect size**
All QS Students	**113.788**	**9.187**	**120.555**	**10.019**	**6.767**	**<0.001***	**0.704**
All comparison students	**121.741**	**9.661**	**125.750**	**9.620**	**4.009**	**<0.001***	**0.416**
Indigenous QS Students	111.740	9.031	118.066	10.113	6.326	<0.001*	0.660
Male QS Students	113.676	9.167	120.441	10.130	6.765	<0.001*	0.700
Male comparison students	121.044	9.950	125.430	9.728	4.386	<0.001*	0.446
Female QS Students	113.879	9.206	120.647	9.931	6.768	<0.001*	0.707
Female comparison Students	122.445	9.320	126.074	9.510	3.629	<0.001*	0.385
Male Indigenous QS Students	111.017	9.311	118.189	10.359	7.172	<0.001*	0.728
Female Indigenous QS Students	112.263	8.817	117.976	9.965	5.713	<0.001*	0.607

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

7.3 PAT Results by State (Scale Scores) 2019

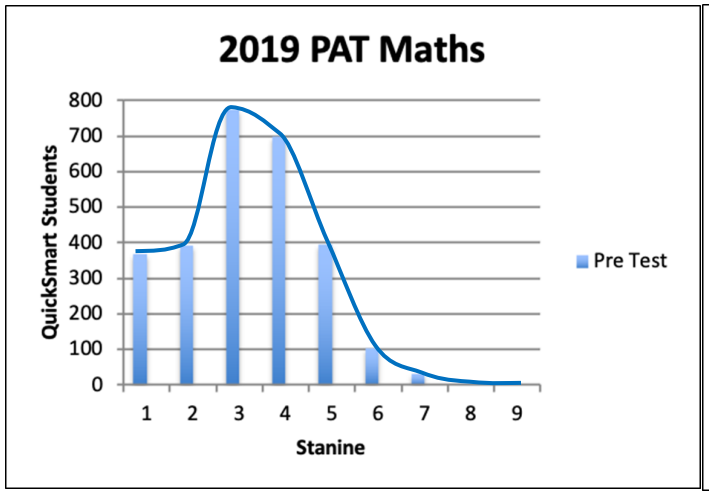
State	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
All *QuickSmart* Students	**113.788**	**9.187**	**120.555**	**10.019**	**6.767**	**<0.001***	**0.704**
All comparison students	**121.741**	**9.661**	**125.750**	**9.620**	**4.009**	**<0.001***	**0.416**
Australian Capital Territory							
QuickSmart							
Indigenous *QuickSmart*							
Comparison							
New South Wales							
QuickSmart	113.152	9.123	120.661	10.128	7.509	<0.001*	0.779
Indigenous *QuickSmart*	111.183	8.850	118.938	10.758	7.755	<0.001*	0.787
Comparison	122.302	9.867	125.972	9.099	3.670	<0.001*	0.387
Northern Territory							
QuickSmart							
Indigenous *QuickSmart*							
Comparison							
Queensland							
QuickSmart	115.941	6.003	121.760	10.876	5.819	<0.001*	0.662
Indigenous *QuickSmart*	118.003	5.142	119.841	7.061	1.838	0.216	0.298
Comparison	121.927	7.848	127.154	8.541	5.227	<0.001*	0.637
South Australia							
QuickSmart	111.024	9.119	117.633	9.082	6.609	<0.001*	0.726
Indigenous *QuickSmart*	109.024	9.839	113.015	7.906	3.991	0.005	0.447
Comparison	119.198	8.144	124.162	8.467	4.964	<0.001*	0.598
Tasmania							
QuickSmart	118.086	7.279	121.564	6.013	3.478	0.010	0.521
Indigenous *QuickSmart*	119.333	2.641	126.967	3.002	7.634	0.021	2.700
Comparison	118.710	5.103	124.930	9.139	6.220	0.051	0.840
Victoria							
QuickSmart	117.545	8.989	123.388	9.887	5.843	<0.001*	0.618
Indigenous *QuickSmart*	112.967	14.530	114.433	6.062	1.466	0.811	0.132
Comparison	123.950	10.806	127.051	11.180	3.101	<0.001*	0.282
Western Australia							
QuickSmart	120.080	3.627	123.560	5.805	3.480	0.058	0.719
Indigenous *QuickSmart*							
Comparison	118.709	8.812	120.482	8.257	1.773	0.532	0.208

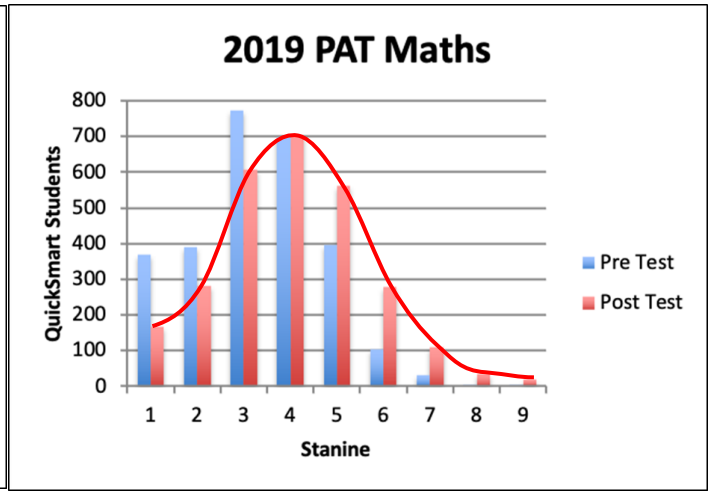
Note: only students who did both 'pre' and 'post' test are included in the table.

7.4 *QuickSmart* Students by Year (Scale Scores) 2019

Year	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
Year 4							
QuickSmart	106.321	9.408	116.352	10.447	10.031	<0.001*	1.009
Indigenous *QuickSmart*	103.251	6.975	114.076	10.001	10.825	<0.001*	1.256
Comparison	114.628	9.794	120.589	9.482	5.961	<0.001*	0.618
Year 5							
QuickSmart	111.687	7.967	117.174	9.151	5.487	<0.001*	0.640
Indigenous *QuickSmart*	108.669	7.242	114.618	8.298	5.949	<0.001*	0.764
Comparison	120.254	9.147	123.123	8.936	2.869	<0.001*	0.317
Year 6							
QuickSmart	114.177	7.705	121.658	8.548	7.481	<0.001*	0.919
Indigenous *QuickSmart*	112.935	9.754	119.442	10.428	6.507	<0.001*	0.644
Comparison	122.619	8.375	129.438	7.722	6.819	<0.001*	0.847
Year 7							
QuickSmart	117.005	7.665	122.612	9.796	5.607	<0.001*	0.638
Indigenous *QuickSmart*	114.656	7.153	119.260	10.307	4.604	<0.001*	0.519
Comparison	124.819	8.334	127.155	8.991	2.336	<0.001*	0.269
Year 8							
QuickSmart	119.213	7.480	125.696	8.678	6.483	<0.001*	0.800
Indigenous *QuickSmart*	118.426	7.725	124.449	8.104	6.023	<0.001*	0.761
Comparison	127.723	9.164	130.911	11.347	3.188	0.006	0.309
Year 9							
QuickSmart	120.683	6.917	123.914	8.487	3.231	0.009	0.417
Indigenous *QuickSmart*	117.733	13.395	121.500	14.022	3.767	0.299	0.275
Comparison	128.090	6.164	130.800	4.936	2.710	0.104	0.485
All Schools							
QuickSmart	**113.788**	**9.187**	**120.555**	**10.019**	**6.767**	**<0.001***	**0.704**
Indigenous *QuickSmart*	**111.740**	**9.031**	**118.066**	**10.113**	**6.326**	**<0.001***	**0.660**
Comparison	**121.741**	**9.661**	**125.750**	**9.620**	**4.009**	**<0.001***	**0.416**

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 4-10% of the population
3 represents performance in the lower 11-22% of the population
4 represents performance in the lower 23-39% of the population
5 represents performance in middle 40-59% of the population
6 represents performance in the higher 60-76% of the population
7 represents performance in the higher 77-88% 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*	**24.88**	**34.84**	**9.96**
All Comparison	**45.57**	**49.24**	**3.67**
Indigenous *QuickSmart*	19.08	28.59	9.51
QuickSmart Female	24.92	34.58	9.66
Comparison Female	46.71	49.13	2.42
QuickSmart Male	24.83	35.16	10.33
Comparison Male	44.44	49.34	4.90
Year			
QuickSmart Year 4	27.00	41.58	14.58
Comparison Year 4	54.37	57.33	2.96
QuickSmart Year 5	28.70	33.75	5.05
Comparison Year 5	52.48	51.79	-0.69
QuickSmart Year 6	25.27	35.84	10.57
Comparison Year 6	45.38	55.82	10.44
QuickSmart Year 7	23.03	32.06	9.03
Comparison Year 7	36.67	40.19	3.52
QuickSmart Year 8	20.00	33.26	13.26
Comparison Year 8	39.92	43.21	3.29
QuickSmart Year 9	16.51	21.26	4.75
Comparison Year 9	29.50	31.60	2.10
Lessons attended			
<=20	34.89	39.94	5.05
21-40	24.64	32.81	8.17
41-60	23.49	32.52	9.03
61-80	24.73	36.29	11.56
80+	26.86	38.13	11.27