quicksmart

Annual Numeracy Program Report

2018

The SiMERR National Research Centre
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1 *QuickSmart* Executive Summary in 2018

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

Three issues confront schools in Australia with regard to addressing the needs of at-risk students.

1. Too many Australian Indigenous and non-Indigenous students have shown to be resistant to improvements in learning despite large investments of funds to overcome their problems. Longitudinal national data indicate that low-achieving students have not drawn lasting benefits from most current in-class and withdrawal instructional activities.
2. Teaching assistants are an underutilised, poorly supported, and seldom recognised resource in school education. With appropriate training these adults are highly motivated, and offer cost-effective, long-term sustainable ways to close the achievement gap for low-achieving students. In remote and rural areas, trained Indigenous teaching assistants (as *QuickSmart* Instructors) are a resource able to enrich their whole community.
3. Educational support programs need to be sustainable in the short- and long-term without large drains on the public purse. Sustainability means cost-efficient, clear exit criteria, proven longitudinal results, documented ongoing benefits for students and instructors, and replicability (including quality assurance) across all regions of Australia.

The analyses presented in this report provide information about students' performance in the QuickSmart Numeracy program. In particular, the focus here is on the Cognitive Aptitude Assessment System, Australian version (OZCAAS) and on standardised test measures, specifically the Progressive Achievement Tests in Mathematics (ACER, 2016). Some schools provided data for other independent tests, however, there was insufficient use of these tests for inclusion in this report. Further investigation of the data in this report examines the results in terms of gender and for participating Indigenous students.

In 2018, the *QuickSmart* team at the University of New England received matched data from 4,439 students who participated in *QuickSmart* Numeracy lessons and 1,213 average-achieving comparison peers. These students were drawn from schools from 28 regions around Australia.

In terms of the OZCAAS (a random number computer generated testing approach that measures the reaction time (speed) and the accuracy of basic arithmetic computation) the results for the four operations offered at each of two levels indicate a very strong to substantial improvement for the *QuickSmart* students in terms of accuracy and response time. The evidence provided illustrates that *QuickSmart* students narrowed the achievement gap by improving to such an extent that there was either no substantial difference between them and the comparison students or they had reached a slightly better level of performance than their average-achieving comparison group peers.

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

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

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

A further mark of the success of *QuickSmart* can be found in the post-test results of those students who did not succeed in completing the pre-test. In such cases, (see Table 18) Instructors are advised not to continue collecting data in the pre-test as doing so would confront these students with the extent of their weaknesses at the beginning of the program. Significantly, the fact that these students are now able to complete all OZCAAS assessments at the end of the program is an achievement in and of itself.

In addition and subtraction, the average response rates were below 4.063 seconds and above 92% accuracy. In multiplication and division, the average response times were below 4.119 seconds and accuracy over 81% at post-test. This improvement is most likely due to the fact that:

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

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

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

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

The results of independent samples *t*-tests of *QuickSmart* students show that for the ACER PAT results the differences in male and female scores are not statistically significant at the 0.01 significance level ($p = 0.307$).

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

Overall, the focus of this report is on the quantitative aspects of the program. In all analyses, the data report a narrowing of the achievement gap between *QuickSmart* students and their average-performing comparison group peers. Impressive Effect Sizes and shifts in national percentile performance have been reported as well as highly significant gains on the part of individual students who, in some cases, could not complete the full suite of pre-test assessments.

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

The data collected to date from many tens of thousands of *QuickSmar*t students indicate that the narrowing of the achievement gap between *QuickSmart* and comparison students results in low-achieving students proceeding with their studies more successfully by learning to 'trust their heads' in the same ways that effective learners do. Importantly, previous *QuickSmart* studies demonstrate that *QuickSmart* students can maintain the gains made during the program for years after they completed the program. Analyses have consistently identified impressive statistically significant end-of-program and longitudinal gains in terms of probability measures and effect sizes that mirror the qualitative improvements reported by teachers, paraprofessionals, parents and *QuickSmart* students.

2 Background

2.1 Purpose of *QuickSmart*

The prime purpose of the *QuickSmart in Schools* program is to reverse the trend of ongoing poor academic performance for students who have been struggling at school and who are caught in a cycle of continued failure. These targeted students experience significant and sustained difficulties in basic mathematics and/or literacy, and have a profile of low progress despite attempts to overcome their learning problems. Many such students have not drawn lasting benefits from other in-class and withdrawal instructional activities.

A second purpose concerns the professional learning program designed for classroom teachers, special needs support teachers, and paraprofessionals to learn how to work with, and significantly improve, the learning outcomes in basic mathematics and/or literacy of under-achieving middle-school students. The program features professional learning and support for working in a small-class instructional setting with two students, using a specially constructed teaching program supported by extensive material and computer-based resources.

2.2 *QuickSmart* Program Description

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

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

3 *QuickSmart* Tests — 2018

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 a greater margin of improvement relative to that group of comparison students.

Additionally, as *QuickSmart* programs become established in schools, sometimes even within the first year of operation, it becomes increasingly difficult to establish even a true 'comparison' group. This occurs as more and more *QuickSmart* practitioners are sharing *QuickSmart* teaching practices, resources and activities throughout their schools. Our information from school reports is that a majority of Principals begin this school-wide implementation of *QuickSmart* in their schools within the first two years. While this attests to the impact that *QuickSmart* is having in schools, it does not allow a straightforward interpretation of results. Specifically, in many schools, average-achieving comparison students are receiving some experience with *QuickSmart* approaches, activities and resources in their classrooms, and consequently their scores are higher at post-test because of this exposure.

It should also be noted that in order to obtain the difference between the improvement of *QuickSmart* students and comparison students we analysed the data using paired-samples *t*-tests. To protect against the cascading Type I error associated with multiple *t*-tests we lowered the significance level from the customary 0.05 to 0.01. (The reason for this is to adjust for the situation where *t*-tests are repeated many times. This repetition means that, on average, the decision that the means of two groups are significantly different would be incorrect one time in every one hundred replications.) This means that in our analysis for any two means to be judged significantly different from each other, there has to be a less than 1% chance that the result was obtained by chance.

4 Results on the OZCAAS Assessments

4.1 Introduction

In 2018, the *QuickSmart* team at the SiMERR National Research Centre at the University of New England received matched data from 4,439 students who participated in *QuickSmart* Numeracy lessons and 1,213 'average-achieving' comparison peers. These students were drawn from schools from 28 regions around Australia.

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

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

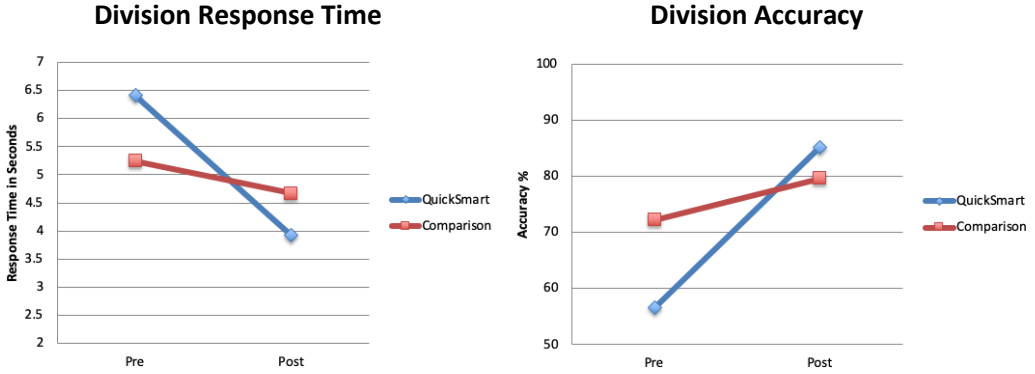
4.2 Combined OZCAAS Analysis

4.2.1 Division

Table 1 below summarises the data submitted for OZCAAS division.

Table 1: OZCAAS division – all students 2018

Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.413	3.021	3.920	2.446	-2.493	<0.001*	0.907
Res Time (secs) Comp	5.248	2.764	4.666	2.473	-0.582	<0.001*	0.222
Accuracy (%) QS	56.526	27.201	85.172	20.110	28.646	<0.001*	1.198
Accuracy (%) Comp	72.217	25.441	79.599	21.912	7.382	<0.001*	0.311



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 2.493 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 0.907, which indicates substantial improvement.

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

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

In terms of accuracy, the *QuickSmart* students' average scores have improved by over 28 percentage points, which is a very strong result. The effect size for this result is 1.198, which again indicates substantial improvement for the *QuickSmart* group.

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

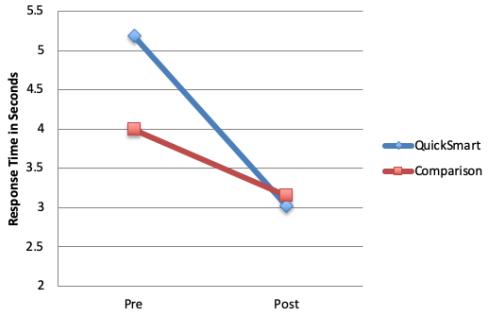
In summary, Table 1 shows that when compared to the scores of the comparison students, *QuickSmart* students' scores indicate substantial improvement for both response time and accuracy. The diagrams illustrate that *QuickSmart* students improved to reach better levels than their comparison average-achieving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

4.2.2 Basic Division

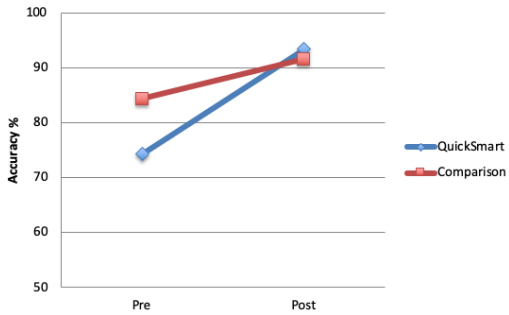
Table 2: OZCAAS basic division – all students 2018

Basic Division	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.188	2.661	3.017	2.025	-2.171	<0.001*	0.918
Res Time (secs) Comp	3.997	2.209	3.150	1.960	-0.847	<0.001*	0.406
Accuracy (%) QS	74.254	25.453	93.356	12.834	19.102	<0.001*	0.948
Accuracy (%) Comp	84.354	19.973	91.538	15.487	7.184	<0.001*	0.402

Basic Division Response Time



Basic Division Accuracy



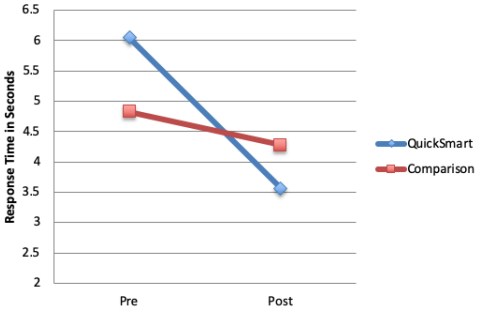
In summary, the results for basic division indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.3 Multiplication

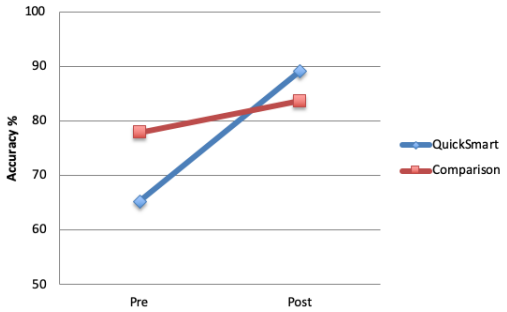
Table 3: OZCAAS multiplication – all students 2018

Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	6.046	2.818	3.563	2.235	-2.483	<0.001*	0.976
Res Time (secs) Comp	4.826	2.622	4.279	2.352	-0.547	<0.001*	0.22
Accuracy (%) QS	65.224	22.507	89.151	16.393	23.927	<0.001*	1.215
Accuracy (%) Comp	77.922	20.077	83.683	17.628	5.761	<0.001*	0.305

Multiplication Response Time



Multiplication Accuracy



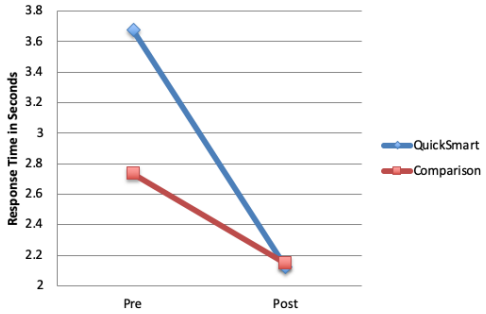
In summary, the results for multiplication indicate a substantial improvement in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a better level of performance than the comparison students.

4.2.4 Basic Multiplication

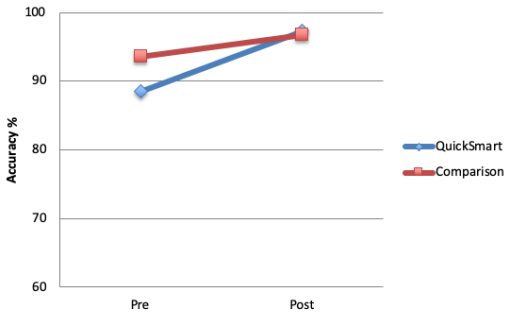
Table 4: OZCAAS basic multiplication – all students 2018

Basic Multiplication	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.675	2.250	2.121	1.411	-1.554	<0.001*	0.827
Res Time (secs) Comp	2.735	1.594	2.147	1.265	-0.588	<0.001*	0.409
Accuracy (%) QS	88.528	16.546	97.301	6.930	8.773	<0.001*	0.692
Accuracy (%) Comp	93.603	12.876	96.741	7.859	3.138	<0.001*	0.294

Basic Multiplication Response Time



Basic Multiplication Accuracy

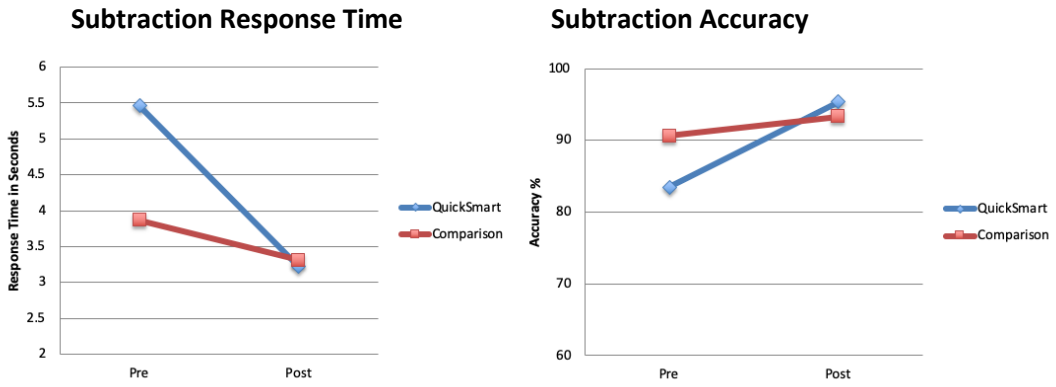


In summary, the results for basic multiplication indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison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

4.2.5 Subtraction

Table 5: OZCAAS subtraction – all students 2018

Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	5.461	2.763	3.217	1.886	-2.244	<0.001*	0.949
Res Time (secs) Comp	3.869	2.199	3.307	1.767	-0.562	<0.001*	0.282
Accuracy (%) QS	83.484	16.765	95.392	8.978	11.908	<0.001*	0.886
Accuracy (%) Comp	90.659	12.378	93.310	11.162	2.651	<0.001*	0.225

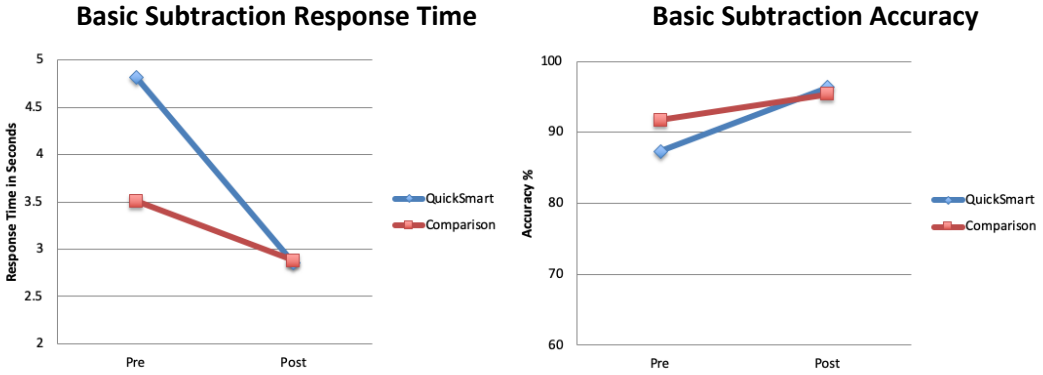


In summary, the results for subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students.

4.2.6 Basic Subtraction

Table 6: OZCAAS basic subtraction – all students 2018

Basic Subtraction	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	4.821	2.693	2.854	1.780	-1.967	<0.001*	0.862
Res Time (secs) Comp	3.510	2.068	2.880	1.625	-0.63	<0.001*	0.339
Accuracy (%) QS	87.343	14.319	96.356	6.975	9.013	<0.001*	0.8
Accuracy (%) Comp	91.703	13.938	95.348	10.274	3.645	<0.001*	0.298

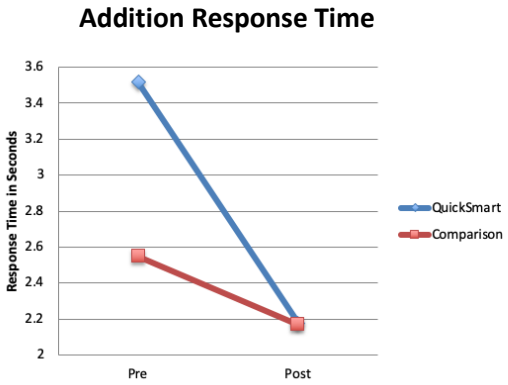


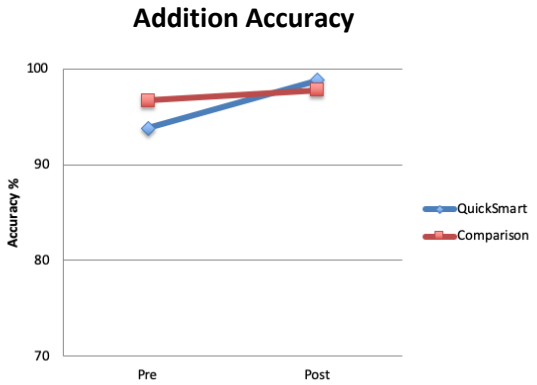
In summary, the results for basic subtraction indicate a substantial improvement for the *QuickSmart* students in both response time and accuracy. The diagrams illustrate that the *QuickSmart* students improved to such an extent that there was no substantial difference between them and the comparison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

4.2.7 Addition

Table 7: OZCAAS addition – all students 2018

Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	3.518	1.789	2.178	1.059	-1.34	<0.001*	0.912
Res Time (secs) Comp	2.548	1.343	2.169	1.056	-0.379	<0.001*	0.314
Accuracy (%) QS	93.819	9.101	98.788	3.573	4.969	<0.001*	0.719
Accuracy (%) Comp	96.673	7.184	97.790	6.001	1.117	<0.001*	0.169



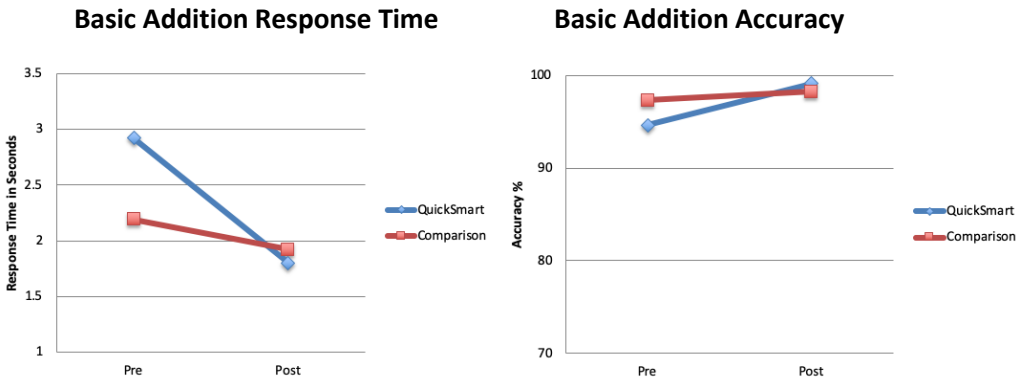


In summary, the results for addition indicate a substantial improvement for the *QuickSmart* students in response time and a very strong improvement in accuracy. The diagrams illustrate that the *QuickSmart* students improved to reach a slightly better level of performance than the comparison students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

4.2.8 Basic Addition

Table 8: OZCAAS Basic Addition results – all students 2018

Basic Addition	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Res Time (secs) QS	2.921	1.637	1.799	0.859	-1.122	<0.001*	0.858
Res Time (secs) Comp	2.193	1.077	1.920	0.928	-0.273	<0.001*	0.272
Accuracy (%) QS	94.646	9.088	99.114	2.706	4.468	<0.001*	0.666
Accuracy (%) Comp	97.315	6.374	98.250	5.092	0.935	0.021	0.162



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 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	6.218	2.921	3.801	2.388	-2.417	<0.001*	0.906
Male Comparison	5.040	2.693	4.456	2.439	-0.584	<0.001*	0.227
Female *QuickSmart*	6.586	3.097	4.027	2.493	-2.559	<0.001*	0.91
Female Comparison	5.454	2.821	4.874	2.492	-0.58	<0.001*	0.218
Accuracy (%)							
Male *QuickSmart*	57.338	27.388	85.268	20.138	27.93	<0.001*	1.162
Male Comparison	72.644	26.045	79.617	22.294	6.973	<0.001*	0.288
Female *QuickSmart*	55.805	27.023	85.087	20.092	29.282	<0.001*	1.23
Female Comparison	71.792	24.848	79.581	21.551	7.789	<0.001*	0.335

These results indicate that females did slightly better than males in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level (p = 0.233 for response time and 0.124 for accuracy).

4.3.2 Basic Division by Gender

Table 10: OZCAAS basic division results – all students by gender 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.980	2.560	2.952	1.977	-2.028	<0.001*	0.887
Male Comparison	3.829	2.055	2.898	1.638	-0.931	<0.001*	0.501
Female *QuickSmart*	5.344	2.726	3.066	2.060	-2.278	<0.001*	0.943
Female Comparison	4.134	2.323	3.355	2.170	-0.778	<0.001*	0.346
Accuracy (%)							
Male *QuickSmart*	74.095	26.874	93.564	12.575	19.469	<0.001*	0.928
Male Comparison	84.673	18.584	90.853	16.589	6.180	<0.001*	0.351
Female *QuickSmart*	74.374	24.349	93.201	13.031	18.827	<0.001*	0.964
Female Comparison	84.095	21.082	92.095	14.555	8.0	<0.001*	0.442

These results indicate that males did marginally better than females in accuracy and females did slightly better in response time. The results of independent samples *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level (p = 0.073 for response time and 0.599 for accuracy).

4.3.3 Multiplication by Gender

Table 11: OZCAAS multiplication results – all students by gender 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	5.993	2.801	3.503	2.211	-2.49	<0.001*	0.987
Male Comparison	4.762	2.633	4.160	2.381	-0.602	<0.001*	0.24
Female *QuickSmart*	6.093	2.833	3.617	2.255	-2.476	<0.001*	0.967
Female Comparison	4.890	2.612	4.396	2.320	-0.494	<0.001*	0.2
Accuracy (%)							
Male *QuickSmart*	65.456	22.848	89.151	16.345	23.695	<0.001*	1.193
Male Comparison	78.049	20.912	83.503	17.966	5.454	<0.001*	0.28
Female *QuickSmart*	65.018	22.206	89.152	16.439	24.134	<0.001*	1.235
Female Comparison	77.797	19.240	83.861	17.305	6.064	<0.001*	0.331

These results indicate that, based on gain, males did slightly better than females in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level (p = 0.888 in response time and 0.524 in accuracy).

4.3.4 Basic Multiplication by Gender

Table 12: OZCAAS Basic multiplication results – all students by gender 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.680	2.359	2.116	1.512	-1.564	<0.001*	0.79
Male Comparison	2.639	1.324	2.039	1.144	-0.6	<0.001*	0.485
Female *QuickSmart*	3.671	2.169	2.126	1.334	-1.545	<0.001*	0.858
Female Comparison	2.812	1.783	2.234	1.352	-0.578	<0.001*	0.365
Accuracy (%)							
Male *QuickSmart*	87.464	18.351	97.217	6.757	9.753	<0.001*	0.705
Male Comparison	93.796	12.132	96.894	7.657	3.098	<0.001*	0.305
Female *QuickSmart*	89.300	15.067	97.362	7.056	8.062	<0.001*	0.685
Female Comparison	93.446	13.481	96.617	8.040	3.171	<0.001*	0.286

These results indicate that males did slightly better than females in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in response time the differences are not statistically significant at the 0.01 significance level (p = 0.854) but they are close to being significant in accuracy (p = 0.032). However, the small effect size for accuracy (Cohen's d = 0.118) indicates that this statistical finding is not meaningful for practical purposes.

4.3.5 Subtraction by Gender

Table 13: OZCAAS subtraction results – all students by gender 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	5.013	2.596	2.999	1.791	-2.014	<0.001*	0.903
Male Comparison	3.550	2.077	2.982	1.600	-0.568	<0.001*	0.306
Female *QuickSmart*	5.844	2.842	3.403	1.945	-2.441	<0.001*	1.002
Female Comparison	4.182	2.271	3.626	1.864	-0.556	<0.001*	0.268
Accuracy (%)							
Male *QuickSmart*	84.367	16.333	95.586	8.715	11.219	<0.001*	0.857
Male Comparison	91.398	12.508	93.433	11.490	2.035	<0.001*	0.169
Female *QuickSmart*	82.731	17.092	95.226	9.195	12.495	<0.001*	0.91
Female Comparison	89.933	12.217	93.188	10.840	3.255	<0.001*	0.282

These results indicate that females did better than males in both response time and accuracy. The independent samples *t*-tests of *QuickSmart* students show that these results are statistically significant at the 0.01 significance level ($p < 0.001$ for response time and 0.013 in accuracy). However, the small effect sizes (Cohen's $d = 0.184$ for response time and 0.082 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 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	4.575	2.664	2.731	1.867	-1.844	<0.001*	0.802
Male Comparison	3.320	2.043	2.701	1.567	-0.619	<0.001*	0.34
Female *QuickSmart*	5.021	2.702	2.954	1.702	-2.067	<0.001*	0.916
Female Comparison	3.658	2.084	3.019	1.661	-0.639	<0.001*	0.339
Accuracy (%)							
Male *QuickSmart*	86.746	14.659	96.180	6.906	9.434	<0.001*	0.823
Male Comparison	91.361	14.343	94.731	12.424	3.37	0.003	0.251
Female *QuickSmart*	87.828	14.030	96.498	7.032	8.67	<0.001*	0.781
Female Comparison	91.967	13.665	95.826	8.254	3.859	<0.001*	0.342

These results indicate that males did better than females in accuracy and females did slightly better in response time. The results of independent samples *t*-tests of *QuickSmart* students show that these differences are not statistically significant at the 0.01 significance level ($p = 0.085$ in response time and 0.335 in accuracy).

4.3.7 Addition by Gender

Table 15: OZCAAS addition results – all students by gender 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	3.338	1.735	2.102	1.066	-1.236	<0.001*	0.859
Male Comparison	2.441	1.358	2.056	1.030	-0.385	<0.001*	0.319
Female *QuickSmart*	3.669	1.821	2.242	1.050	-1.427	<0.001*	0.96
Female Comparison	2.652	1.321	2.278	1.070	-0.374	<0.001*	0.312
Accuracy (%)							
Male *QuickSmart*	93.848	8.833	98.660	3.975	4.812	<0.001*	0.703
Male Comparison	96.797	7.431	97.879	6.016	1.082	<0.001*	0.16
Female *QuickSmart*	93.795	9.322	98.894	3.194	5.099	<0.001*	0.732
Female Comparison	96.554	6.942	97.704	5.991	1.15	<0.001*	0.177

These results indicate that females did better than males in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.319$) but they are significant in response time ($p < 0.001$). However, the small effect size for response time (Cohen's $d = 0.125$) 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 2018

Group	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Response Time (seconds)							
Male *QuickSmart*	2.901	1.739	1.759	0.196	-1.142	<0.001*	0.923
Male Comparison	2.248	1.230	1.892	0.963	-0.356	<0.001*	0.322
Female *QuickSmart*	2.936	1.548	1.831	0.808	-1.105	<0.001*	0.895
Female Comparison	2.149	0.939	1.942	0.902	-0.207	0.001	0.224
Accuracy (%)							
Male *QuickSmart*	94.177	9.411	99.12	2.715	4.943	<0.001*	0.714
Male Comparison	97.242	5.537	98.439	3.777	1.197	0.013	0.253
Female *QuickSmart*	95.032	8.802	99.109	2.701	4.077	<0.001*	0.626
Female Comparison	97.373	6.996	98.098	5.952	0.725	0.243	0.112

These results indicate that males did better than females in both response time and accuracy. The results of independent samples *t*-tests of *QuickSmart* students show that in both response time and accuracy the differences are not statistically significant at the 0.01 significance level ($p = 0.635$ for response time and 0.108 for accuracy).

4.3.9 Indigenous Students

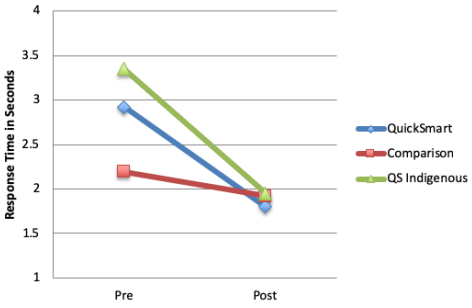
Table 17: OZCAAS results – Indigenous students 2018

Test	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Basic Addition								
Response time (seconds)	3.348	2.392	1.952	1.010	-1.396	<0.001*	0.76	
Accuracy (%)	93.260	11.093	98.753	3.181	5.493	<0.001*	0.673	
Addition								
Response time (seconds)	3.922	2.309	2.513	1.414	-1.409	<0.001*	0.736	
Accuracy (%)	93.740	8.577	97.831	5.533	4.091	<0.001*	0.567	
Basic Subtraction								
Response time (seconds)	5.753	3.424	3.656	2.351	-2.097	<0.001*	0.714	
Accuracy (%)	85.888	15.156	95.463	7.889	9.575	<0.001*	0.793	
Subtraction								
Response time (seconds)	5.689	2.891	3.871	2.520	-1.818	<0.001*	0.67	
Accuracy (%)	81.839	18.057	93.441	11.106	11.602	<0.001*	0.774	
Basic Multiplication								
Response time (seconds)	3.852	2.347	2.214	1.369	-1.639	<0.001*	0.853	
Accuracy (%)	85.253	21.619	97.230	6.083	11.977	<0.001*	0.754	
Multiplication								
Response time (seconds)	6.025	2.626	3.996	2.560	-2.029	<0.001*	0.782	
Accuracy (%)	64.704	21.625	86.106	17.625	21.402	<0.001*	1.085	
Basic Division								
Response time (seconds)	5.121	2.513	3.443	2.571	-1.678	<0.001*	0.66	
Accuracy (%)	70.747	30.169	91.389	14.837	20.642	<0.001*	0.868	
Division								
Response time (seconds)	6.562	3.063	4.543	2.795	-2.019	<0.001*	0.688	
Accuracy (%)	51.911	27.366	80.843	22.292	28.932	<0.001*	1.159	

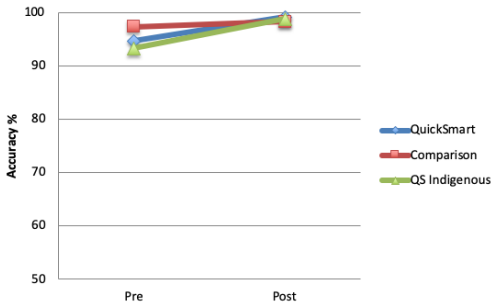
These results indicate that in most instances the Indigenous students' improvement was very similar to that of the overall *QuickSmart* group. For addition, the accuracy results exhibit the ceiling effect (the pre-intervention scores were so high that the students did not have much room for further improvement).

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).

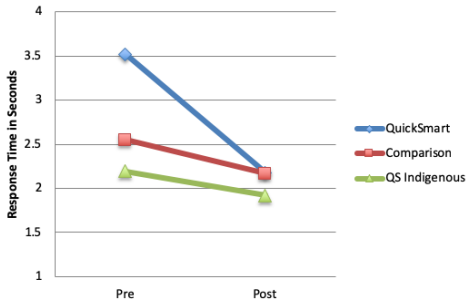
Basic Addition Response Time



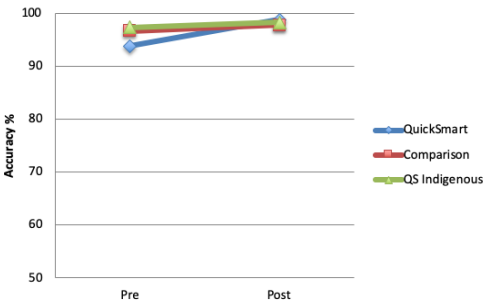
Basic Addition Accuracy



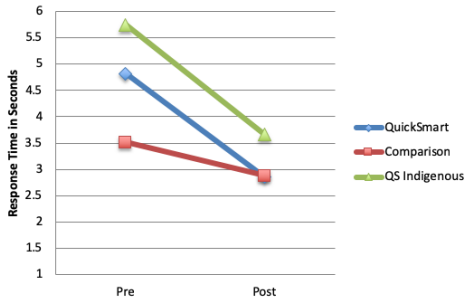
Addition Response Time



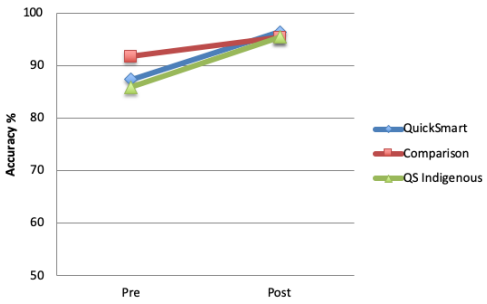
Addition Accuracy



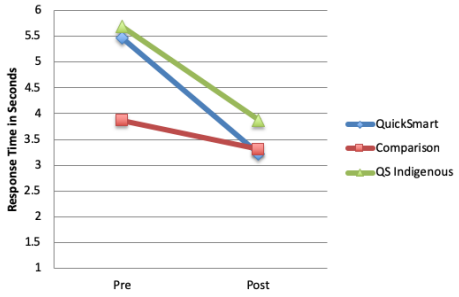
Basic Subtraction Response Time



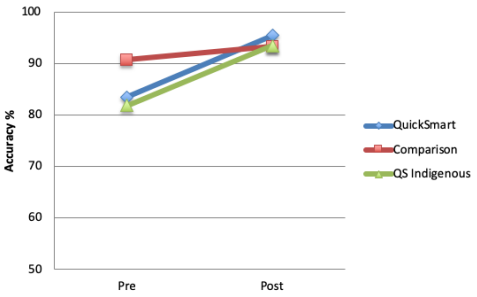
Basic Subtraction Accuracy



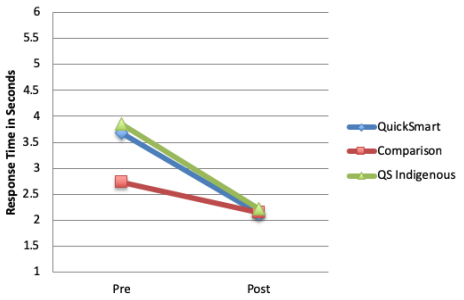
Subtraction Response Time



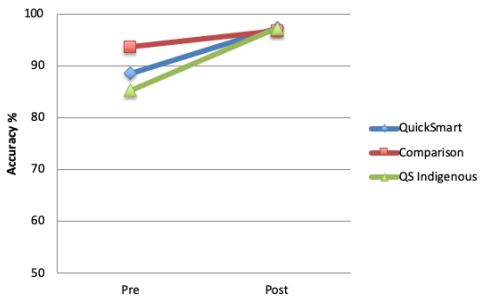
Subtraction Accuracy



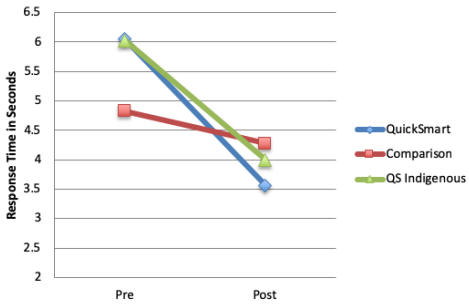
Basic Multiplication Response Time



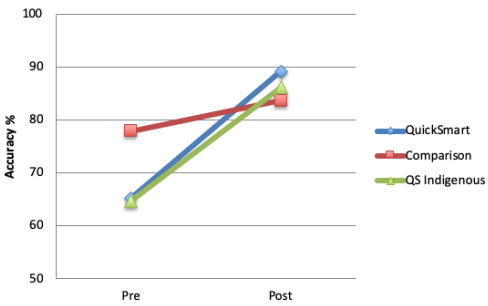
Basic Multiplication Accuracy



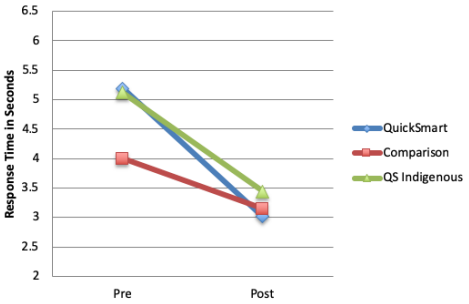
Multiplication Response Time



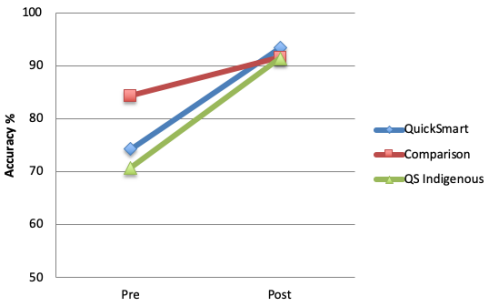
Multiplication Accuracy



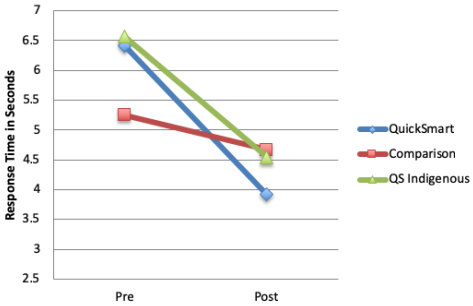
Basic Division Response Time



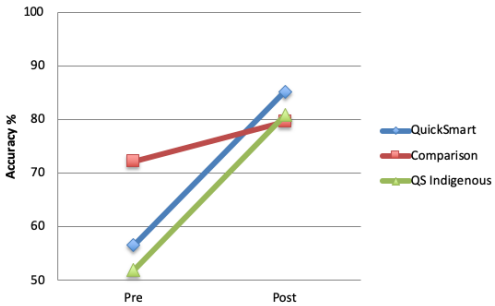
Basic Division Accuracy



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 – 2018

	Mean	Std. Deviation
Basic Addition		
Response time (seconds)	2.400	1.914
Accuracy (%)	96.943	5.267
Addition		
Response time (seconds)	1.823	1.673
Accuracy (%)	97.123	6.555
Basic Subtraction		
Response time (seconds)	4.063	3.702
Accuracy (%)	97.496	4.299
Subtraction		
Response time (seconds)	3.382	2.826
Accuracy (%)	92.801	14.139
Basic Multiplication		
Response time (seconds)	2.287	1.500
Accuracy (%)	97.235	6.025
Multiplication		
Response time (seconds)	4.073	2.829
Accuracy (%)	86.295	17.143
Basic Division		
Response time (seconds)	2.978	2.091
Accuracy (%)	91.751	13.441
Division		
Response time (seconds)	4.119	2.586
Accuracy (%)	81.876	23.125

The results in Table 18 are impressive given that these students did not have the skills or confidence to complete the OZCAAS pre-tests initially. In addition and subtraction, the average response rates were below 4.063 seconds and above 92% accuracy. In multiplication and division, the average response times were below 4.119 seconds and accuracy over 81% at post-test. Even though some of these students may not have progressed to multiplication and division during *QuickSmart* lessons, their results are encouraging. It is likely that part of this improvement may be due to the fact that:

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

4.6 Conclusion on OZCAAS Testing

Overall, the *QuickSmart* students showed very strong growth in their understanding and use of number facts. In all four mathematical operations, they either closed the gap between them and the comparison group of average-achieving peers or narrowed this gap to a very small margin. Such growth is critical for these students as number facts are a vital skill underpinning mathematics functioning in general. This improvement provides the necessary foundation for students to improve in other areas of mathematics that are not specifically taught in *QuickSmart*.

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

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

5 Independent Assessments

5.1 Why They are Used

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

5.2 Results on the PATM Assessments

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

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

Table 19: PATM results – (Scale scores) 2018

	Average Gain score	Significance	Effect size
All *QuickSmart*	6.442	<0.001*	0.657
All comparison	4.369	<0.001*	0.415

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) 2018

Gender	Average Gain score	Significance	Effect size
Male			
QuickSmart Students	6.622	<0.001*	0.667
Comparison Students	4.613	<0.001*	0.422
Female			
QuickSmart Students	6.303	<0.001*	0.649
Comparison Students	4.137	<0.001*	0.407

These results indicate that QuickSmart males did slightly better than females in PATM assessment. However, the results of independent samples *t*-tests of *QuickSmart* students show that for the ACER PAT results the differences are not statistically significant at the 0.01 significance level ($p = 0.307$).

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) 2018

Indigenous students	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	5.567	<0.001*	0.636
All *QuickSmart*	6.442	<0.001*	0.657

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

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

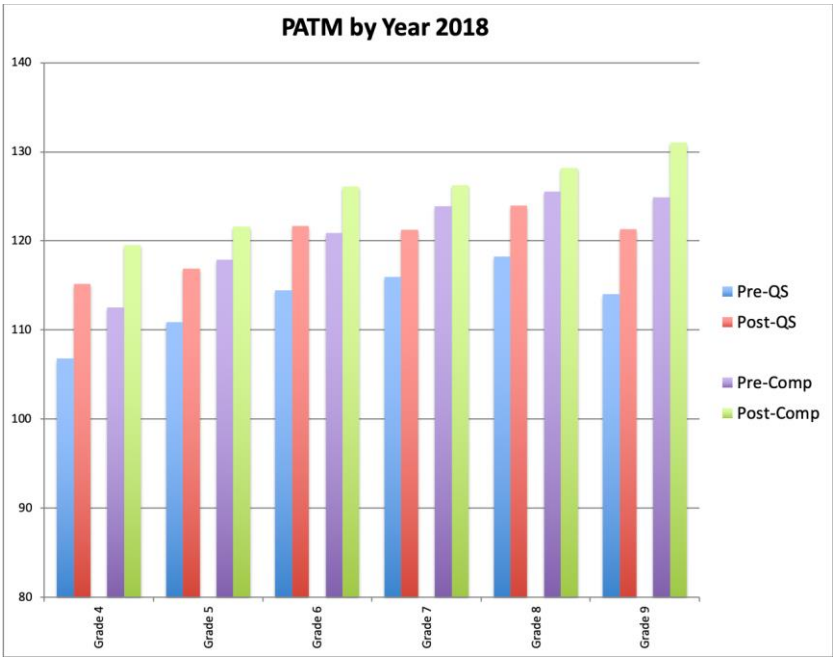


Figure 1: PAT by Year

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

Table 22: Percentage students with PAT Gain

Student Type	Percentage with Gain
QuickSmart	78.3
Indigenous *QuickSmart*	73.6
Comparison	68.5

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

6 Conclusion to Report

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

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

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

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

Professor John Pegg

7 APPENDIX A: Independent Assessment Results

7.1 PAT Results by Region (Scale Scores) 2018

School Region	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
Adelaide QS Students	109.908	9.544	116.497	9.150	6.589	<0.001*	0.705
Ballarat QS Students	117.847	7.637	121.598	8.613	3.751	<0.001*	0.461
Eyre Peninsula QS Students	104.022	5.262	108.964	8.133	4.942	<0.001*	0.722
Geelong QS Students	113.457	9.577	121.532	11.412	8.075	<0.001*	0.767
Gippsland QS Students	109.506	5.309	115.347	8.756	5.841	0.003	0.807
Goulbourn QS Students	117.267	6.033	118.391	5.712	1.124	0.256	0.191
Horsham QS Students	118.708	6.935	120.281	7.468	1.573	0.215	0.218
Hunter QS Students	111.642	8.932	119.008	10.945	7.366	<0.001*	0.737
Limestone Coast QS Students	110.083	7.383	116.979	8.183	6.896	<0.001*	0.885
Melbourne QS Students	117.286	8.243	125.021	11.048	7.735	<0.001*	0.794
Mid-West QS Students	114.243	9.971	121.261	6.988	7.018	<0.001*	0.815
Mornington QS Students	115.863	9.332	118.725	9.973	2.862	0.188	0.296
Murray/Mallee QS Students	116.741	9.218	119.376	6.429	2.635	0.192	0.332
New England QS Students	115.147	10.688	122.220	9.193	7.073	0.002	0.71
North Coast QS Students	112.169	7.209	122.625	10.561	10.456	<0.001*	1.156
North Tas QS Students	115.562	7.069	117.286	8.001	1.724	0.161	0.228
North West QS Students	112.582	5.965	118.501	8.718	5.919	<0.001*	0.792
Port Pirie QS Students	115.317	7.213	124.073	11.102	8.756	<0.001*	0.935
Queensland QS Students	112.279	12.935	120.777	15.720	8.498	<0.001*	0.59
Remote QS Students	113.057	8.388	120.257	10.162	7.2	<0.001*	0.773
Riverina QS Students	117.683	8.925	121.098	8.226	3.415	<0.001*	0.398
South Tas QS Students	118.350	6.121	121.975	5.152	3.625	0.099	0.641
Southern Sydney QS Students	114.278	8.428	120.313	9.390	6.035	<0.001*	0.676
Sydney QS Students	113.418	8.891	119.380	9.172	5.962	<0.001*	0.66
Warrnambool QS Students	118.952	7.676	123.992	7.912	5.04	<0.001*	0.647
Western QS Students	107.983	8.277	112.335	7.265	4.352	<0.001*	0.559
Western Syd QS Students	110.974	9.877	117.355	10.208	6.381	<0.001*	0.635
Yorke Peninsula/Mid North QS Students	111.015	8.981	120.820	7.421	9.805	<0.001*	1.19

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

7.2 PAT Results by Demographic (Scale Scores) 2018

Demographic	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**113.163**	**9.359**	**119.605**	**10.240**	**6.442**	**<0.001***	**0.657**
All comparison students	**119.553**	**10.258**	**123.922**	**10.806**	**4.369**	**<0.001***	**0.415**
Indigenous QS Students	110.216	8.291	115.783	9.193	5.567	<0.001*	0.636
Male QS Students	113.191	9.611	119.813	10.250	6.622	<0.001*	0.667
Male comparison students	119.465	10.647	124.078	11.213	4.613	<0.001*	0.422
Female QS Students	113.141	9.163	119.444	10.233	6.303	<0.001*	0.649
Female comparison Students	119.636	9.887	123.773	10.417	4.137	<0.001*	0.407
Male Indigenous QS Students	110.003	8.720	116.176	9.063	6.173	<0.001*	0.694
Female Indigenous QS Students	110.398	7.943	115.446	9.333	5.048	<0.001*	0.583

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

7.3 PAT Results by State (Scale Scores) 2018

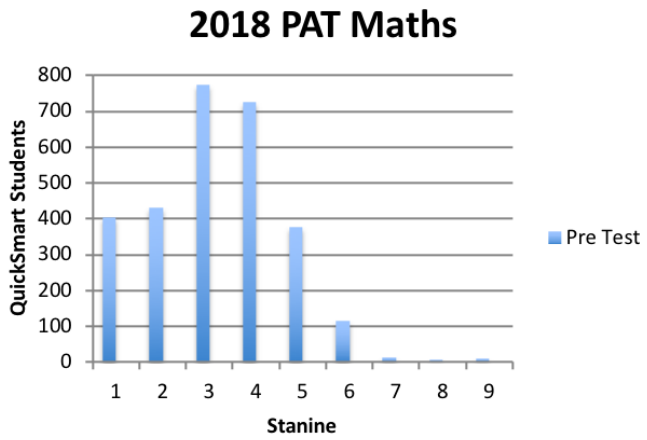
State	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
All *QuickSmart* Students	**113.163**	**9.359**	**119.605**	**10.240**	**6.442**	**<0.001***	**0.657**
All comparison students	**119.553**	**10.258**	**123.922**	**10.806**	**4.369**	**<0.001***	**0.415**
New South Wales							
QuickSmart	112.748	8.846	119.577	9.837	6.829	<0.001*	0.73
Indigenous *QuickSmart*	110.236	7.855	116.185	8.907	5.949	<0.001*	0.708
Comparison	119.246	9.402	125.080	9.446	5.834	<0.001*	0.619
Queensland							
QuickSmart	112.279	12.935	120.777	15.720	8.498	<0.001*	0.59
Indigenous *QuickSmart*	108.967	14.813	114.733	12.559	5.766	0.065	0.42
Comparison	122.476	8.114	127.373	10.699	4.897	0.001	0.516
South Australia							
QuickSmart	110.232	9.326	116.901	9.593	6.669	<0.001*	0.705
Indigenous *QuickSmart*	105.360	8.491	110.087	11.760	4.727	0.146	0.461
Comparison	116.587	9.541	122.154	9.289	5.567	<0.001*	0.591
Tasmania							
QuickSmart	116.245	6.894	118.435	7.632	2.19	0.039	0.301
Indigenous *QuickSmart*	118.550	1.100	121.400	1.953	2.85	0.104	1.798
Comparison	121.325	7.025	121.217	6.842	-0.108		no improvement
Victoria							
QuickSmart	117.382	8.028	122.552	9.472	5.17	<0.001*	0.589
Indigenous *QuickSmart*	114.200	8.041	116.345	6.822	2.145	0.238	0.288
Comparison	122.240	11.059	124.543	12.815	2.303	<0.001*	0.192

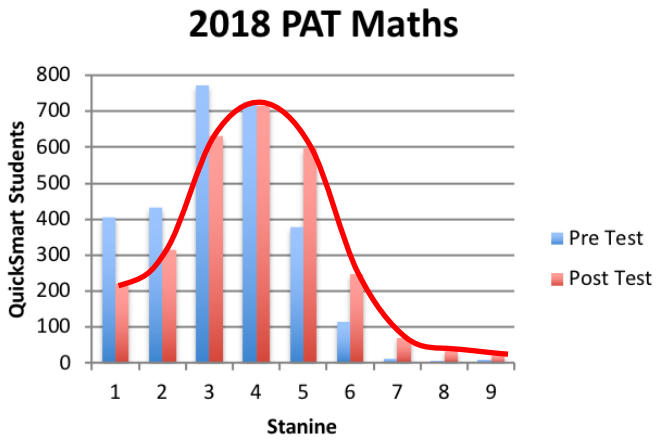
Note: only students who did both 'pre' and 'post' test are included in the table.

7.4 *QuickSmart* Students by Year (Scale Scores) 2018

Year	Pre-Intervention		Post-Intervention				
	Mean	SD	Mean	SD	Gain	*p*	Effect size
Year 4							
QuickSmart	106.790	8.486	115.177	9.650	8.387	<0.001	0.923
Indigenous *QuickSmart*	107.072	7.731	112.058	9.449	4.986	<0.001	0.578
Comparison	112.506	9.411	119.513	9.440	7.007	<0.001	0.743
Year 5							
QuickSmart	110.883	8.297	116.923	9.461	6.04	<0.001	0.679
Indigenous *QuickSmart*	107.545	7.323	115.157	9.970	7.612	<0.001	0.87
Comparison	117.882	8.864	121.632	9.858	3.75	<0.001	0.4
Year 6							
QuickSmart	114.451	7.869	121.678	8.851	7.227	<0.001	0.863
Indigenous *QuickSmart*	109.313	9.365	117.840	7.102	8.527	<0.001	1.026
Comparison	120.883	8.541	126.109	11.040	5.226	<0.001	0.529
Year 7							
QuickSmart	115.972	8.055	121.231	9.838	5.259	<0.001	0.585
Indigenous *QuickSmart*	111.544	6.799	115.695	7.809	4.151	<0.001	0.567
Comparison	123.887	8.056	126.239	10.385	2.352	<0.001	0.253
Year 8							
QuickSmart	118.229	8.822	123.969	10.434	5.74	<0.001	0.594
Indigenous *QuickSmart*	116.445	7.870	120.687	8.938	4.242	0.003	0.504
Comparison	125.518	9.223	128.164	11.240	2.646	0.006	0.257
Year 9							
QuickSmart	114.015	19.038	121.347	15.814	7.332	<0.001	0.419
Indigenous *QuickSmart*	110.933	18.546	112.200	9.154	1.267	0.837	0.087
Comparison	124.900	17.051	131.067	9.218	6.167	0.243	0.45
All Schools							
QuickSmart	**113.163**	**9.359**	**119.605**	**10.240**	**6.442**	**<0.001**	**0.657**
Indigenous *QuickSmart*	**110.216**	**8.291**	**115.783**	**9.193**	**5.567**	**<0.001**	**0.636**
Comparison	**119.553**	**10.258**	**123.922**	**10.806**	**4.369**	**<0.001**	**0.415**

7.5 PATM Stanine Improvement for *QuickSmart* Students





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

A stanine score of:

1 represents performance below the bottom 4% of the population
2 represents performance in the lower 4-10% of the population
3 represents performance in the lower 11-22% of the population
4 represents performance in the lower 23-39% of the population
5 represents performance in middle 40-59% of the population
6 represents performance in the higher 60-76% of the population
7 represents performance in the higher 77-88% of the population
8 represents performance in the higher 89-96% of the population
9 represents performance above the top 4% of the population.

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

7.6 PAT Results by Percentile

Demographic	Mean Percentile		
	Pre	Post	Gain
All *QuickSmart*	**24.014**	**32.835**	**8.821**
All Comparison	**40.761**	**44.828**	**4.067**
Indigenous *QuickSmart*	16.596	24.663	8.067
QuickSmart Female	24.083	32.498	8.415
Comparison Female	40.430	43.923	3.493
QuickSmart Male	23.925	33.272	9.347
Comparison Male	41.109	45.779	4.670
Year			
QuickSmart Year 4	28.721	39.998	11.277
Comparison Year 4	47.163	54.023	6.860
QuickSmart Year 5	25.845	31.850	6.005
Comparison Year 5	44.420	45.315	0.895
QuickSmart Year 6	24.536	35.193	10.657
Comparison Year 6	41.432	48.012	6.580
QuickSmart Year 7	22.288	29.789	7.501
Comparison Year 7	35.623	38.623	3.000
QuickSmart Year 8	18.936	29.251	10.315
Comparison Year 8	33.373	37.328	3.955
QuickSmart Year 9	17.529	24.441	6.912
Comparison Year 9	32.733	38.333	5.600
Lessons attended			
<20	33.93	38.55	4.62
21-40	28.58	32.67	4.09
41-60	21.88	30.84	8.96
61-80	24.65	33.16	8.51
80+	23.74	41.65	17.91

8 APPENDIX B: SiMERR's Response to RCT

This is SiMERR's response to the Evaluation Report (Report) of the Evidence for Learning Randomised Controlled Trial of QuickSmart Numeracy (the Trial) evaluated by the Teachers and Teaching Research Centre, University of Newcastle (the Evaluator).

Executive Summary

Data collected by the Evaluator in the Trial and analysed by SiMERR using approved Australian Council for Educational Research (ACER) procedures showed students who undertook 75% or more of the QuickSmart lessons achieved on average 2.5-to-3 times expected one-year's growth. These results are consistent with that reported by SiMERR, education jurisdictions, principals, schools and parents over the past two decades.

Using Trial data, ACER procedures also show national percentile progress in the 14 months of the Trial for students who achieved:

(i) 90%+ lesson participation in QuickSmart, progressed 38 percentiles from the 11th percentile to the 49th percentile; and

(ii) 75%+ lesson participation progressed 33 percentiles from the 16th percentile to the 49th percentile.

Students… with 75%+ lesson participation… achieved on average 2.5-to-3 times expected one-year's growth

The critical concern of the SiMERR/QuickSmart Team of the Trial is that important data are not clearly revealed in the Report. The analysis in the Report, while technically correct, does not include within-group analysis, which reveals crucial information not made evident in the Report.

***at least* 25%-to-38% of the school year was not available to schools for QuickSmart setup and lesson participation**

Also, not revealed fully or discussed carefully in the Report, are important details on how *implementation* aspects of the Trial design, including obtaining parent permissions for student participation, pre-and post-testing using PATMaths and randomising students into groups, meant that *at least* 25%-to-38% of the school year was not available to school for QuickSmart setup and lesson participation.

This loss of school weeks precluded the possibility for schools to offer 30 weeks of QuickSmart instruction. For schools, this meant a late start, early finish, no setup time and no flexibility for them to cover student or Instructor absences, or any competing in-school activities or excursions. The impact of these normal/typical school functions, with no room for schools to manoeuvre, resulted in further reductions in QuickSmart lesson rates that were beyond the control of schools to address.

Because of concerns with these limitations to the Trial, SiMERR conducted additional analyses of the Trial data (i) using the instrument-based national Australian norms of the PAT-Maths test, and (ii) incorporating lesson participation using sub-groups defined by their levels of lesson participation. We argue that a more appropriate analysis procedure is through the Australian Council for Educational Research (ACER), developers of the PAT-Maths test series. ACER's approach is robust, statistically valid, and widely used and understood throughout Australia and Internationally. The ACER approach is employed currently across Australia involving many 100,000s of students, and operates at national, state, school, sub-school group, and individual-student levels.