SiMERR National Research Centre

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University of New England

Annual Numeracy Program Report 2015

The SiMERR National Research Centre
The University of New England
ARMIDALE NSW

quicksmart

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1 *QuickSmart* Executive Summary in 2015

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 replicable (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, 2005). 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 the participating Indigenous students.

In 2015, the *QuickSmart* team at the University of New England received data from 7028 students who participated in *QuickSmart* Numeracy lessons and 1627 average-achieving comparison peers. These students were drawn from schools from 33 regions around Australia. Further data were also submitted for independent analysis to the Northern Territory (NT) Department of Education and Training by NT schools.

In terms of the OZCAAS (a random number computer generated testing approach that measures the time 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 speed. The diagrammatic evidence illustrate that the *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 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 that are not specifically taught in *QuickSmart*.

Some small differences between male and female students were observed. Females performed slightly better in most operations 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 lower starting and finishing points in most operations but their overall improvement in terms of effect size is rated strong to substantial over all operations.

A mark of the success of *QuickSmart* is the results of those students, who did not succeed in completing the pre-test. 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. These students did manage to complete all OZCAAS assessments at the end of the program.

The results for this cohort 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 3.9 seconds and above 91% accuracy. In multiplication and division the average response speeds were below 4.8 seconds and accuracy over 78% at post-test. This improvement is most likely due to:

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

In the case of the ACER PATM tests, Norm Tables (2005) 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 results of independent sample *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 ($p = 0.395$).

Once again, these results show substantial improvement for the Indigenous students who participated in *QuickSmart*. This improvement is greater 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 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 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 speed 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 — 2015

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 gender and participating Indigenous students.

The first set of analyses examine data from speed 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' speed 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 an even 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 2015, the *QuickSmart* team at the SiMERR National Research Centre at the University of New England received matched data from 7028 students who participated in *QuickSmart* Numeracy lessons and 1627 average-achieving comparison peers. These students were drawn from schools from 33 regions around Australia. Further data were also submitted for independent analysis to the Northern Territory (NT) Department of Education and Training by NT schools.

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.

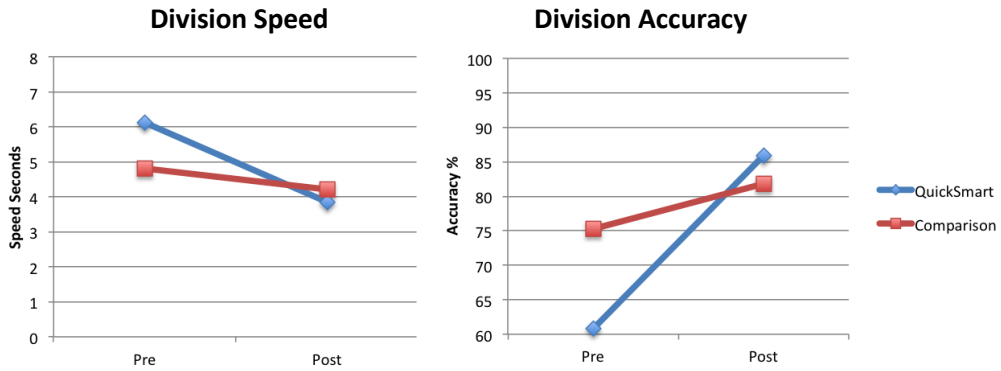
4.2 Combined OZCAAS Analysis

4.2.1 Division

Table 1 below summarises the data submitted for OZCAAS division.

Table 1: OZCAAS division – all students 2015

Division	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	3671	6.114	3.024	3.856	2.412	-2.258	<0.001*	0.826
Speed (secs) Comp	991	4.822	2.674	4.206	2.428	-0.616	<0.001*	0.241
Accuracy (%) QS	3671	60.834	26.093	85.893	18.994	25.059	<0.001*	1.098
Accuracy (%) Comp	991	75.253	23.122	81.819	20.450	6.566	<0.001*	0.301



On the division test, there were paired data for 3671 *QuickSmart* students and 991 comparison students. The desired criterion for response speed on the OZCAAS assessments is between 1

and 2 seconds as an indication of automaticity. The decrease in time for *QuickSmart* students is 2.258 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 0.826, 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 three years' growth.

In terms of accuracy, the *QuickSmart* students' average scores have improved by over 25 percentage points, which is a very strong result. The effect size for this result is 1.098, which again indicates substantial improvement for the *QuickSmart* group.

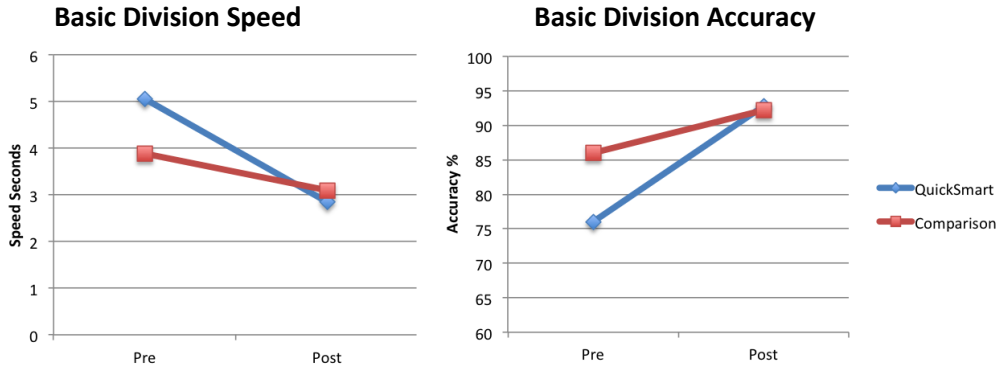
Division is typically (but not always) the final focus of the *QuickSmart* program for students. As a result a number of students may not reach the lessons that focus on division facts. Interestingly, students still appear to make important gains even if lessons on division had not been undertaken. It 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 speed and accuracy. The diagrams illustrate that *QuickSmart* students improved to reach slightly better levels than their comparison average-achieving peers.

4.2.2 Basic Division

Table 2: OZCAAS basic division – all students 2015

Basic Division	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	1833	5.057	2.625	2.846	1.774	-2.211	<0.001*	0.987
Speed (secs) Comp	354	3.885	2.167	3.100	1.778	-0.785	<0.001*	0.396
Accuracy (%) QS	1833	76.046	22.347	92.770	11.916	16.724	<0.001*	0.934
Accuracy (%) Comp	354	85.997	16.351	92.212	10.044	6.215	<0.001*	0.458

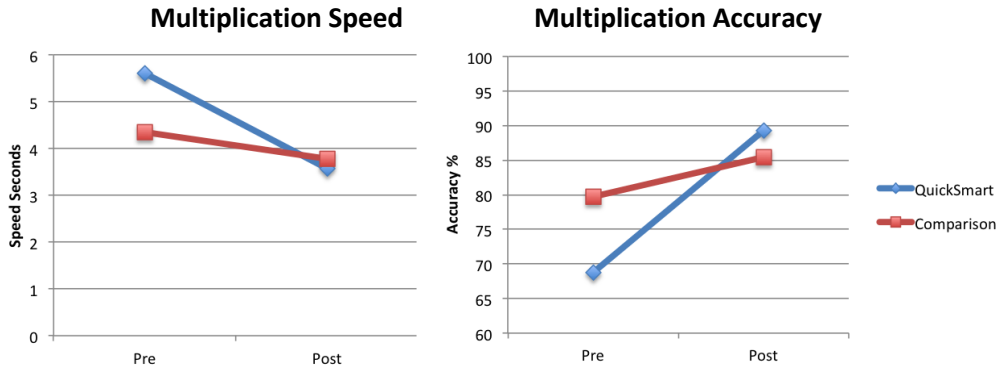


In summary, the results for basic division indicate a substantial improvement for the *QuickSmart* students in both speed and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.3 Multiplication

Table 3: OZCAAS multiplication – all students 2015

Multiplication	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	4382	5.616	2.783	3.571	2.292	-2.045	<0.001*	0.802
Speed (secs) Comp	1092	4.353	2.520	3.783	2.138	-0.570	<0.001*	0.244
Accuracy (%) QS	4382	68.804	21.948	89.324	15.224	20.52	<0.001*	1.086
Accuracy (%) Comp	1092	79.736	19.741	85.459	16.582	5.723	<0.001*	0.314

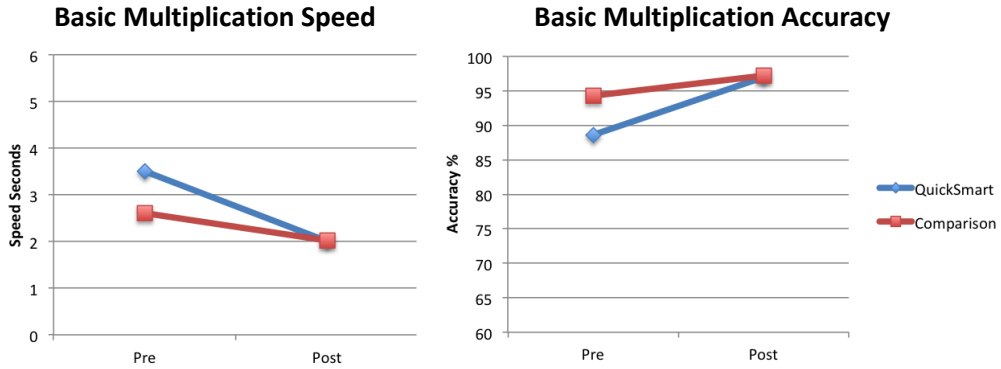


In summary, the results for multiplication indicate a substantial improvement in both speed and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.4 Basic Multiplication

Table 4: OZCAAS basic multiplication – all students 2015

Basic Multiplication	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	1992	3.513	1.996	2.008	1.202	-1.505	<0.001*	0.913
Speed (secs) Comp	377	2.615	1.549	2.022	1.083	-0.593	<0.001*	0.443
Accuracy (%) QS	1992	88.628	14.672	96.925	7.674	8.297	<0.001*	0.709
Accuracy (%) Comp	377	94.257	10.072	97.176	5.190	2.919	<0.001*	0.364

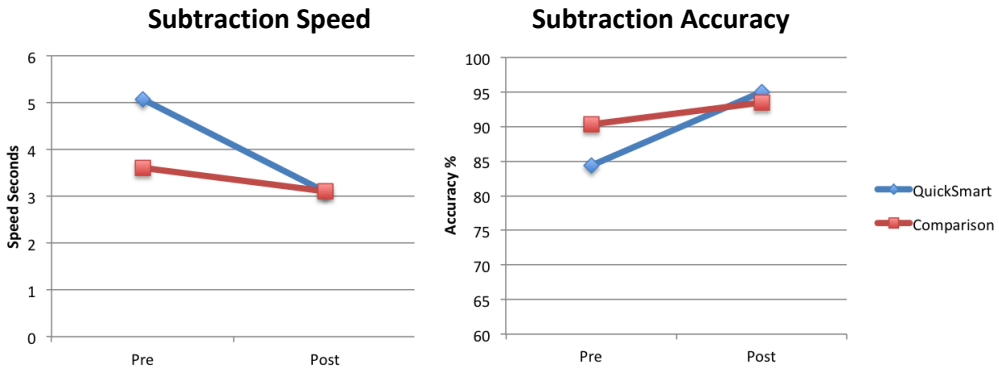


In summary, the results for basic multiplication indicate a substantial improvement for the *QuickSmart* students in speed and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them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

4.2.5 Subtraction

Table 5: OZCAAS subtraction – all students 2015

Subtraction	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	4993	5.077	2.636	3.101	1.844	-1.976	<0.001*	0.869
Speed (secs) Comp	1197	3.610	2.098	3.102	1.825	-0.508	<0.001*	0.258
Accuracy (%) QS	4993	84.383	15.722	94.977	9.070	10.594	<0.001*	0.825
Accuracy (%) Comp	1197	90.298	12.610	93.423	10.469	3.125	<0.001*	0.270

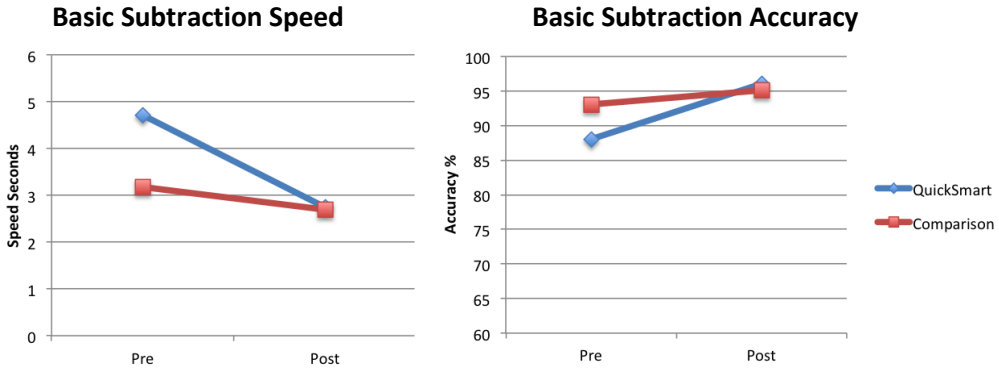


In summary, the results for subtraction indicate a substantial improvement for the *QuickSmart* students in both speed and accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students.

4.2.6 Basic Subtraction

Table 6: OZCAAS basic subtraction – all students 2015

Basic Subtraction	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	2149	4.714	2.494	2.744	1.590	-1.97	<0.001*	0.942
Speed (secs) Comp	414	3.185	1.910	2.689	1.473	-0.496	<0.001*	0.291
Accuracy (%) QS	2149	88.050	13.201	96.033	7.589	7.983	<0.001*	0.741
Accuracy (%) Comp	414	93.068	9.966	95.164	6.723	2.096	<0.001*	0.247

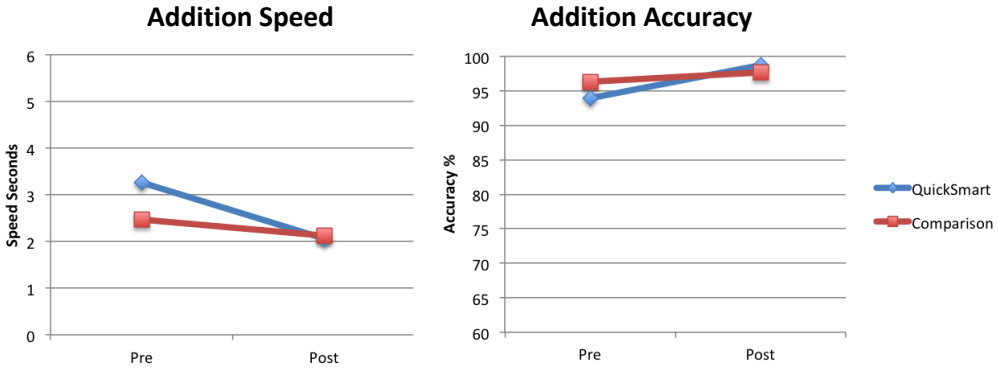


In summary, the results for basic subtraction indicate a substantial improvement for the *QuickSmart* students in speed and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and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

4.2.7 Addition

Table 7: OZCAAS addition – all students 2015

Addition	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	5294	3.271	1.661	2.064	0.941	-1.207	<0.001*	0.894
Speed (secs) Comp	1219	2.464	1.320	2.125	1.078	-0.339	<0.001*	0.281
Accuracy (%) QS	5294	93.901	8.881	98.679	3.877	4.778	<0.001*	0.697
Accuracy (%) Comp	1219	96.320	7.012	97.686	4.865	1.366	<0.001*	0.226

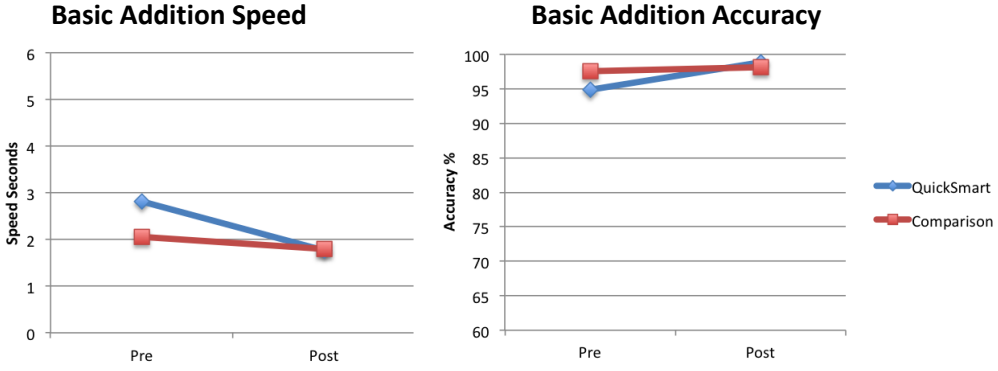


In summary, the results for addition indicate a substantial improvement for the *QuickSmart* students in speed and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students. 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 2015

Basic Addition	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Speed (secs) QS	2162	2.821	1.48	1.766	0.94	-1.055	<0.001*	0.85
Speed (secs) Comp	412	2.054	1.017	1.791	0.760	-0.263	<0.001*	0.293
Accuracy (%) QS	2162	94.883	8.273	98.866	3.017	3.983	<0.001*	0.64
Accuracy (%) Comp	412	97.551	4.472	98.124	4.042	0.573	<0.001*	0.134



In summary, the results for basic addition indicate a very strong improvement for the *QuickSmart* students in accuracy and a substantial improvement in speed. 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 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1788	5.897	2.951	3.782	2.419	-2.115	<0.001*	0.784
Male COMP (speed)	506	4.691	2.575	4.038	2.151	-0.653	<0.001*	0.275
Female QS (speed)	1883	6.320	3.078	3.926	2.404	-2.394	<0.001*	0.867
Female COMP (speed)	212	2.116	1.102	1.820	0.762	-0.295	<0.001*	0.312
Male QS (accuracy)	1788	61.915	25.713	86.120	18.694	24.205	<0.001*	1.077
Male COMP (accuracy)	506	75.186	23.774	81.730	20.422	6.544	<0.001*	0.295
Female QS (accuracy)	1883	59.807	26.415	85.677	19.278	25.870	<0.001*	1.119
Female COMP (accuracy)	212	97.450	4.667	97.975	4.243	0.525	<0.001*	0.118

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.031$) but they are significant in speed ($p = 0.007$). However, the small effect size for speed (Cohen's $d = 0.089$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.2 Basic Division by Gender

Table 10: OZCAAS basic division results – all students by gender 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	818	4.749	2.429	2.711	1.685	-2.038	<0.001*	0.975
Male COMP (speed)	177	3.698	1.908	3.100	1.743	-0.598	<0.001*	0.327
Female QS (speed)	1015	5.305	2.749	2.955	1.836	-2.351	<0.001*	1.006
Female COMP (speed)	177	4.071	2.389	3.100	1.817	-0.971	<0.001*	0.458
Male QS (accuracy)	818	77.653	21.407	93.144	11.246	15.491	<0.001*	0.906
Male COMP (accuracy)	177	86.464	15.940	92.234	10.320	5.770	<0.001*	0.430
Female QS (accuracy)	1015	74.751	23.006	92.469	12.427	17.718	<0.001*	0.958
Female COMP (accuracy)	177	85.531	16.784	92.189	9.789	6.658	<0.001*	0.485

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.015$) but they are

significant in speed (p = 0.006). However, the small effect size for speed (Cohen's d = 0.127) 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 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	2130	5.448	2.755	3.511	2.301	-1.936	<0.001*	0.763
Male COMP (speed)	557	4.210	2.328	3.679	2.012	-0.531	<0.001*	0.244
Female QS (speed)	2252	5.775	2.801	3.628	2.283	-2.147	<0.001*	0.840
Female COMP (speed)	535	4.502	2.700	3.892	2.258	-0.610	<0.001*	0.245
Male QS (accuracy)	2130	69.329	22.020	89.690	15.139	20.361	<0.001*	1.078
Male COMP (accuracy)	557	79.851	19.475	85.362	16.701	5.511	<0.001*	0.304
Female QS (accuracy)	2252	68.307	21.872	88.979	15.301	20.672	<0.001*	1.095
Female COMP (accuracy)	535	79.616	20.031	85.559	16.473	5.943	<0.001*	0.324

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level (p = 0.604) but they are significant in speed (p = 0.010). However, the small effect size for speed (Cohen's d = 0.077) indicates that this statistical finding is not meaningful for practical purposes.

4.3.4 Basic Multiplication by Gender

Table 12: OZCAAS Basic multiplication results – all students by gender 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	885	3.369	1.892	1.955	1.170	-1.414	<0.001*	0.899
Male COMP (speed)	184	2.606	1.393	2.002	0.982	-0.604	<0.001*	0.501
Female QS (speed)	1107	3.628	2.070	2.051	1.226	-1.577	<0.001*	0.927
Female COMP (speed)	193	2.623	1.688	2.041	1.173	-0.582	<0.001*	0.400
Male QS (accuracy)	885	88.860	14.742	97.053	7.883	8.193	<0.001*	0.693
Male COMP (accuracy)	184	94.714	8.139	97.336	5.702	2.622	<0.001*	0.373
Female QS (accuracy)	1107	88.443	14.620	96.823	7.505	8.380	<0.001*	0.721
Female COMP (accuracy)	193	93.822	11.626	97.024	4.659	3.202	<0.001*	0.362

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in both speed and accuracy the differences are not statistically significant at the 0.01 significance level (p = 0.034 for speed and 0.765 for accuracy).

4.3.5 Subtraction by Gender

Table 13: OZCAAS subtraction results – all students by gender 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	2364	4.561	2.376	2.895	1.743	-1.666	<0.001*	0.800
Male COMP (speed)	611	3.346	1.992	2.843	1.670	-0.503	<0.001*	0.274
Female QS (speed)	2629	5.541	2.770	3.286	1.912	-2.254	<0.001*	0.947
Female COMP (speed)	586	3.884	2.171	3.372	1.939	-0.513	<0.001*	0.249
Male QS (accuracy)	2364	85.465	15.062	94.995	9.227	9.530	<0.001*	0.763
Male COMP (accuracy)	611	90.891	12.353	93.910	9.917	3.019	<0.001*	0.270
Female QS (accuracy)	2629	83.411	16.235	94.961	8.929	11.550	<0.001*	0.882
Female COMP (accuracy)	586	89.679	12.853	92.915	11.000	3.236	<0.001*	0.271

These results indicate that females did better than males in both speed and accuracy. The independent sample *t*-tests of *QuickSmart* students show that these results are statistically significant at the 0.01 significance level ($p < 0.001$ for speed and $p < 0.001$ in accuracy). However, the small effect sizes (Cohen's $d = 0.265$ for speed and 0.136 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 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	978	4.409	2.408	2.647	1.576	-1.762	<0.001*	0.866
Male COMP (speed)	201	2.971	1.690	2.569	1.393	-0.402	<0.001*	0.260
Female QS (speed)	1171	4.969	2.537	2.824	1.597	-2.145	<0.001*	1.012
Female COMP (speed)	213	3.386	2.080	2.802	1.539	-0.584	<0.001*	0.319
Male QS (accuracy)	978	88.419	13.142	96.044	8.118	7.625	<0.001*	0.698
Male COMP (accuracy)	201	93.139	8.354	95.030	6.920	1.891	<0.001*	0.247
Female QS (accuracy)	1171	87.742	13.247	96.024	7.120	8.282	<0.001*	0.779
Female COMP (accuracy)	213	93.000	11.297	95.291	6.546	2.291	<0.001*	0.248

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.292$) but they are significant in speed ($p < 0.001$). However, the small effect size for speed (Cohen's $d = 0.190$) 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 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	2494	3.076	1.583	2.001	0.943	-1.075	<0.001*	0.825
Male COMP (speed)	621	2.362	1.240	2.004	1.001	-0.359	<0.001*	0.318
Female QS (speed)	2800	3.444	1.709	2.120	0.936	-1.323	<0.001*	0.961
Female COMP (speed)	598	2.569	1.392	2.251	1.140	-0.318	<0.001*	0.250
Male QS (accuracy)	2494	94.087	8.503	98.537	4.036	4.450	<0.001*	0.669
Male COMP (accuracy)	621	96.165	7.224	97.733	5.019	1.568	<0.001*	0.252
Female QS (accuracy)	2800	93.736	9.202	98.805	3.726	5.069	<0.001*	0.722
Female COMP (accuracy)	598	96.481	6.786	97.636	4.704	1.155	<0.001*	0.198

These results indicate that females did better than males in both speed and accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.016$) but they are significant in speed ($p < 0.001$). However, the small effect size for speed (Cohen's $d = 0.178$) 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 2015

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	990	2.698	1.401	1.728	1.029	-0.970	<0.001*	0.790
Male COMP (speed)	200	1.988	0.915	1.760	0.759	-0.228	<0.001*	0.271
Female QS (speed)	1172	2.925	1.537	1.799	0.858	-1.126	<0.001*	0.904
Female COMP (speed)	212	2.116	1.102	1.820	0.762	-0.295	<0.001*	0.312
Male QS (accuracy)	990	94.948	8.124	98.956	2.887	4.008	<0.001*	0.657
Male COMP (accuracy)	200	97.659	4.264	98.282	3.821	0.623	0.043	0.154
Female QS (accuracy)	1172	94.827	8.400	98.790	3.121	3.963	<0.001*	0.625
Female COMP (accuracy)	212	97.450	4.667	97.975	4.243	0.525	<0.001*	0.118

These results indicate that females did better than males in speed and males did slightly better accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.898$) but they are significant in speed ($p = 0.005$). However, the small effect size for speed (Cohen's $d = 0.122$) indicates that this statistical finding is not meaningful for practical purposes.

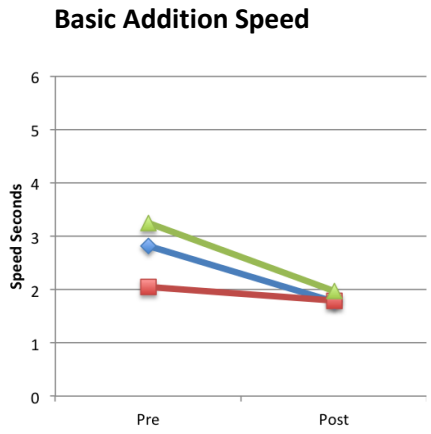
4.3.9 Indigenous Students

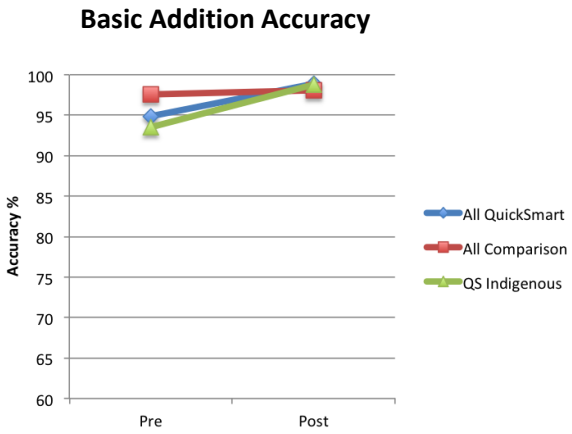
Table 17: OZCAAS results – Indigenous students 2015

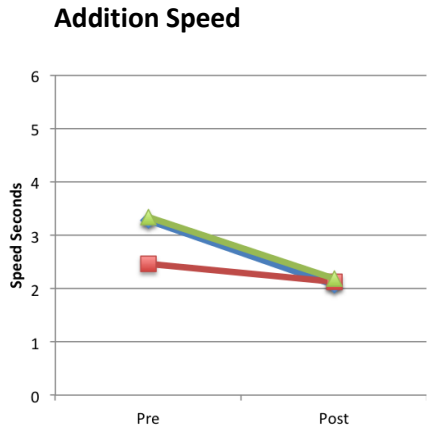
Test	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Basic Add QS (speed)	220	3.245	1.804	1.964	1.15	-1.281	<0.001*	0.847
Basic Add QS (acc)	220	93.516	10.191	98.832	2.992	5.316	<0.001*	0.708
Addition QS (speed)	466	3.330	1.778	2.183	1.039	-1.147	<0.001*	0.788
Addition QS (acc)	466	94.035	10.030	98.335	4.524	4.300	<0.001*	0.553
Basic Sub QS (speed)	212	5.534	2.666	3.103	1.729	-2.431	<0.001*	1.082
Basic Sub QS (acc)	212	85.305	15.584	95.248	7.889	9.943	<0.001*	0.805
Sub QS (speed)	417	5.253	2.817	3.481	2.152	-1.771	<0.001*	0.707
Sub QS (accuracy)	417	83.755	17.011	93.808	11.457	10.053	<0.001*	0.693
Basic Mult QS (speed)	203	3.739	2.129	2.255	1.404	-1.484	<0.001*	0.823
Basic Mult QS (acc)	203	88.691	14.006	96.777	7.257	8.086	<0.001*	0.725
Mult QS (speed)	369	5.892	2.995	4.073	2.469	-1.819	<0.001*	0.663
Mult QS (accuracy)	369	68.414	22.458	87.256	16.372	18.842	<0.001*	0.959
Basic Div QS (speed)	164	5.269	2.733	3.319	2.198	-1.951	<0.001*	0.787
Basic Div QS (acc)	164	72.790	23.911	90.676	13.696	17.886	<0.001*	0.918
Division QS (speed)	300	5.977	3.001	4.235	2.549	-1.742	<0.001*	0.626
Division QS (acc)	300	60.354	26.527	83.509	20.883	23.155	<0.001*	0.970

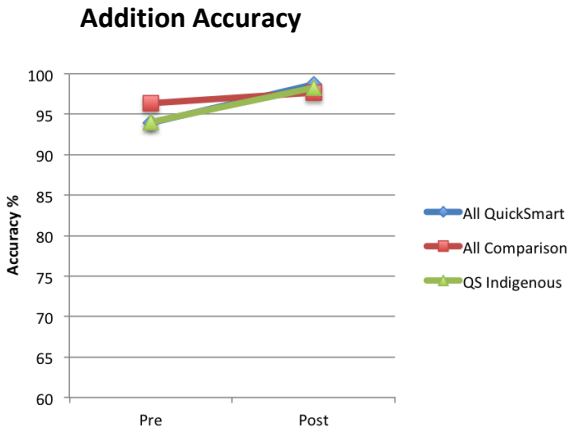
These results indicate that in most instances for both the pre-intervention and post-intervention the Indigenous students' mean scores were slightly lower than those of the overall *QuickSmart* group. In other words, these students had lower starting and finishing points. However, their improvement was very similar to that of the overall *QuickSmart* group, and sometimes better. This is particularly so for basic addition and basic subtraction. For addition, 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).

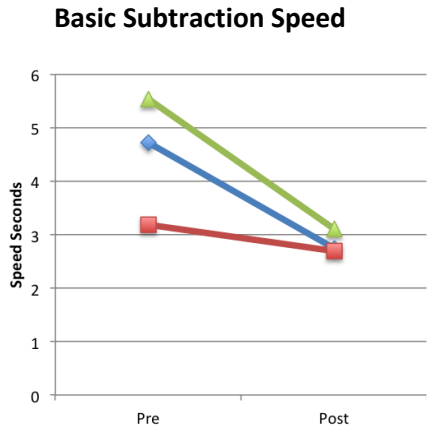
The following graphs illustrate how the Indigenous students (green) have performed in each operation compared to the whole *QuickSmart* group (blue) as well as the comparison students (red).

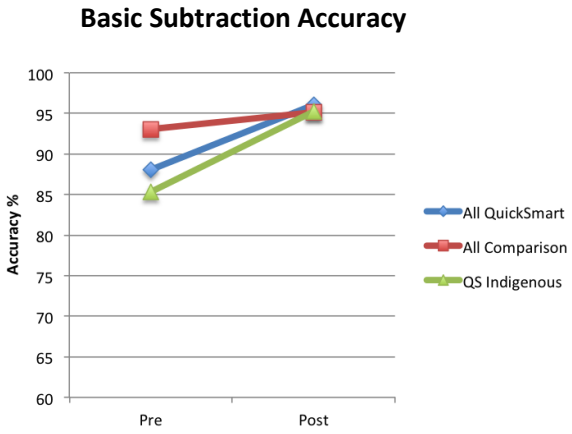

Basic Addition Speed
Speed Seconds
6
5
4
3
2
1
0
Pre
Post

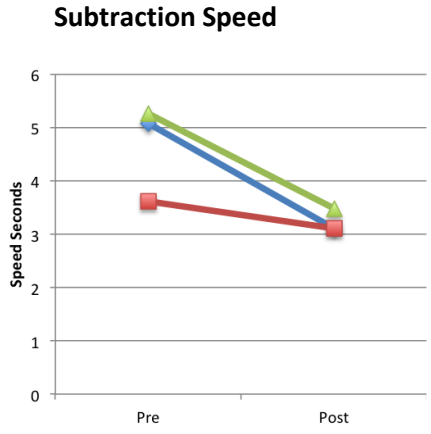

Basic Addition Accuracy
Accuracy %
100
95
90
85
80
75
70
65
60
Pre
Post
All QuickSmart
All Comparison
QS Indigenous

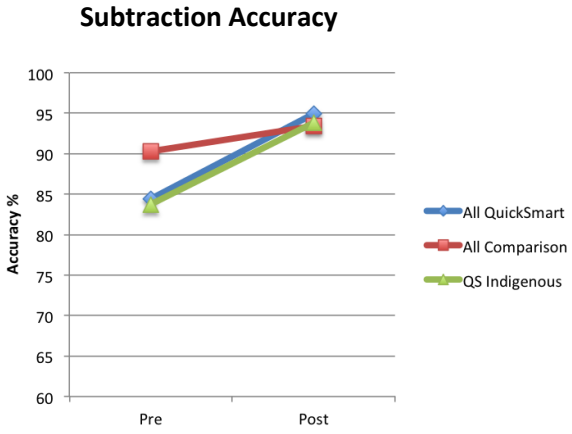

Addition Speed
Speed Seconds
6
5
4
3
2
1
0
Pre
Post


Addition Accuracy
Accuracy %
100
95
90
85
80
75
70
65
60
Pre
Post
All QuickSmart
All Comparison
QS Indigenous

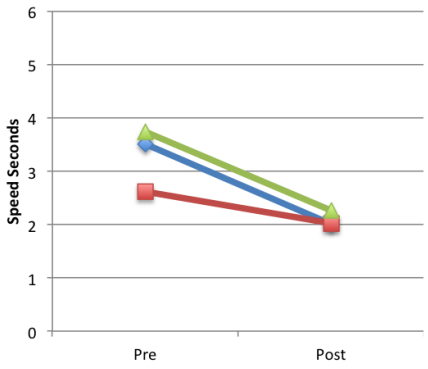

Basic Subtraction Speed
Speed Seconds
6
5
4
3
2
1
0
Pre
Post


Basic Subtraction Accuracy
Accuracy %
100
95
90
85
80
75
70
65
60
Pre
Post
All QuickSmart
All Comparison
QS Indigenous

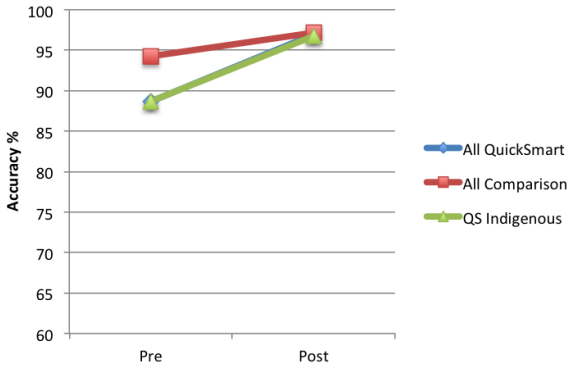

Subtraction Speed
Speed Seconds
6
5
4
3
2
1
0
Pre
Post


Subtraction Accuracy
Accuracy %
100
95
90
85
80
75
70
65
60
Pre
Post
All QuickSmart
All Comparison
QS Indigenous

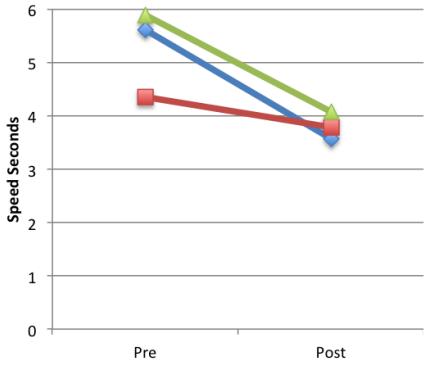
Basic Multiplication Speed



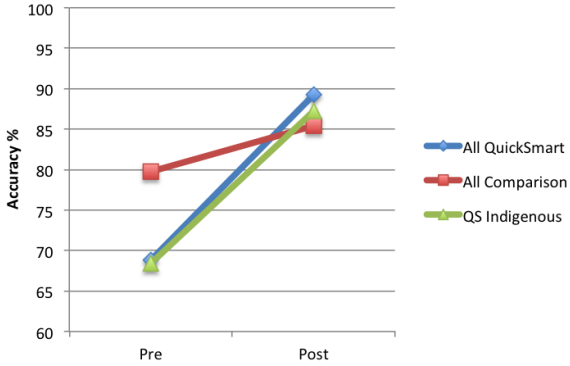
Basic Multiplication Accuracy



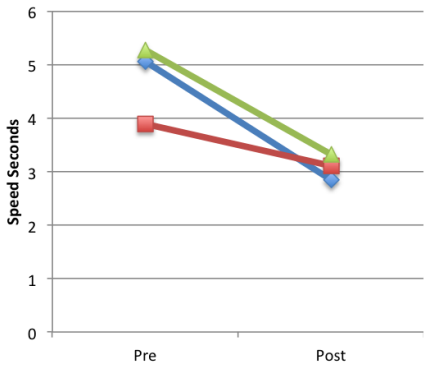
Multiplication Speed



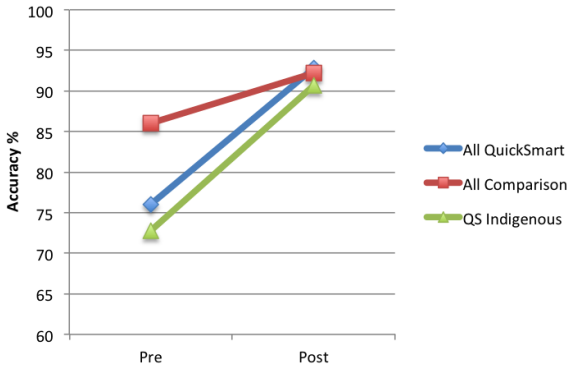
Multiplication Accuracy



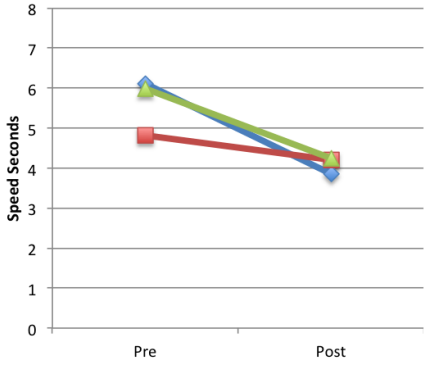
Basic Division Speed



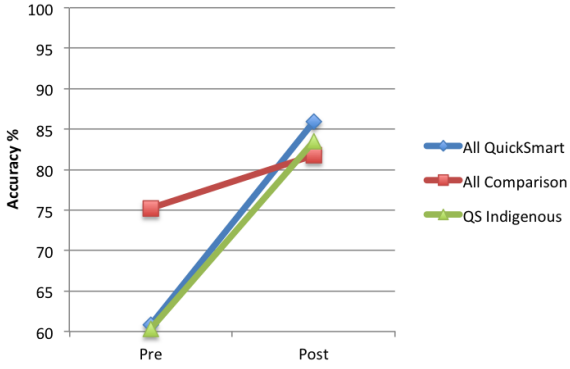
Basic Division Accuracy



Division Speed



Division Accuracy



4.4 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 – 2015

	N	Mean	Std. Deviation
Basic Addition Speed	69	1.597	0.727
Basic Addition Accuracy	69	98.310	3.885
Addition Speed	117	2.440	1.174
Addition Accuracy	117	98.056	4.527
Basic Subtraction Speed	75	3.145	1.744
Basic Subtraction Accuracy	75	94.136	8.397
Subtraction Speed	176	3.842	2.180
Subtraction Accuracy	176	91.074	12.055
Basic Multiplication Speed	142	2.256	1.341
Basic Multiplication Accuracy	142	95.970	10.313
Multiplication Speed	297	4.031	2.475
Multiplication Accuracy	297	85.080	16.709
Basic Division Speed	174	3.324	1.930
Basic Division Accuracy	174	90.270	14.889
Division Speed	480	4.705	2.724
Division Accuracy	480	78.077	22.422

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 3.9 seconds and above 91% accuracy. Even though some of these students may not have progressed to multiplication and division during *QuickSmart* lessons, their results are encouraging.

In multiplication and division, the average response speeds were below 4.8 seconds and accuracy over 78% at post-test. 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 have increased their ability to benefit from classroom instruction; and
3. 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.

4.5 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. Females performed slightly better in most operations 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 had lower starting and finishing points in most operations but their overall improvement in terms of effect size is rated very strong to substantial over all operations, except were the ceiling effect was evident.

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 (2005) 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) 2015

	Students with paired data	Average Gain score	Significance	Effect size
All *QuickSmart*	**4674**	**7.213**	**<0.001***	**0.608**
All comparison	**1163**	**5.591**	**<0.001***	**0.410**

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) 2015

Gender	Students with paired data	Average Gain score	Significance	Effect size
Male QS Students	2221	7.098	<0.001*	0.595
Male Comp Students	598	6.117	<0.001*	0.420
Female QS Students	2453	7.316	<0.001*	0.621
Female Comp Students	565	5.033	<0.001*	0.400

These results indicate that QuickSmart females did better than males in PATM assessment. However, the results of independent sample *t*-tests of *QuickSmart* students show that for the ACER PAT results the differences are not statistically significant at the 0.01 significance level ($p = 0.395$).

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) 2015

Indigenous students	Students with paired data	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	442	6.614	<0.001*	0.563

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 grades targeted by the program, that is Grade 3 through to Grade 9. The tables of figures for these graphs are available in the Appendices.

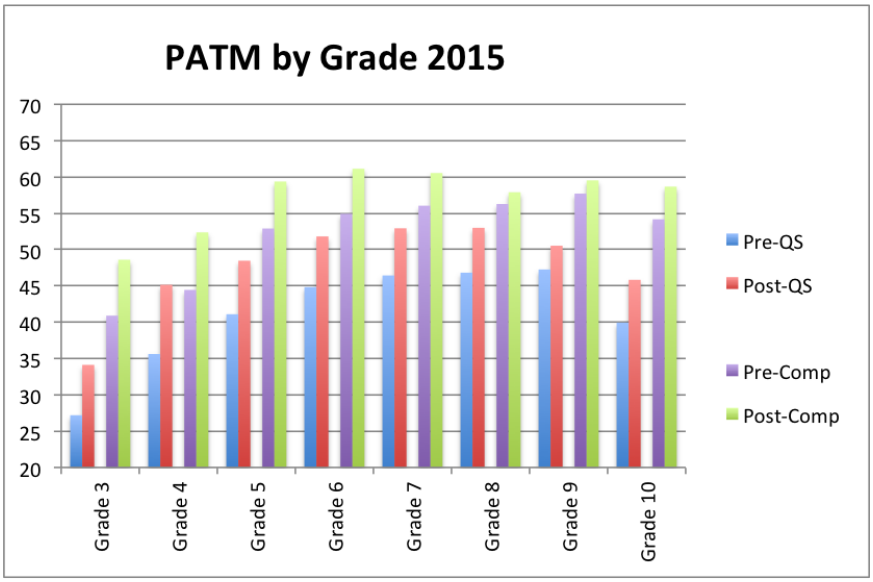


Figure 1: PAT by Grade

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	3761	4674	80.5
Indigenous QS	344	442	77.8
Comparison	874	1163	75.2

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) 67735065.

Professor John Pegg

7 APPENDIX A: Independent Assessment Results

7.1 PAT Results by Region (Scale Scores) 2015

School Region		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
ACT QS Students	33	40.997	7.581	51.127	8.495	10.130	<0.001*	1.258
Adelaide QS Students	818	41.919	13.527	49.330	14.081	7.411	<0.001*	0.537
Ballarat QS Students	221	43.914	10.031	50.127	9.766	6.213	<0.001*	0.628
Eyre Peninsula QS Students	57	38.847	9.691	47.932	8.430	9.085	<0.001*	1.000
Gawler QS Students	37	39.554	6.712	47.951	7.578	8.397	<0.001*	1.173
Geelong QS Students	35	41.860	4.699	48.331	8.252	6.471	<0.001*	0.964
Gippsland QS Students	11	36.709	8.436	43.909	7.368	7.200	0.003*	0.909
Horsham QS Students	85	47.092	8.951	53.941	8.958	6.849	<0.001*	0.765
Hunter QS Students	402	40.385	8.909	48.244	10.051	7.859	<0.001*	0.828
Limestone Coast QS Students	10	38.030	8.222	49.140	5.617	11.110	<0.001*	1.578
Melbourne QS Students	309	43.868	9.020	50.628	10.424	6.760	<0.001*	0.694
Mid West QS Students	98	45.970	8.031	52.608	9.898	6.638	<0.001*	0.737
Murray/Mallee QS Students	38	80.300	36.656	86.155	40.395	5.855	<0.001*	0.152
New England QS Students	17	40.894	12.447	57.559	8.811	16.665	<0.001*	1.545
North Coast QS Students	555	41.987	9.501	49.901	10.773	7.914	<0.001*	0.779
North Sydney QS Students	2	54.050	7.000	56.650	3.323	2.600	0.500	0.474
North Tas QS Students	30	47.630	6.363	52.407	8.274	4.777	<0.001*	0.647
North West QS Students	147	37.125	10.791	45.085	12.090	7.960	<0.001*	0.695
Perth QS Students	56	41.502	12.963	48.620	8.948	7.118	<0.001*	0.639
Pilbara QS Students	26	39.804	6.346	40.658	9.057	0.854	0.429	0.109
Port Augusta QS Students	77	47.766	9.500	51.145	11.186	3.379	0.001	0.326
Port Pirie QS Students	81	44.533	7.473	53.522	11.302	8.989	<0.001*	0.938
Queensland QS Students	150	44.277	8.384	49.885	8.455	5.608	<0.001*	0.666
Riverina QS Students	83	47.825	8.071	54.089	7.651	6.264	<0.001*	0.797
South Tas QS Students	20	44.500	9.121	47.585	8.676	3.085	0.023	0.347
Southern Sydney QS Students	59	47.590	9.081	55.202	7.136	7.612	<0.001*	0.932
Sydney QS Students	880	42.953	11.287	50.138	10.454	7.185	<0.001*	0.660
Western QS Students	172	42.212	10.492	51.485	11.331	9.273	<0.001*	0.849
Western Syd QS Students	121	40.981	8.923	45.283	9.636	4.302	<0.001*	0.463
Yorke Peninsula/Mid North QS Students	44	40.743	8.982	47.077	6.369	6.334	<0.001*	0.814

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

7.2 PAT Results by Demographic (Scale Scores) 2015

Demographic		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**4674**	**42.871**	**11.657**	**50.084**	**12.063**	**7.213**	**<0.001***	**0.608**
All comparison students	**1163**	**52.887**	**13.314**	**58.478**	**13.955**	**5.591**	**<0.001***	**0.410**
Indigenous QS Students	442	40.026	11.68	46.64	11.815	6.614	<0.001*	0.563
Male QS Students	2221	43.343	11.702	50.441	12.163	7.098	<0.001*	0.595
Male comparison students	598	52.988	14.376	59.105	14.734	6.117	<0.001*	0.420
Female QS Students	2453	42.444	11.602	49.760	11.965	7.316	<0.001*	0.621
Female comparison Students	565	52.781	12.100	57.814	13.060	5.033	<0.001*	0.400
Male Indigenous QS Students	234	40.412	11.271	46.765	12.387	6.353	<0.001*	0.536
Female Indigenous QS Students	208	39.591	12.136	46.501	11.165	6.910	<0.001*	0.593

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

7.3 PAT Results by State (Scale Scores) 2015

School		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**4674**	**42.871**	**11.657**	**50.084**	**12.063**	**7.213**	**<0.001***	**0.608**
All comparison students	**1163**	**52.887**	**13.314**	**58.478**	**13.955**	**5.591**	**<0.001***	**0.410**
ACT QS students	33	40.997	7.581	51.127	8.495	10.130	<0.001*	1.258
ACT Ind QS	1	40.700		42.200		1.500		
ACT COMP students	2	52.150	11.667	51.350	1.909	-0.800	0.927	no improvement
NSW QS students	2536	42.231	10.320	49.750	10.626	7.519	<0.001*	0.718
NSW Ind QS	318	40.169	10.488	46.836	10.767	6.667	<0.001*	0.627
NSW COMP students	414	53.016	10.636	58.442	11.917	5.426	<0.001*	0.480
NT QS students	0							
NT Ind QS	0							
NT COMP students	0							
QLD QS students	150	44.277	8.384	49.885	8.455	5.608	<0.001*	0.666
QLD Ind QS	9	35.111	8.672	38.456	12.252	3.345	0.005*	0.315
QLD COMP students	34	52.909	7.822	56.868	9.657	3.959	0.011	0.451
SA QS students	1162	43.440	15.500	50.748	16.114	7.308	<0.001*	0.462
SA Ind QS	83	40.355	15.183	48.330	15.247	7.975	<0.001*	0.524
SA COMP students	363	52.978	18.240	58.921	18.201	5.943	<0.001*	0.326
TAS QS students	50	46.378	7.656	50.478	8.683	4.100	<0.001*	0.501
TAS Ind QS	5	43.880	6.854	49.840	2.981	5.960	0.268	1.128
TAS COMP students	15	45.613	6.659	49.280	12.097	3.667	0.115	0.376
VIC QS students	661	44.072	9.289	50.653	9.979	6.581	<0.001*	0.683
VIC Ind QS	8	46.663	10.761	51.350	9.149	4.687	<0.001*	0.469
VIC COMP students	291	53.038	10.389	58.715	11.056	5.677	<0.001*	0.529
WA QS students	82	40.963	11.277	46.095	9.674	5.132	<0.001*	0.488
WA Ind QS	18	34.372	14.457	36.756	7.916	2.384	0.040	0.205
WA COMP students	44	52.430	9.544	58.302	11.404	5.872	<0.001*	0.558

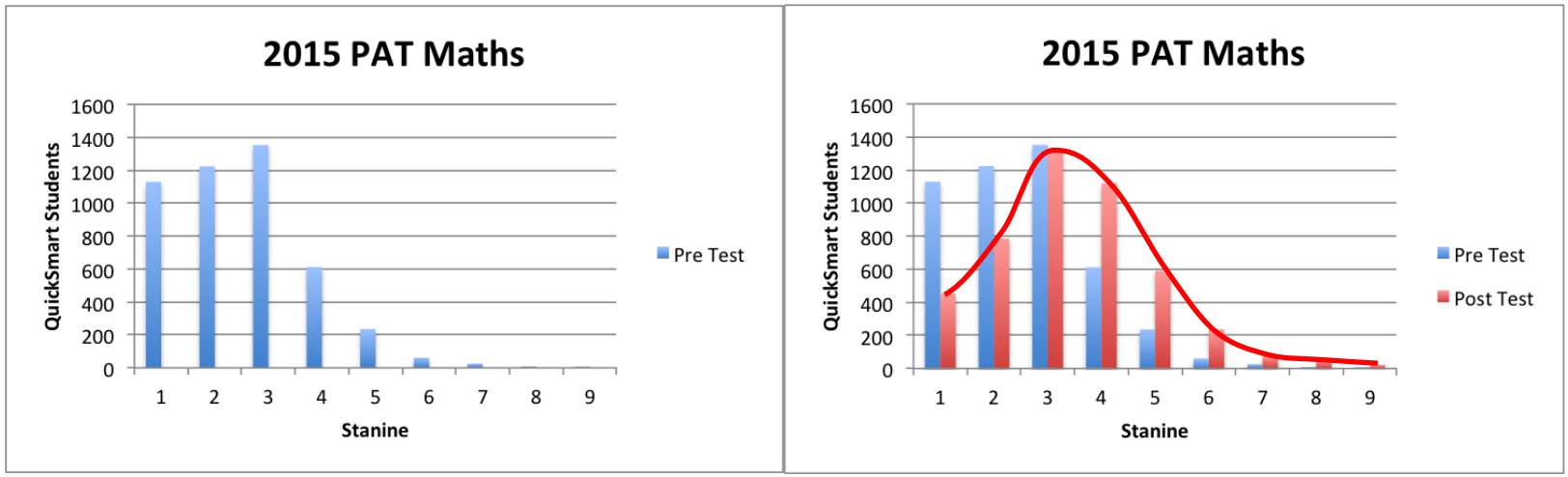
Note: only students who did both 'pre' and 'post' test are included in the table.

7.4 *QuickSmart* Students by Grade (Scale Scores) 2015

Grade		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
Grade 3 QS	18	27.194	7.487	34.122	6.640	6.928	0.002*	0.979
Grade 3 QS Ind	0	-	-	-	-	-	-	-
Grade 3 Comp	3	40.900	0.693	48.600	10.589	7.700	0.325	1.026
Grade 4 QS	805	35.623	10.643	45.149	10.610	9.526	<0.001*	0.896
Grade 4 QS Ind	67	34.652	8.567	42.810	8.935	8.158	<0.001*	0.932
Grade 4 Comp	212	44.442	12.330	52.364	13.102	7.922	<0.001*	0.623
Grade 5 QS	1217	41.098	10.629	48.463	11.820	7.365	<0.001*	0.655
Grade 5 QS Ind	113	38.108	11.308	45.099	12.299	6.991	<0.001*	0.592
Grade 5 Comp	311	52.897	15.087	59.368	16.170	6.471	<0.001*	0.414
Grade 6 QS	841	44.831	10.522	51.807	11.278	6.976	<0.001*	0.640
Grade 6 QS Ind	54	41.230	10.608	47.933	8.256	6.703	<0.001*	0.705
Grade 6 Comp	237	54.925	12.901	61.127	14.196	6.202	<0.001*	0.457
Grade 7 QS	981	46.434	12.364	52.928	13.273	6.494	<0.001*	0.506
Grade 7 QS Ind	116	43.065	11.643	49.436	11.813	6.371	<0.001*	0.543
Grade 7 Comp	227	56.039	10.943	60.538	11.629	4.499	<0.001*	0.398
Grade 8 QS	710	46.819	10.347	52.992	10.988	6.173	<0.001*	0.578
Grade 8 QS Ind	76	42.184	13.124	48.092	14.260	5.908	<0.001*	0.431
Grade 8 Comp	138	56.273	9.471	57.894	11.069	1.621	0.031	0.157
Grade 9 QS	92	47.260	7.208	50.528	8.657	3.268	<0.001*	0.410
Grade 9 QS Ind	14	42.271	8.419	43.943	9.869	1.672	0.425	0.182
Grade 9 Comp	32	57.703	10.361	59.525	8.905	1.822	0.054	0.189
Grade 10 QS	6	39.950	20.348	45.833	13.946	5.883	0.294	0.337
Grade 10 QS Ind	2	21.900	31.961	28.700	4.526	6.800	0.785	0.298
Grade 10 Comp	3	54.167	11.001	58.667	11.277	4.500	0.095	0.404
All Schools – QS Group	**4674**	**42.871**	**11.657**	**50.084**	**12.063**	**7.213**	**<0.001***	**0.608**
All Schools – Indigenous QS Group	**442**	**40.026**	**11.68**	**46.64**	**11.815**	**6.614**	**<0.001***	**0.563**
All Schools – Comp Group	**1163**	**52.887**	**13.314**	**58.478**	**13.955**	**5.591**	**<0.001***	**0.410**

Note: Other grades were excluded from the analyses as they had fewer than 5 *QuickSmart* students.

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.

8 APPENDIX B: *QuickSmart* Sessions

8.1 Attendance Summary

	N (students)	N (schools)	Mean Sessions Offered	Mean Sessions Attended	% Mean Attended	Weeks completed	% Program completed
All QS students	**3699**	**237**	**68.881**	**56.237**	**81.795**	**18.746**	**62.485**
Female QS students	1991	229	69.415	57.288	82.753	19.096	63.653
Male QS students	1708	233	68.258	55.009	80.676	18.336	61.122
Indigenous QS students	317	91	68.363	53.25	76.499	17.75	59.167
Grade 3	16	6	65.75	55.75	85.06	18.583	61.944
Grade 4	674	95	72.95	62.899	86.728	20.966	69.887
Grade 5	964	147	72.607	61.453	85.187	20.484	68.281
Grade 6	691	134	66.748	54.718	82.858	18.239	60.798
Grade 7	704	84	65.453	50.989	77.969	16.996	56.654
Grade 8	557	53	67.325	50.491	74.493	16.83	56.101
Grade 9	73	16	50.658	36.137	71.741	12.046	40.152

Note: Only students and schools for whom attendance data were provided are included in the table (about 59% of students).
Note: 'Weeks completed' is based on the assumption that the school did three *QuickSmart* sessions a week.
Note: '% Program completed' is calculated relative to the full *QuickSmart* program of 30 weeks.
Note: Other grades were excluded from the analyses as they had fewer than 5 *QuickSmart* students with attendance.