SiMERR National Research Centre

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University of New England

Annual Numeracy Program Report 2016

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

quicksmart

Acknowledgements

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1 *QuickSmart* Executive Summary in 2016

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, 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 2016, the *QuickSmart* team at the University of New England received data from 5257 students who participated in *QuickSmart* Numeracy lessons and 1331 average-achieving comparison peers. These students were drawn from schools from 30 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 response time. 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 improvements comparable to those of *QuickSmart* students with effect sizes rated very 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 92% accuracy. In multiplication and division the average response times were below 4.5 seconds and accuracy over 79% at post-test. This improvement is most likely 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.

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 ($p = 0.495$).

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 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 — 2016

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 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 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 2016, the *QuickSmart* team at the SiMERR National Research Centre at the University of New England received matched data from 5257 students who participated in *QuickSmart* Numeracy lessons and 1331 average-achieving comparison peers. These students were drawn from schools from 30 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

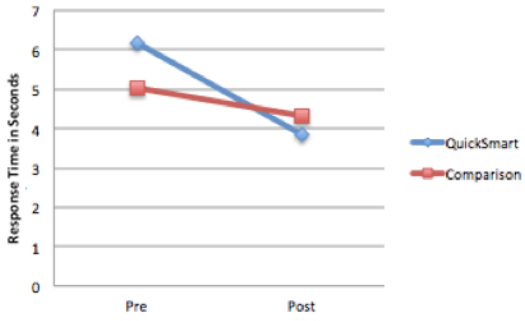
4.2.1 Division

Table 1 below summarises the data submitted for OZCAAS division.

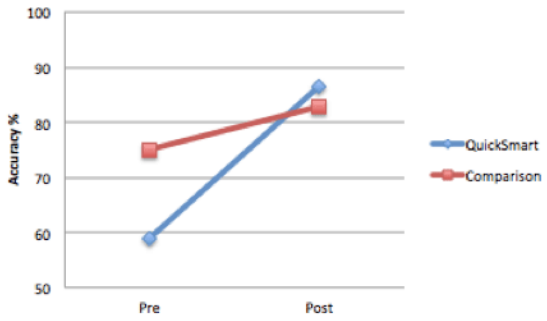
Table 1: OZCAAS division – all students 2016

Division	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3081	6.170	2.941	3.850	2.367	-2.320	<0.001*	0.869
Res Time (secs) Comp	891	5.016	3.058	4.324	2.507	-0.692	<0.001*	0.248
Accuracy (%) QS	3081	58.920	26.969	86.501	18.593	27.581	<0.001*	1.191
Accuracy (%) Comp	891	75.062	24.296	82.914	19.051	7.852	<0.001*	0.360

Division Response Time



Division Accuracy



On the division test, there were paired data for 3081 *QuickSmart* students and 891 comparison students. 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 2.320 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 0.869, 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 27 percentage points, which is a very strong result. The effect size for this result is 1.191, 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.

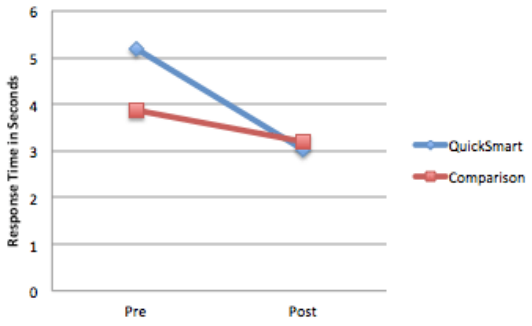
In summary, Table 1 shows that when compared to the scores of the comparison students, *QuickSmart* students' scores indicate substantial improvement for both response time and accuracy. The diagrams illustrate that *QuickSmart* students improved to reach slightly better levels than their comparison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

4.2.2 Basic Division

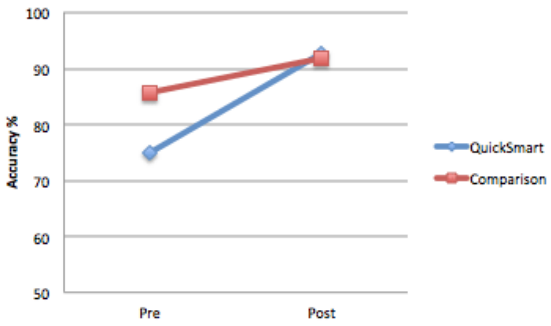
Table 2: OZCAAS basic division – all students 2016

Basic Division	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	1548	5.199	2.739	3.032	1.929	-2.167	<0.001*	0.915
Res Time (secs) Comp	328	3.887	2.087	3.200	1.865	-0.687	<0.001*	0.347
Accuracy (%) QS	1548	74.926	22.727	92.729	11.763	17.803	<0.001*	0.984
Accuracy (%) Comp	328	85.715	16.441	91.963	11.208	6.248	<0.001*	0.444

Basic Division Response Time



Basic Division Accuracy



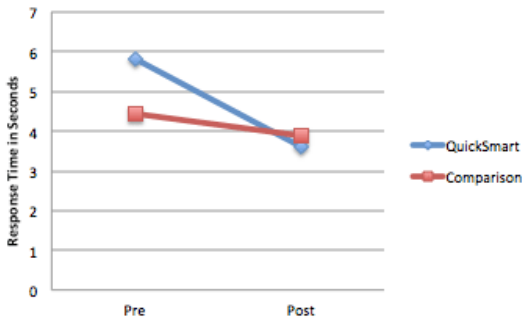
In summary, the results for basic division indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.3 Multiplication

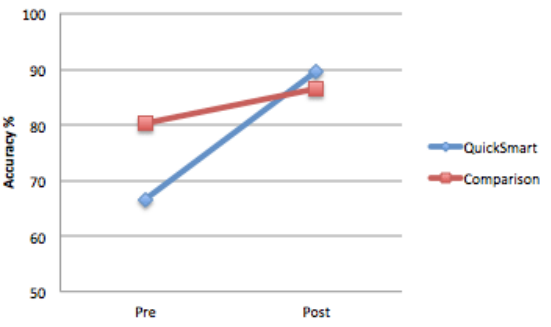
Table 3: OZCAAS multiplication – all students 2016

Multiplication	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3649	5.821	2.830	3.602	2.334	-2.219	<0.001*	0.856
Res Time (secs) Comp	974	4.441	2.638	3.872	2.277	-0.569	<0.001*	0.231
Accuracy (%) QS	3649	66.635	22.593	89.707	15.249	23.072	<0.001*	1.197
Accuracy (%) Comp	974	80.174	19.712	86.400	15.272	6.226	<0.001*	0.353

Multiplication Response Time



Multiplication Accuracy



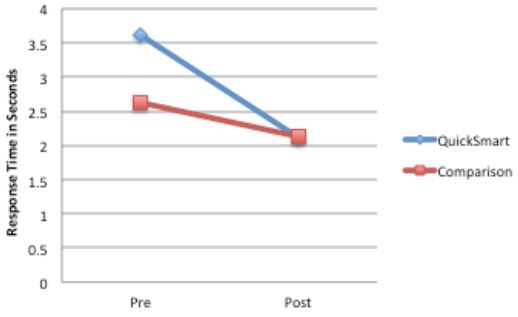
In summary, the results for multiplication indicate a substantial improvement in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.4 Basic Multiplication

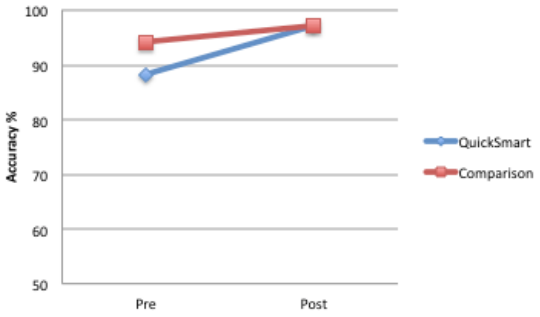
Table 4: OZCAAS basic multiplication – all students 2016

Basic Multiplication	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	1777	3.608	2.208	2.118	1.358	-1.491	<0.001*	0.813
Res Time (secs) Comp	350	2.633	1.472	2.124	1.105	-0.510	<0.001*	0.391
Accuracy (%) QS	1777	88.284	15.433	97.264	6.681	8.980	<0.001*	0.755
Accuracy (%) Comp	350	94.230	9.753	97.065	5.992	2.835	<0.001*	0.350

Basic Multiplication Response Time



Basic Multiplication Accuracy

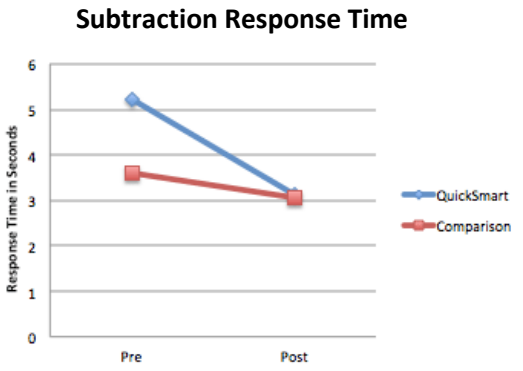


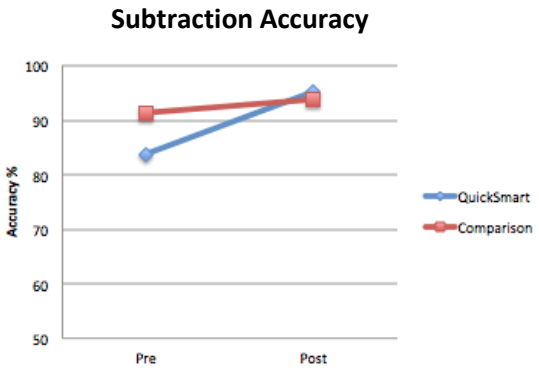
In summary, the results for basic multiplication indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between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

4.2.5 Subtraction

Table 5: OZCAAS subtraction – all students 2016

Subtraction	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	4259	5.217	2.684	3.128	1.840	-2.089	<0.001*	0.908
Res Time (secs) Comp	1098	3.598	1.986	3.059	1.645	-0.539	<0.001*	0.296
Accuracy (%) QS	4259	83.796	16.368	95.261	8.549	11.465	<0.001*	0.878
Accuracy (%) Comp	1098	91.362	10.787	93.721	8.760	2.359	<0.001*	0.240



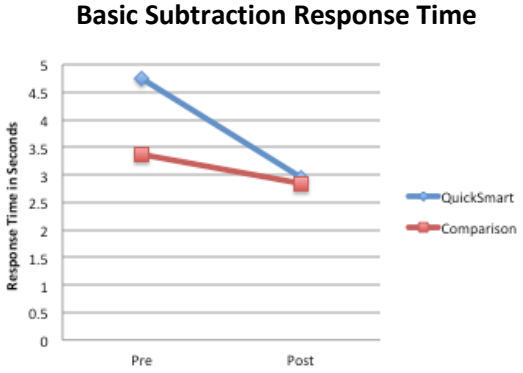


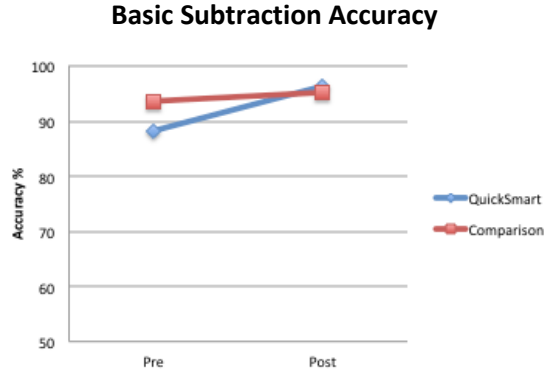
In summary, the results for subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison students.

4.2.6 Basic Subtraction

Table 6: OZCAAS basic subtraction – all students 2016

Basic Subtraction	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	1692	4.735	2.552	2.955	1.794	-1.779	<0.001*	0.807
Res Time (secs) Comp	293	3.354	2.056	2.843	1.636	-0.511	<0.001*	0.275
Accuracy (%) QS	1692	88.238	13.308	96.344	6.763	8.106	<0.001*	0.768
Accuracy (%) Comp	293	93.635	8.762	95.174	7.011	1.539	0.002	0.194





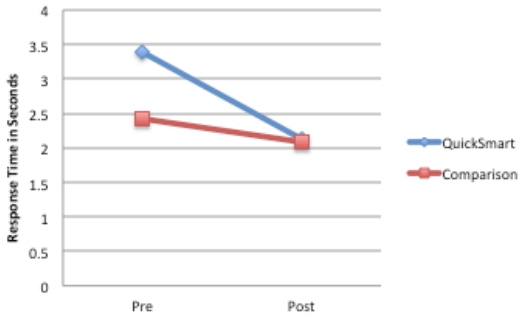
In summary, the results for basic subtraction indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between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

4.2.7 Addition

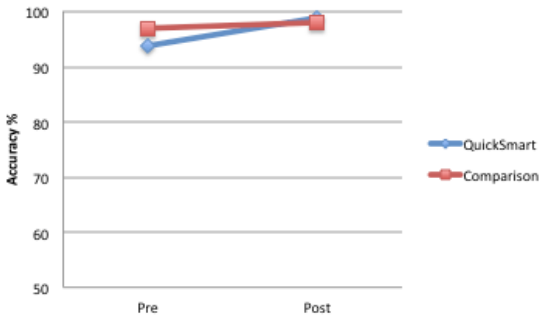
Table 7: OZCAAS addition – all students 2016

Addition	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	4476	3.387	1.691	2.120	1.028	-1.267	<0.001*	0.905
Res Time (secs) Comp	1114	2.417	1.204	2.084	0.988	-0.333	<0.001*	0.302
Accuracy (%) QS	4476	93.762	9.085	98.777	3.649	5.015	<0.001*	0.724
Accuracy (%) Comp	1114	96.995	5.782	98.049	4.014	1.054	<0.001*	0.212

Addition Response Time



Addition Accuracy



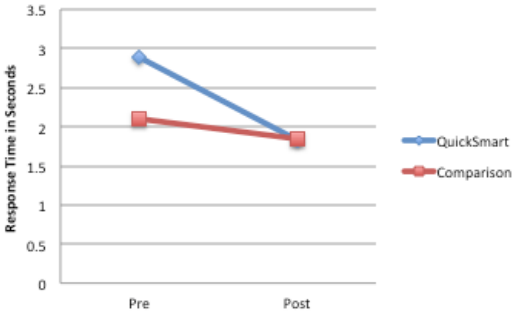
In summary, the results for addition indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and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

4.2.8 Basic Addition

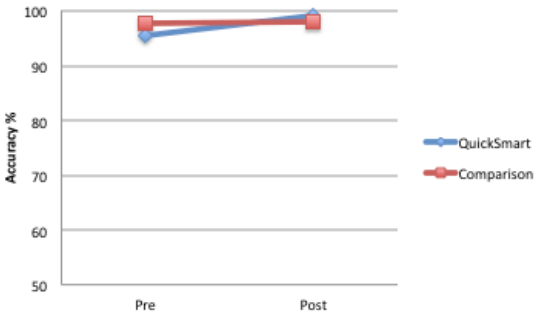
Table 8: OZCAAS Basic Addition results – all students 2016

Basic Addition	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	1624	2.891	1.538	1.832	0.868	-1.059	<0.001*	0.848
Res Time (secs) Comp	291	2.092	0.967	1.846	0.838	-0.246	<0.001*	0.271
Accuracy (%) QS	1624	95.411	7.107	99.043	2.862	3.632	<0.001*	0.670
Accuracy (%) Comp	291	97.701	5.286	98.075	3.695	0.374	0.221	0.082

Basic Addition Response Time



Basic Addition Accuracy



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 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	1481	5.958	2.822	3.79	2.362	-2.168	<0.001*	0.833
Male COMP (res time)	452	4.781	2.903	4.111	2.312	-0.670	<0.001*	0.255
Female QS (res time)	1600	6.366	3.034	3.905	2.37	-2.461	<0.001*	0.904
Female COMP (res time)	439	5.258	3.196	4.543	2.677	-0.715	<0.001*	0.243
Male QS (accuracy)	1481	59.465	27.273	86.174	18.79	26.709	<0.001*	1.14
Male COMP (accuracy)	452	76.243	23.881	84.088	18.462	7.845	<0.001*	0.368
Female QS (accuracy)	1600	58.417	26.682	86.803	18.409	28.386	<0.001*	1.238
Female COMP (accuracy)	439	73.847	24.684	81.706	19.587	7.859	<0.001*	0.353

These results indicate that females did slightly better than males in both response time 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 ($p = 0.041$) but they are significant in response time ($p = 0.007$). However, the small effect size for response time (Cohen's $d = 0.097$) 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 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	736	4.951	2.603	2.981	1.889	-1.97	<0.001*	0.866
Male COMP (res time)	160	3.526	1.741	3.007	1.558	-0.519	<0.001*	0.314
Female QS (res time)	812	5.424	2.839	3.078	1.964	-2.346	<0.001*	0.961
Female COMP (res time)	168	4.231	2.324	3.384	2.105	-0.847	<0.001*	0.382
Male QS (accuracy)	736	75.41	22.352	92.544	11.688	17.134	<0.001*	0.961
Male COMP (accuracy)	160	86.981	16.623	92.186	9.691	5.205	<0.001*	0.383
Female QS (accuracy)	812	74.488	23.068	92.897	11.836	18.409	<0.001*	1.004
Female COMP (accuracy)	168	84.509	16.224	91.752	12.508	7.243	<0.001*	0.500

These results indicate that females did slightly better than males in both response time 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 ($p = 0.234$) but they are significant in response time ($p = 0.002$). However, the small effect size for response time (Cohen's $d = 0.159$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.4 Multiplication by Gender

Table 11: OZCAAS multiplication results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	1765	5.699	2.798	3.479	2.233	-2.22	<0.001*	0.877
Male COMP (res time)	494	4.353	2.630	3.670	2.020	-0.683	<0.001*	0.291
Female QS (res time)	1884	5.936	2.856	3.717	2.419	-2.219	<0.001*	0.838
Female COMP (res time)	480	4.532	2.646	4.081	2.499	-0.451	<0.001*	0.175
Male QS (accuracy)	1765	67.145	22.338	89.617	15.175	22.472	<0.001*	1.177
Male COMP (accuracy)	494	81.027	19.392	87.486	14.591	6.459	<0.001*	0.376
Female QS (accuracy)	1884	66.157	22.826	89.791	15.32	23.634	<0.001*	1.216
Female COMP (accuracy)	480	79.295	20.019	85.282	15.880	5.987	<0.001*	0.331

These results indicate that males did marginally better than females in response time and females did slightly better in accuracy. The results of independent sample *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level ($p = 1.000$ in response time and 0.069 in accuracy).

4.3.5 Basic Multiplication by Gender

Table 12: OZCAAS Basic multiplication results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	835	3.518	2.077	2.109	1.407	-1.409	<0.001*	0.794
Male COMP (res time)	172	2.641	1.502	2.139	1.024	-0.502	<0.001*	0.391
Female QS (res time)	942	3.688	2.316	2.125	1.314	-1.563	<0.001*	0.83
Female COMP (res time)	178	2.626	1.448	2.109	1.181	-0.517	<0.001*	0.391
Male QS (accuracy)	835	88.604	14.514	97.186	6.615	8.582	<0.001*	0.761
Male COMP (accuracy)	172	93.975	10.947	97.128	5.551	3.153	<0.001*	0.363
Female QS (accuracy)	942	88.001	16.206	97.333	6.742	9.332	<0.001*	0.752
Female COMP (accuracy)	178	94.477	8.466	97.003	6.405	2.526	<0.001*	0.337

These results indicate that females did slightly better than males in both response time and accuracy. The results of independent sample *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 ($p = 0.072$ for response time and 0.259 for accuracy).

4.3.6 Subtraction by Gender

Table 13: OZCAAS subtraction results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	2035	4.821	2.497	2.961	1.737	-1.86	<0.001*	0.865
Male COMP (res time)	551	3.274	1.943	2.777	1.564	-0.496	<0.001*	0.281
Female QS (res time)	2224	5.578	2.797	3.281	1.918	-2.297	<0.001*	0.958
Female COMP (res time)	547	3.925	1.978	3.343	1.677	-0.582	<0.001*	0.317
Male QS (accuracy)	2035	84.483	16.068	95.326	8.421	10.843	<0.001*	0.845
Male COMP (accuracy)	551	92.548	9.852	94.674	7.894	2.126	<0.001*	0.238
Female QS (accuracy)	2224	83.167	16.616	95.201	8.665	12.034	<0.001*	0.908
Female COMP (accuracy)	547	90.168	11.540	92.761	9.464	2.593	<0.001*	0.246

These results indicate that females did better than males in both response time and accuracy. The independent sample *t*-tests of *QuickSmart* students show that these results are statistically significant at the 0.01 significance level for response time and very close to being significant in accuracy ($p < 0.001$ for response time and $p = 0.011$ in accuracy). However, the small effect sizes (Cohen's $d = 0.125$ for response time and 0.078 for accuracy) indicate that these statistical findings are not meaningful for practical purposes.

4.3.7 Basic Subtraction by Gender

Table 14: OZCAAS Basic subtraction results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	829	4.547	2.558	2.893	1.855	-1.654	<0.001*	0.74
Male COMP (res time)	142	3.059	2.056	2.628	1.568	-0.431	<0.001*	0.236
Female QS (res time)	863	4.915	2.535	3.016	1.733	-1.899	<0.001*	0.875
Female COMP (res time)	151	3.631	2.024	3.045	1.678	-0.587	<0.001*	0.316
Male QS (accuracy)	829	88.188	13.182	95.932	7.448	7.744	<0.001*	0.723
Male COMP (accuracy)	142	93.230	9.671	95.585	6.842	2.355	0.001	0.281
Female QS (accuracy)	863	88.287	13.435	96.74	6.009	8.453	<0.001*	0.812
Female COMP (accuracy)	151	94.017	7.826	94.787	7.168	0.770	0.288	0.103

These results indicate that females did better than males in both response time 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 ($p = 0.249$) but they are very close to being significant in response time ($p < 0.013$). However, the small effect size for response time (Cohen's $d = 0.121$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.8 Addition by Gender

Table 15: OZCAAS addition results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	2136	3.262	1.629	2.054	1.029	-1.208	<0.001*	0.887
Male COMP (res time)	559	2.281	1.227	1.960	0.994	-0.321	<0.001*	0.287
Female QS (res time)	2340	3.5	1.738	2.18	1.023	-1.32	<0.001*	0.926
Female COMP (res time)	555	2.554	1.165	2.209	0.966	-0.345	<0.001*	0.322
Male QS (accuracy)	2136	93.771	8.9	98.78	3.562	5.009	<0.001*	0.739
Male COMP (accuracy)	559	97.296	5.370	98.270	3.847	0.974	<0.001*	0.209
Female QS (accuracy)	2340	93.755	9.252	98.774	3.727	5.019	<0.001*	0.712
Female COMP (accuracy)	555	96.692	6.159	97.826	4.167	1.134	<0.001*	0.216

These results indicate that females did slightly better than males in both response time 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 ($p = 0.918$) but they are very close to being significant in response time ($p = 0.012$). However, the small effect size for response time (Cohen's $d = 0.075$) indicates that this statistical finding is not meaningful for practical purposes.

4.3.9 Basic Addition by Gender

Table 16: OZCAAS basic addition results – all students by gender 2016

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (res time)	797	2.831	1.55	1.822	0.936	-1.009	<0.001*	0.788
Male COMP (res time)	141	1.970	0.733	1.757	0.757	-0.213	<0.001*	0.286
Female QS (res time)	827	2.948	1.524	1.843	0.797	-1.105	<0.001*	0.909
Female COMP (res time)	150	2.205	1.136	1.929	0.902	-0.276	<0.001*	0.269
Male QS (accuracy)	797	95.396	6.722	99.003	3.009	3.607	<0.001*	0.693
Male COMP (accuracy)	141	97.921	4.798	98.207	3.356	0.286	0.489	0.069
Female QS (accuracy)	827	95.425	7.463	99.082	2.714	3.657	<0.001*	0.651
Female COMP (accuracy)	150	97.495	5.716	97.951	3.995	0.456	0.309	0.092

These results indicate that females did slightly better than males in response time and males did slightly better in accuracy. The results of independent sample *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 ($p = 0.116$ for response time and 0.887 for accuracy).

4.3.10 Indigenous Students

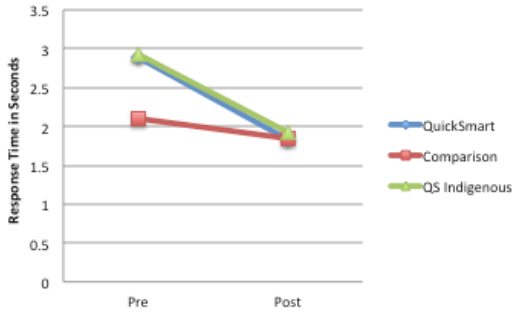
Table 17: OZCAAS results – Indigenous students 2016

Test	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Basic Add QS (res time)	105	2.938	1.583	1.915	0.919	-1.023	<0.001*	0.790
Basic Add QS (acc)	105	94.996	7.833	99.210	3.354	4.214	<0.001*	0.699
Addition QS (res time)	255	3.624	2.062	2.277	1.275	-1.348	<0.001*	0.786
Addition QS (acc)	255	93.662	10.621	98.851	3.167	5.189	<0.001*	0.662
Basic Sub QS (res time)	112	4.926	2.588	3.442	2.188	-1.483	<0.001*	0.619
Basic Sub QS (acc)	112	87.079	15.715	96.339	6.922	9.260	<0.001*	0.763
Sub QS (res time)	238	5.269	2.986	3.469	2.242	-1.799	<0.001*	0.681
Sub QS (accuracy)	238	83.258	20.281	95.144	8.942	11.886	<0.001*	0.758
Basic Mult QS (res time)	93	3.680	2.127	2.195	1.167	-1.485	<0.001*	0.866
Basic Mult QS (acc)	93	88.058	16.969	97.151	8.166	9.093	<0.001*	0.683
Mult QS (res time)	212	5.955	2.956	3.734	2.314	-2.221	<0.001*	0.837
Mult QS (accuracy)	212	68.493	24.021	91.229	14.326	22.736	<0.001*	1.150
Basic Div QS (res time)	69	4.848	2.413	2.995	1.812	-1.853	<0.001*	0.869
Basic Div QS (acc)	69	73.626	22.462	93.401	9.769	19.775	<0.001*	1.142
Division QS (res time)	180	6.292	2.998	4.097	2.492	-2.195	<0.001*	0.796
Division QS (acc)	180	62.009	28.396	88.952	16.500	26.943	<0.001*	1.160

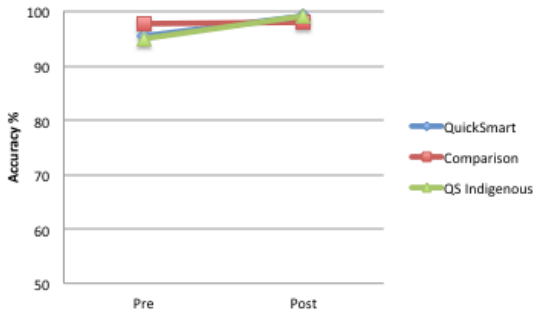
These results indicate that in most instances the Indigenous students' improvement was very similar to that of the overall *QuickSmart* group, and sometimes better. For addition, the accuracy results exhibit the ceiling effect (the pre-intervention scores were so high that the students did not have much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

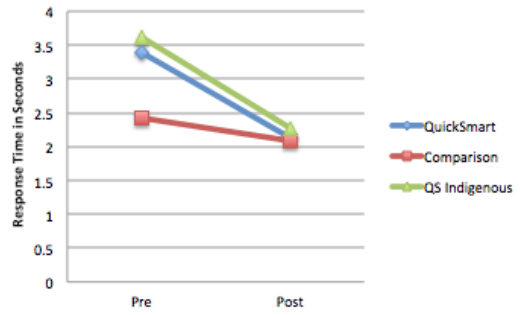
Basic Addition Response Time



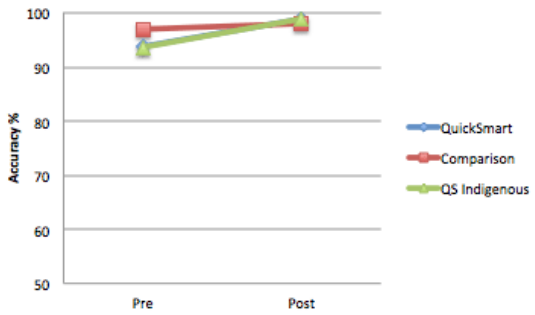
Basic Addition Accuracy



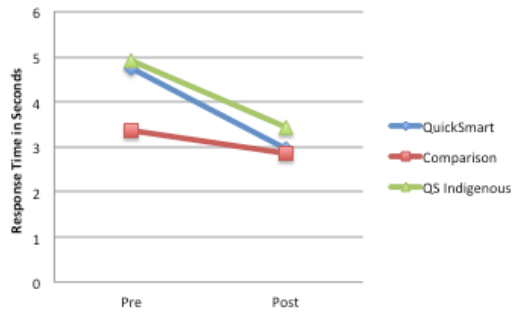
Addition Response Time



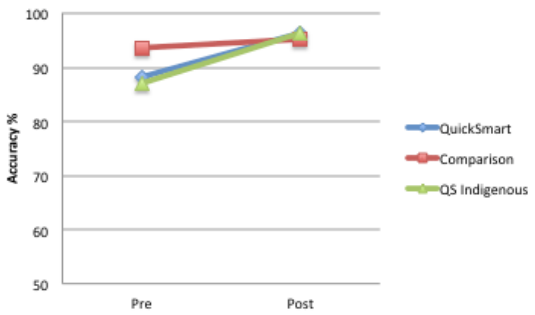
Addition Accuracy



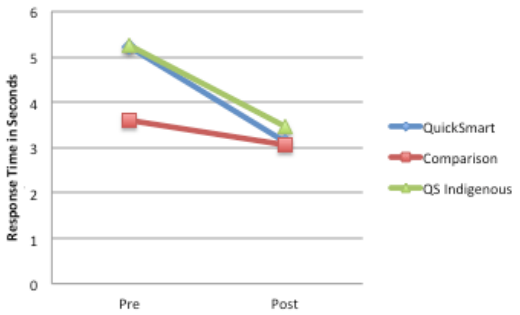
Basic Subtraction Response Time



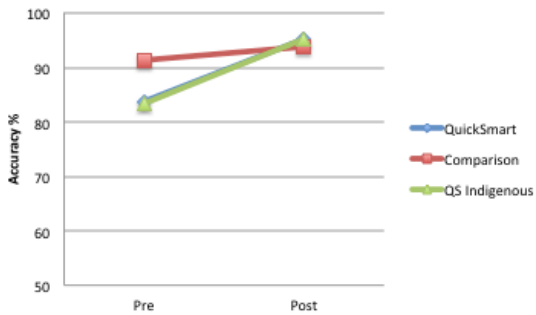
Basic Subtraction Accuracy



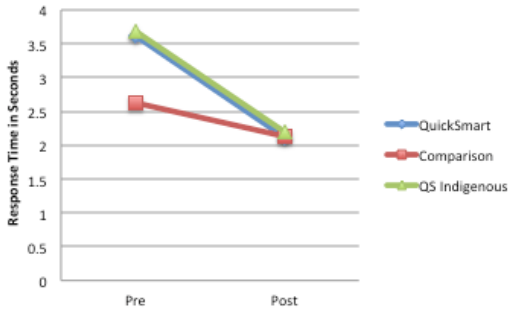
Subtraction Response Time



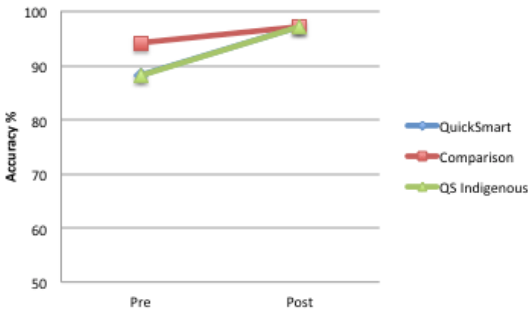
Subtraction Accuracy



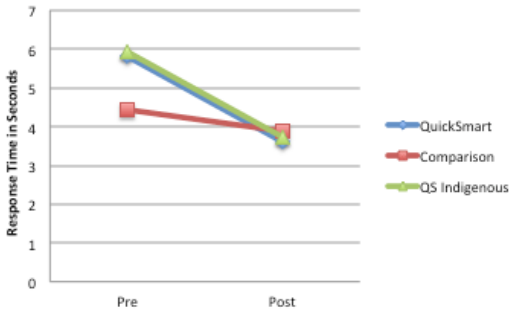
Basic Multiplication Response Time



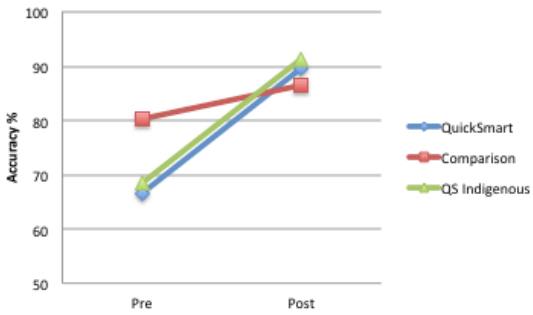
Basic Multiplication Accuracy



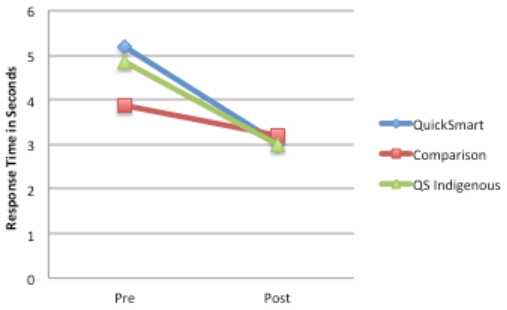
Multiplication Response Time



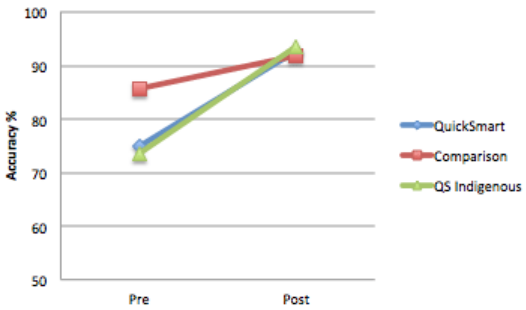
Multiplication Accuracy



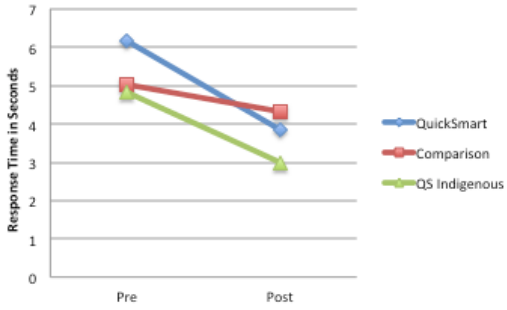
Basic Division Response Time



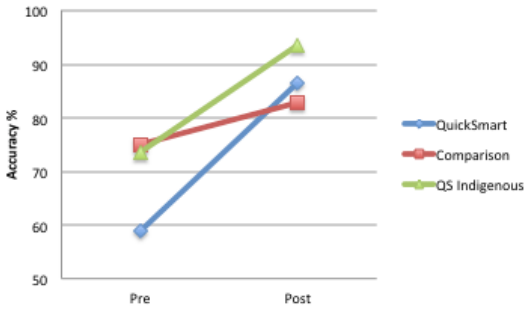
Basic Division Accuracy



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 – 2016

	N	Mean	Std. Deviation
Basic Addition Res Time	22	1.731	0.646
Basic Addition Accuracy	22	99.518	1.560
Addition Res Time	104	2.289	1.028
Addition Accuracy	104	99.048	2.412
Basic Subtraction Res Time	33	2.396	1.097
Basic Subtraction Accuracy	33	98.042	3.547
Subtraction Res Time	149	3.823	2.527
Subtraction Accuracy	149	92.535	11.132
Basic Multiplication Res Time	107	2.405	1.468
Basic Multiplication Accuracy	107	95.843	7.699
Multiplication Res Time	239	4.411	2.484
Multiplication Accuracy	239	83.013	20.436
Basic Division Res Time	153	3.444	2.178
Basic Division Accuracy	153	90.863	15.048
Division Res Time	336	4.405	2.556
Division Accuracy	336	79.684	21.651

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 92% accuracy. In multiplication and division, the average response times were below 4.5 seconds and accuracy over 79% 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 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.

4.6 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. 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' improvements were comparable to those of the overall *QuickSmart* group with effect sizes rated very strong to substantial over all operations.

5 Independent Assessments

5.1 Why They are Used

The *QuickSmart* pre- and post-assessments include use of independent tests 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) 2016

	Students with paired data	Average Gain score	Significance	Effect size
All *QuickSmart*	**3511**	**7.075**	**<0.001***	**0.742**
All comparison	**936**	**4.932**	**<0.001***	**0.486**

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) 2016

Gender	Students with paired data	Average Gain score	Significance	Effect size
Male QS Students	1675	7.177	<0.001*	0.745
Male Comp Students	464	4.923	<0.001*	0.474
Female QS Students	1836	6.983	<0.001*	0.738
Female Comp Students	472	4.940	<0.001*	0.499

These results indicate that QuickSmart males did slightly better than females 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 ($p = 0.495$).

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) 2016

Indigenous students	Students with paired data	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	232	7.342	<0.001*	0.634

Once again these results show very strong improvement for the Indigenous students who participated in *QuickSmart*. This improvement is slightly higher 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.

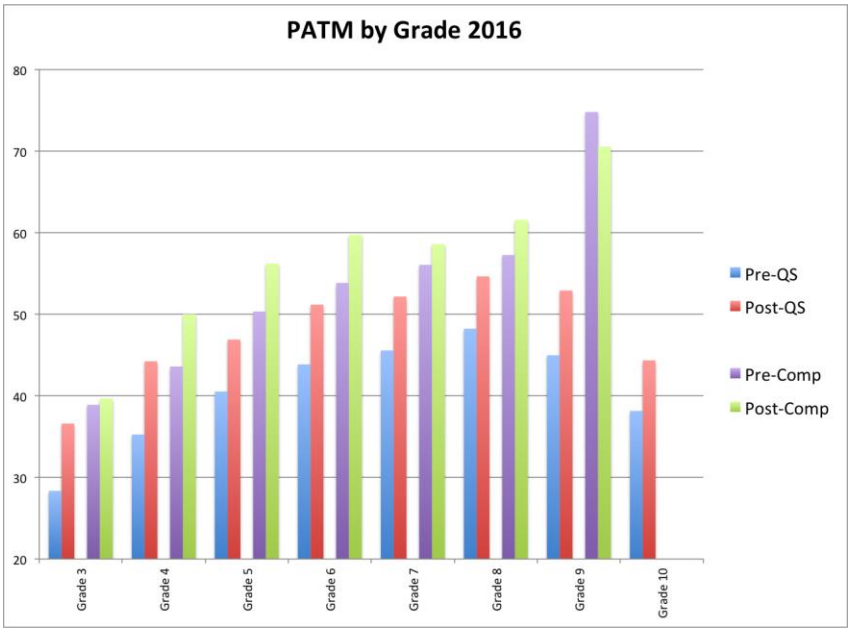


Figure 1: PAT by Grade

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	2856	3511	81.3
Indigenous QS	181	232	78.0
Comparison	682	936	72.9

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) 67735065.

Professor John Pegg

7 APPENDIX A: Independent Assessment Results

7.1 PAT Results by Region (Scale Scores) 2016

School Region		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
Adelaide QS Students	693	41.170	8.207	47.580	8.262	6.409	<0.001*	0.778
Ballarat QS Students	221	42.780	10.265	49.834	10.145	7.055	<0.001*	0.691
Eyre Peninsula QS Students	51	36.669	9.420	41.982	9.722	5.314	0.018	0.555
Gawler QS Students	12	53.192	4.926	56.442	5.331	3.250	<0.001*	0.633
Geelong QS Students	50	45.686	12.400	54.636	7.212	8.950	<0.001*	0.882
Gippsland QS Students	22	43.559	9.089	56.050	6.290	12.491	<0.001*	1.598
Horsham QS Students	77	46.261	8.603	53.349	7.639	7.088	<0.001*	0.871
Hunter QS Students	379	41.451	8.262	48.465	9.737	7.013	<0.001*	0.777
Limestone Coast QS Students	40	38.280	9.873	47.543	9.647	9.263	<0.001*	0.949
Melbourne QS Students	312	46.636	9.377	54.052	9.662	7.417	<0.001*	0.779
Mid West QS Students	91	45.771	9.865	52.387	9.911	6.615	<0.001*	0.669
Mornington QS Students	19	46.179	5.305	58.463	5.629	12.284	0.062	2.246
Murray/Mallee QS Students	28	48.589	5.639	50.404	7.121	1.814	<0.001*	0.282
New England QS Students	21	41.029	6.149	51.543	9.971	10.514	<0.001*	1.269
North Coast QS Students	365	42.340	8.883	50.768	10.120	8.428	<0.001*	0.885
North Tas QS Students	49	46.157	6.790	49.682	6.331	3.524	<0.001*	0.537
North West QS Students	94	40.483	6.861	51.459	9.803	10.976	<0.001*	1.297
Northern Territory QS Students	15	33.440	7.232	42.853	6.236	9.413	0.005	1.394
Perth QS Students	38	41.989	12.944	46.355	10.709	4.366	<0.001*	0.368
Port Pirie QS Students	34	40.053	7.275	51.126	8.900	11.074	<0.001*	1.362
Queensland QS Students	135	44.227	8.891	52.687	9.846	8.460	0.163	0.902
Remote QS Students	15	41.847	16.746	47.293	6.052	5.447	<0.001*	0.433
Riverina QS Students	56	48.254	6.742	52.705	7.431	4.452	0.009	0.627
South Tas QS Students	19	37.421	8.822	44.474	11.537	7.053	<0.001*	0.687
Southern Sydney QS Students	9	47.144	6.148	56.989	5.426	9.844	<0.001*	1.698
Sydney QS Students	472	41.147	9.401	47.917	8.934	6.770	<0.001*	0.738
Western QS Students	72	46.487	12.740	51.393	14.990	4.906	<0.001*	0.353
Western Syd QS Students	98	39.389	8.995	43.229	9.895	3.840	0.001	0.406
Yorke Peninsula/Mid North QS Students	24	40.408	10.415	49.938	6.749	9.529	<0.001*	1.086

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

7.2 PAT Results by Demographic (Scale Scores) 2016

Demographic		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**3511**	**42.543**	**9.347**	**49.619**	**9.726**	**7.075**	**<0.001***	**0.742**
All comparison students	**936**	**51.853**	**10.375**	**56.785**	**9.900**	**4.932**	**<0.001***	**0.486**
Indigenous QS Students	232	41.257	10.820	48.599	12.282	7.342	<0.001*	0.634
Male QS Students	1675	42.370	9.409	49.547	9.843	7.177	<0.001*	0.745
Male comparison students	464	51.820	10.997	56.743	9.747	4.923	<0.001*	0.474
Female QS Students	1836	42.701	9.290	49.684	9.620	6.983	<0.001*	0.738
Female comparison Students	472	51.886	9.735	56.826	10.059	4.940	<0.001*	0.499
Male Indigenous QS Students	119	41.355	10.955	48.589	12.520	7.234	<0.001*	0.615
Female Indigenous QS Students	113	41.154	10.725	48.610	12.083	7.456	<0.001*	0.653

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

7.3 PAT Results by State (Scale Scores) 2016

School		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**3511**	**42.543**	**9.347**	**49.619**	**9.726**	**7.075**	**<0.001***	**0.742**
All comparison students	**936**	**51.853**	**10.375**	**56.785**	**9.900**	**4.932**	**<0.001***	**0.486**
ACT QS students	0							
ACT Ind QS	0							
ACT COMP students	0							
NSW QS students	1657	42.095	9.154	49.247	10.062	7.152	<0.001*	0.744
NSW Ind QS	174	42.899	10.225	50.456	12.206	7.557	<0.001*	0.671
NSW COMP students	203	51.987	10.513	57.431	10.062	5.444	0.011	0.529
NT QS students	15	33.440	7.232	42.853	6.236	9.413	<0.001*	1.394
NT Ind QS	0							
NT COMP students	6	34.633	9.282	44.583	6.945	9.950	0.002	1.214
QLD QS students	135	44.227	8.891	52.687	9.846	8.460	<0.001*	0.902
QLD Ind QS	6	42.817	5.568	52.533	5.639	9.717	0.009	1.734
QLD COMP students	36	53.914	9.100	58.122	7.997	4.208	<0.001*	0.491
SA QS students	897	41.127	8.765	47.659	8.502	6.533	<0.001*	0.757
SA Ind QS	33	34.670	9.664	41.312	10.241	6.642	<0.001*	0.667
SA COMP students	338	50.680	9.732	55.052	9.094	4.372	0.013	0.464
TAS QS students	68	43.716	8.338	48.226	8.367	4.510	<0.001*	0.540
TAS Ind QS	8	46.875	7.251	49.588	4.472	2.713	0.214	0.450
TAS COMP students	27	46.722	10.671	49.919	10.381	3.196	<0.001*	0.304
VIC QS students	701	45.202	9.859	52.869	9.526	7.667	<0.001*	0.791
VIC Ind QS	3	45.033	6.561	53.900	3.732	8.867	0.049	1.661
VIC COMP students	309	53.468	10.669	58.849	10.175	5.381	0.045	0.516
WA QS students	38	41.989	12.944	46.355	10.709	4.366	0.005	0.368
WA Ind QS	8	24.525	11.398	32.350	10.289	7.825	0.115	0.721
WA COMP students	17	54.071	8.059	58.353	9.575	4.282	<0.001*	0.484

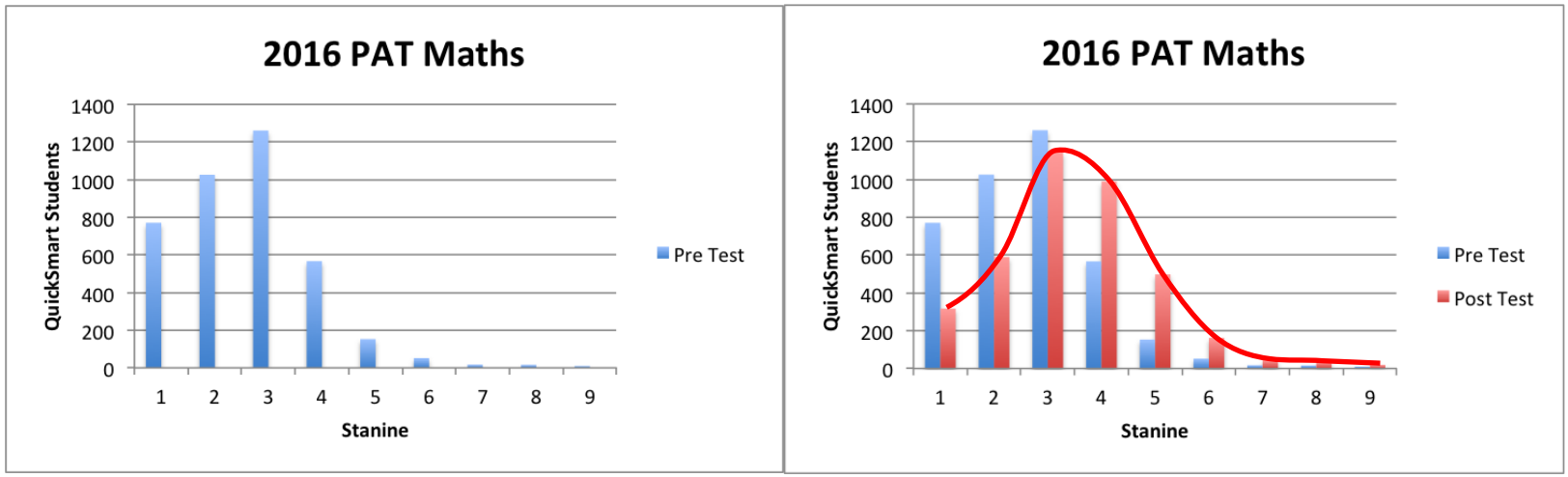
Note: only students who did both 'pre' and 'post' test are included in the table.

7.4 *QuickSmart* Students by Grade (Scale Scores) 2016

Grade		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
Grade 2 QS	6	28.850	4.963	35.300	7.160	6.450	0.034	1.047
Grade 3 QS	31	28.355	5.616	36.600	6.739	8.245	<0.001*	1.329
Grade 3 QS Ind	2	19.050	10.253	30.550	17.890	11.500	0.279	0.789
Grade 3 Comp	10	38.900	9.020	39.680	6.708	0.780	<0.001*	0.098
Grade 4 QS	608	35.264	8.474	44.235	8.444	8.971	<0.001*	1.060
Grade 4 QS Ind	43	34.649	10.353	44.021	11.424	9.372	<0.001*	0.860
Grade 4 Comp	170	43.594	8.871	50.009	8.195	6.416	<0.001*	0.751
Grade 5 QS	799	40.534	7.252	46.900	8.535	6.366	<0.001*	0.804
Grade 5 QS Ind	42	40.355	6.857	46.183	8.528	5.829	<0.001*	0.753
Grade 5 Comp	222	50.340	9.591	56.218	10.155	5.878	<0.001*	0.595
Grade 6 QS	578	43.857	8.369	51.183	8.271	7.326	<0.001*	0.880
Grade 6 QS Ind	21	41.700	12.094	49.105	14.172	7.405	0.001	0.562
Grade 6 Comp	214	53.845	9.660	59.729	8.891	5.884	<0.001*	0.634
Grade 7 QS	954	45.562	8.341	52.171	9.380	6.609	<0.001*	0.745
Grade 7 QS Ind	60	40.532	7.527	48.043	9.750	7.512	<0.001*	0.862
Grade 7 Comp	241	56.061	7.261	58.599	8.288	2.538	<0.001*	0.326
Grade 8 QS	506	48.237	8.736	54.647	9.884	6.411	<0.001*	0.687
Grade 8 QS Ind	58	49.403	10.339	56.481	12.378	7.078	<0.001*	0.621
Grade 8 Comp	76	57.266	11.975	61.568	10.343	4.303	0.715	0.385
Grade 9 QS	23	44.978	12.917	52.913	11.288	7.935	0.006	0.654
Grade 9 QS Ind	4	35.475	3.896	38.075	7.283	2.600	0.545	0.445
Grade 9 Comp	2	74.800	3.253	70.550	9.263	-4.250		no improvement
Grade 10 QS	5	38.160	22.233	44.360	25.885	6.200	0.043	0.257
Grade 10 QS Ind	2	16.950	2.616	19.650	1.202	2.700	0.500	1.326
All Schools – QS Group	**3511**	**42.543**	**9.347**	**49.619**	**9.726**	**7.075**	**<0.001***	**0.742**
All Schools – Indigenous QS Group	**232**	**41.257**	**10.820**	**48.599**	**12.282**	**7.342**	**<0.001***	**0.634**
All Schools – Comp Group	**936**	**51.853**	**10.375**	**56.785**	**9.900**	**4.932**	**<0.001***	**0.486**

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	**3097**	**194**	**69.87**	**56.98**	**81.263**	**18.993**	**63.311**
Female QS students	1597	192	71.22	58.43	82.046	19.477	64.922
Male QS students	1500	193	68.46	55.44	80.429	18.480	61.600
Indigenous QS students	197	44	66.67	51.88	78.120	17.293	57.644
Grade 2	9	2	46.22	40.67	88.686	13.557	45.189
Grade 3	49	8	63.49	57.35	89.931	19.117	63.722
Grade 4	583	81	73.35	63.99	87.480	21.330	71.100
Grade 5	701	110	73.16	61.79	84.930	20.597	68.656
Grade 6	476	94	70.15	57.41	82.438	19.137	63.789
Grade 7	731	68	67.79	53.35	77.843	17.783	59.278
Grade 8	493	41	67.08	49.08	72.645	16.360	54.533
Grade 9	47	13	51.94	36.87	70.591	12.290	40.967
Grade 10	5	4	44.80	38.60	78.898	12.867	42.889

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.