Annual Numeracy Program Report

2011

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

quicksmart

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Acknowledgements

This report has been compiled by our statistician, Dr Stefan Horarik and Executive Assistant, June Billings. It would not be possible to do this reporting without the support of the rest of the *QuickSmart* team in SiMERR who have helped with proof reading and interpreting the data.

1 *QuickSmart* in 2011

In 2011, the *QuickSmart* team at the University of New England received data from 5879 students who participated in *QuickSmart* Numeracy lessons and 1895 average-achieving comparison peers. These students were drawn from twenty-five clusters of schools from around Australia. Further data were also submitted for independent analysis to the Northern Territory (NT) Department of Education and Training by NT schools.

The analyses presented in this report provide information about students' performance on the Cognitive Aptitude Assessment System (CAAS) and on standardised test measures, specifically the Progressive Achievement Tests in Mathematics (ACER, 2011) and the VCAA On-Demand tests used by some schools in Victoria. Further investigation of the data provided in this report examines the results in terms of gender and for the participating Indigenous students.

2 Background

2.1 Purpose of *QuickSmart*

The prime purpose of the *QuickSmart* 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.

In addition, the *QuickSmart* professional learning program is 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 literacy skills of under-achieving students in the middle years of schooling. 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 development and continuous improvement since 2001.

The intervention is called *QuickSmart* to encourage students to become *quick* in their response speed and *smart* in their understanding and strategy use. 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 Overall *QuickSmart* results

Two major sets of analyses quantify the benefits of the *QuickSmart* program. The first analysis examines data from speed and accuracy CAAS measures related to arithmetic operations that were collected at the beginning and end of the *QuickSmart* program. These results represent a direct measure of the work of *QuickSmart* instructors and reflect the primary focus of the *QuickSmart* lessons.

The second set of analyses concern the results of independent tests in mathematics. Most schools have utilised the PATM (Progressive Achievement Test Mathematics) test, 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. PATM provides information about how the knowledge, skills and attitudes developed in *QuickSmart* are used and how they transfer to other broad areas of mathematics. Some schools in Victoria used the On-Demand Testing designed by Victorian Curriculum and Assessment Authority (VCAA) instead of PATM.

The results from these analyses are reported below in separate sections and include analyses of the data by gender and for participating Indigenous students.

3.1 Results on the CAAS assessments

Six tests measured students' speed and accuracy both before *QuickSmart* began and at the end of the program. The tests were: (1) Addition to 20 facts; (2) Addition facts; (3) Subtraction to 20 facts; (4) Subtraction facts; (5) Multiplication facts; and (6) Division facts. These facts 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. Interpretation of results in some other operations (e.g., addition to 20) can be impacted by a 'ceiling effect' as many students record strong results at pre-test which do not leave much room for improvement. The CAAS results recorded for Comparison students should also be interpreted with the knowledge that many of these results were influenced by the ceiling effect.

Average results from all numeracy students are presented in Tables 1 to 6 below. A detailed discussion of Table 1 is provided for clarification purposes and as a model for understanding the results provided in Tables 2 to 6. Note that the *p*-values included in tables in this report represent the probability or likelihood that there is no difference between mean scores for pre-intervention and post-intervention results. If this value is less than 0.05 this difference is usually considered statistically significant. This means that there is a less than 5% probability that the result was obtained by chance. If the *p*-value is more than 0.05 the two means may still be importantly different, however, there is an increased possibility that chance factors influenced the result. In our analyses this sometimes happens when the number of students in the group is quite small (as is often the case for comparison students).

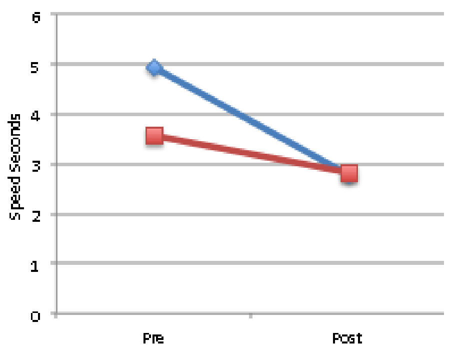
3.1.1 Combined CAAS Analysis

3.1.1.1 Division

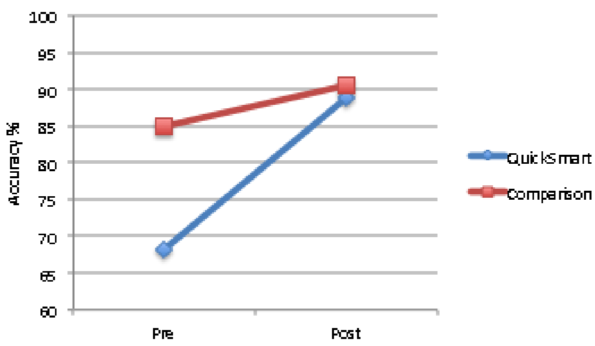
Table 1: CAAS division - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	p	Effect size
Division QS (speed secs)	3914	4.93	2.592	2.778	1.807	-2.151	<0.001*	-0.963
Division COMP (speed secs)	1281	3.564	2.185	2.825	1.61	-0.738	<0.001*	-0.385
Division QS (accuracy %)	3914	68.132	23.638	88.877	14.988	20.745	<0.001*	1.048
Division COMP (accuracy %)	1281	84.852	16.256	90.602	11.95	5.75	<0.001*	0.403

Division Speed



Division Accuracy



On the division test, there were paired data for 3914 *QuickSmart* students and 1281 comparison students. The desired criterion for response speed on the CAAS assessments is between 1 and 2 seconds as an indication of automaticity. The decrease in time for *QuickSmart* students is 2.151 seconds, which is a strong result. The effect size for this result is -0.963, which indicates substantial improvement. (Note the negative number means that the post-test time is lower than the pre-test time which is the desired pattern of 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:

- Effect sizes below 0.2 are considered poor, with an appropriate range of growth over an academic year for a student cohort established as within the range of 0.2 to 0.4;
- Effect size scores of 0.4 to 0.6 are considered strong;
- Effect sizes between 0.6 and 0.8 are considered very strong; and
- Effect size scores above 0.8 represent substantial improvement of the order of approximately three years' growth.

In terms of accuracy, the *QuickSmart* students' average scores have improved by over 20 percentage points, which is a very strong result. The effect size is 1.048, which again indicates substantial improvement for the *QuickSmart* group.

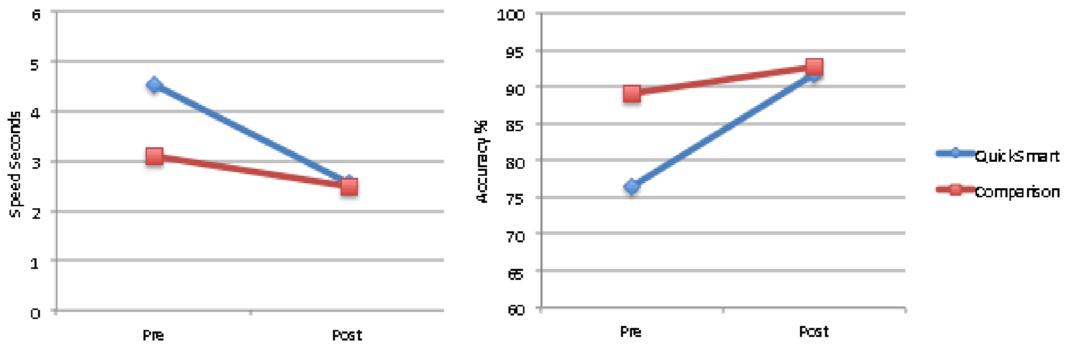
Table 1 shows that when compared to the scores of the comparison students *QuickSmart* students' scores indicate substantial improvement in terms of speed and accuracy in division. The diagrams illustrate the *QuickSmart* students closing the initial gap between them and their average-achieving peers.

3.1.1.2 Multiplication

Table 2: CAAS multiplication - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Multiplication QS (speed secs)	4435	4.534	2.613	2.549	1.625	-1.985	<0.001*	-0.912
Multiplication COMP (speed secs)	1360	3.092	1.884	2.492	1.433	-0.6	<0.001*	-0.358
Multiplication QS (accuracy %)	4435	76.396	19.594	91.736	11.844	15.34	<0.001*	0.948
Multiplication COMP (acc %)	1360	89.106	13.273	92.743	10.124	3.637	<0.001*	0.308

Multiplication Speed **Multiplication Accuracy**



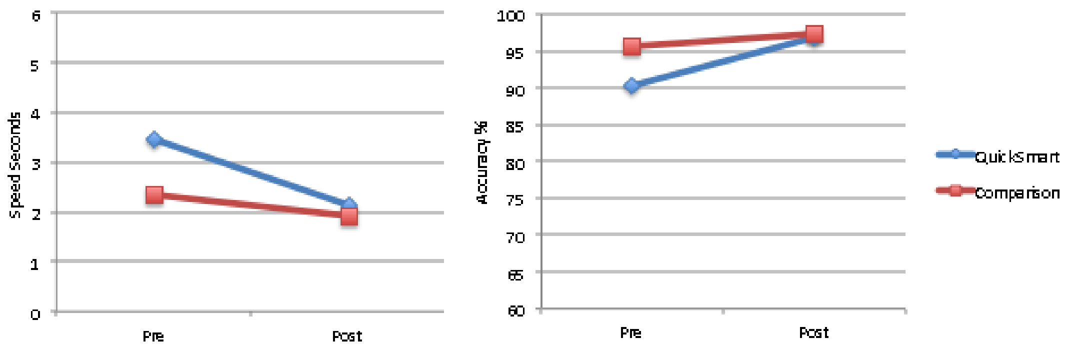
The results for multiplication indicate a significant improvement for the *QuickSmart* students. The diagrams illustrate the narrowing of the gap between the *QuickSmart* students and comparison students.

3.1.1.3 Subtraction

Table 3: CAAS subtraction - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Subtraction QS (speed secs)	3675	3.468	1.764	2.136	1.172	-1.331	<0.001*	-0.889
Subtraction COMP (speed secs)	1137	2.346	1.27	1.921	0.917	-0.424	<0.001*	-0.383
Subtraction QS (accuracy %)	3675	90.199	11.166	96.873	5.663	6.673	<0.001*	0.754
Subtraction COMP (accuracy %)	1137	95.527	6.665	97.386	4.864	1.859	<0.001*	0.319

Subtraction Speed **Subtraction Accuracy**

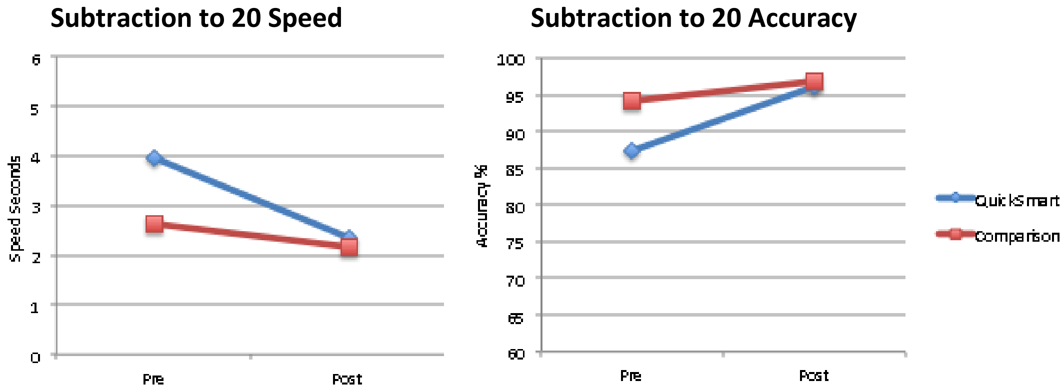


The results for subtraction indicate a very strong improvement for the *QuickSmart* students. The diagrams illustrate the narrowing of the gap between the *QuickSmart* students and comparison students.

3.1.1.4 Subtraction to 20

Table 4: CAAS subtraction to 20 - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Subtraction to 20 *QS* (speed secs)	2561	3.975	2.199	2.354	1.306	-1.621	<0.001*	-0.896
Subtraction to 20 COMP (speed secs)	791	2.613	1.612	2.168	1.173	-0.445	<0.001*	-0.316
Subtraction to 20 *QS* (accuracy %)	2561	87.281	13.897	96.084	7.086	8.802	<0.001*	0.798
Subtraction to 20 COMP (acc %)	791	94.088	10.053	96.875	5.578	2.787	<0.001*	0.343

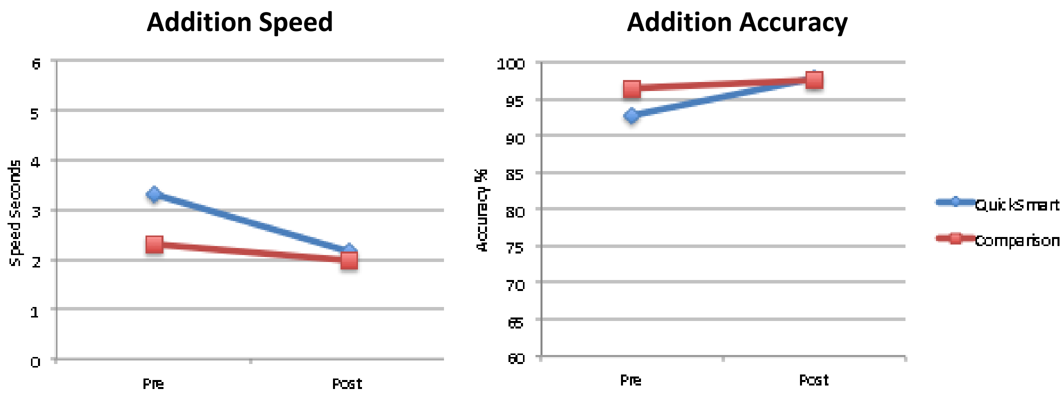


The results for subtraction to 20 indicate a significant improvement for the *QuickSmart* students. The diagrams illustrate the narrowing of the gap between the *QuickSmart* students and comparison students as a result of the *QuickSmart* intervention.

3.1.1.5 Addition

Table 5: CAAS addition - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Addition *QS* (speed secs)	3812	3.313	1.665	2.161	1.003	-1.151	<0.001*	-0.837
Addition COMP (speed secs)	1153	2.3	1.085	1.981	0.879	-0.319	<0.001*	-0.324
Addition *QS* (accuracy %)	3812	92.763	9.959	97.825	4.791	5.062	<0.001*	0.648
Addition COMP (accuracy %)	1153	96.454	6.298	97.647	4.636	1.193	<0.001*	0.216

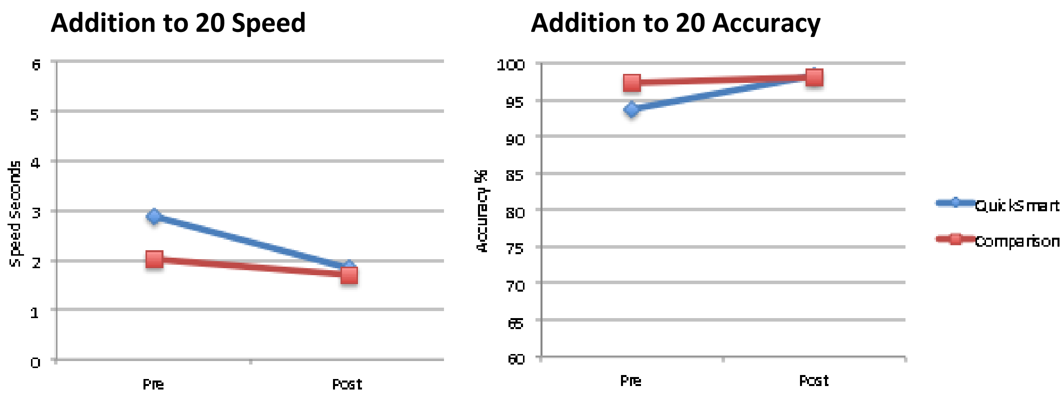


The results for addition indicate a strong improvement for the *QuickSmart* students. The diagrams illustrate the narrowing of the gap between the *QuickSmart* students and comparison students.

3.1.1.6 Addition to 20

Table 6: CAAS add to 20 results - all students 2011

CAAS Operation	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Addition to 20 *QS* (speed secs)	2783	2.884	1.477	1.825	0.893	-1.059	<0.001*	-0.868
Addition to 20 COMP (speed secs)	842	2.026	0.962	1.706	0.685	-0.32	<0.001*	-0.383
Addition to 20 *QS* (accuracy %)	2783	93.729	8.641	98.3	4.244	4.571	<0.001*	0.671
Addition to 20 COMP (accuracy %)	842	97.299	5.667	98.163	3.748	0.864	<0.001*	0.18



The results for addition to 20 indicate a strong improvement for the *QuickSmart* students. The diagrams illustrate the narrowing of the gap between the *QuickSmart* students and comparison students.

3.1.2 CAAS By Demographics

3.1.2.1 Division by Gender

The following tables show an analysis of CAAS results for each operation by gender (Tables 7, 8, 9, 10, 11, 12) and for Indigenous students (Table 13).

Table 7: CAAS division results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1810	4.715	2.44	2.743	1.764	-1.971	<0.001*	-0.926
Male COMP (speed)	633	3.3	1.98	2.718	1.572	-0.582	<0.001*	-0.325
Female QS (speed)	2104	5.115	2.702	2.808	1.844	-2.306	<0.001*	-0.997
Female COMP (speed)	648	3.822	2.341	2.931	1.64	-0.892	<0.001*	-0.441
Male QS (accuracy)	1810	68.791	23.251	88.811	15.108	20.02	<0.001*	1.021
Male COMP (accuracy)	633	86.273	15.61	91.162	11.727	4.889	<0.001*	0.354
Female QS (accuracy)	2104	67.564	23.956	88.933	14.888	21.369	<0.001*	1.071
Female COMP (accuracy)	648	83.465	16.759	90.055	12.149	6.59	<0.001*	0.45

The results of *QuickSmart* students show that in both speed and accuracy the females have improved slightly more than males.

3.1.2.2 Multiplication by Gender

Table 8: CAAS multiplication results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	2058	4.465	2.559	2.572	1.682	-1.894	<0.001*	-0.875
Male COMP (speed)	669	2.941	1.793	2.415	1.467	-0.526	<0.001*	-0.321
Female QS (speed)	2377	4.594	2.658	2.53	1.575	-2.064	<0.001*	-0.945
Female COMP (speed)	691	3.237	1.959	2.566	1.396	-0.671	<0.001*	-0.394
Male QS (accuracy)	2058	76.512	19.672	91.454	12.107	14.943	<0.001*	0.915
Male COMP (accuracy)	669	89.496	13.317	93.356	9.788	3.86	<0.001*	0.33
Female QS (accuracy)	2377	76.295	19.531	91.98	11.608	15.685	<0.001*	0.976
Female COMP (accuracy)	691	88.729	13.229	92.149	10.412	3.421	<0.001*	0.287

The results of *QuickSmart* students show that in terms of speed and accuracy the females have improved slightly more than males.

3.1.2.3 Subtraction by Gender

Table 9: CAAS subtraction results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1699	3.32	1.729	2.117	1.22	-1.203	<0.001*	-0.804
Male COMP (speed)	555	2.141	1.009	1.783	0.736	-0.358	<0.001*	-0.405
Female QS (speed)	1976	3.595	1.784	2.153	1.13	-1.441	<0.001*	-0.965
Female COMP (speed)	582	2.541	1.451	2.053	1.045	-0.488	<0.001*	-0.386
Male QS (accuracy)	1699	90.352	11.055	96.818	5.763	6.466	<0.001*	0.734
Male COMP (accuracy)	555	95.954	6.788	97.748	4.551	1.793	<0.001*	0.31
Female QS (accuracy)	1976	90.068	11.262	96.919	5.577	6.851	<0.001*	0.771
Female COMP (accuracy)	582	95.12	6.526	97.042	5.126	1.922	<0.001*	0.328

The results of *QuickSmart* students show that in both speed and accuracy the females have improved slightly more than males.

3.1.2.4 Subtraction to 20 by Gender

Table 10: CAAS subtraction to 20 results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1177	3.694	2.072	2.279	1.265	-1.415	<0.001*	-0.824
Male COMP (speed)	384	2.353	1.393	1.967	1.021	-0.387	<0.001*	-0.317
Female QS (speed)	1384	4.214	2.275	2.418	1.337	-1.796	<0.001*	-0.963
Female COMP (speed)	407	2.859	1.761	2.358	1.273	-0.5	<0.001*	-0.326
Male QS (accuracy)	1177	87.699	13.657	96.261	6.573	8.563	<0.001*	0.799
Male COMP (accuracy)	384	94.94	8.969	97.322	5.243	2.383	<0.001*	0.324
Female QS (accuracy)	1384	86.927	14.092	95.932	7.494	9.006	<0.001*	0.798
Female COMP (accuracy)	407	93.285	10.93	96.454	5.851	3.169	<0.001*	0.361

The results of *QuickSmart* students show that in both speed and accuracy the females have improved slightly more than males.

3.1.2.5 Addition by Gender

Table 11: CAAS addition results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1766	3.295	1.759	2.151	1.085	-1.143	<0.001*	-0.782
Male COMP (speed)	565	2.147	1.007	1.87	0.837	-0.277	<0.001*	-0.299
Female QS (speed)	2046	3.328	1.58	2.17	0.927	-1.158	<0.001*	-0.894
Female COMP (speed)	588	2.447	1.136	2.087	0.906	-0.36	<0.001*	-0.35
Male QS (accuracy)	1766	92.322	10.417	97.703	5.133	5.381	<0.001*	0.655
Male COMP (accuracy)	565	96.68	5.884	97.655	4.717	0.976	<0.001*	0.183
Female QS (accuracy)	2046	93.144	9.532	97.93	4.473	4.786	<0.001*	0.643
Female COMP (accuracy)	588	96.236	6.67	97.639	4.562	1.403	<0.001*	0.245

The results of *QuickSmart* students show that in speed of response the females have improved slightly more than males but in accuracy the males improved slightly more.

3.1.2.6 Addition to 20 by Gender

Table 12: CAAS addition to 20 results – all students by gender 2011

Group	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	*p*	Effect size
Male QS (speed)	1279	2.872	1.521	1.832	0.939	-1.04	<0.001*	-0.823
Male COMP (speed)	408	1.917	0.957	1.634	0.691	-0.283	<0.001*	-0.339
Female QS (speed)	1504	2.895	1.439	1.819	0.851	-1.075	<0.001*	-0.91
Female COMP (speed)	434	2.128	0.956	1.774	0.673	-0.354	<0.001*	-0.429
Male QS (accuracy)	1279	93.199	9.48	98.152	4.781	4.953	<0.001*	0.66
Male COMP (accuracy)	408	97.673	4.334	98.289	3.764	0.615	0.009*	0.152
Female QS (accuracy)	1504	94.18	7.833	98.426	3.724	4.246	<0.001*	0.692
Female COMP (accuracy)	434	96.947	6.668	98.044	3.734	1.097	0.001*	0.203

The results show that in speed, females outperformed males, but in accuracy the males had a slightly higher gain than the females.

3.1.2.7 Indigenous students

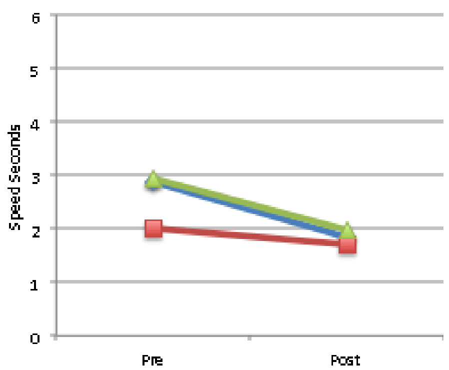
Table 13: CAAS results **-** Indigenous students 2011

Test	N	Pre-Mean	Pre-SD	Post-Mean	Post-SD	Gain	p	Effect size
Add to 20 QS (spd)	312	2.944	1.668	1.949	0.96	-0.995	<0.001*	-0.731
Add to 20 QS (acc)	312	93.088	8.664	98.352	3.693	5.264	<0.001*	0.79
Addition QS (speed)	378	3.46	1.846	2.352	1.063	-1.107	<0.001*	-0.735
Addition QS (acc)	378	92.453	10.725	97.131	6.443	4.678	<0.001*	0.529
Sub to 20 QS (spd)	283	4.207	2.358	2.493	1.408	-1.714	<0.001*	-0.883
Sub to 20 QS (acc)	283	85.482	15.074	95.866	7.357	10.384	<0.001*	0.876
Sub QS (speed)	368	3.617	1.819	2.371	1.276	-1.246	<0.001*	-0.793
Sub QS (accuracy)	368	89.908	10.764	96.395	6.719	6.488	<0.001*	0.723
Mult QS (speed)	407	4.677	2.638	2.862	1.835	-1.815	<0.001*	-0.799
Mult QS (accuracy)	407	76.691	20.732	90.046	14.008	13.355	<0.001*	0.755
Division QS (speed)	335	4.995	2.511	3.108	2.013	-1.888	<0.001*	-0.829
Division QS (acc)	335	66.689	24.053	86.1	17.437	19.411	<0.001*	0.924

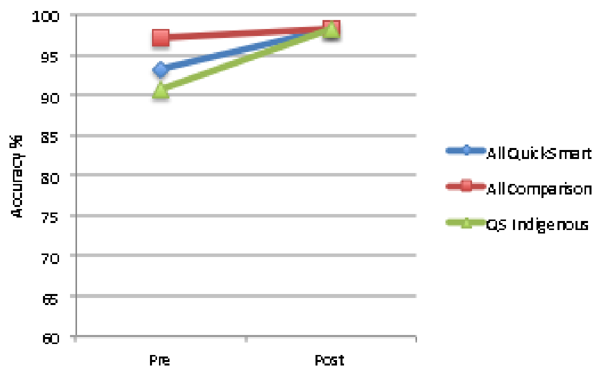
These results indicate that in most instances for both the pre-intervention and post-intervention the Indigenous students' mean scores were slightly lower than those of the overall *QuickSmart* group. In other words, these students had lower starting and finishing points. However, their improvement, even though slightly smaller than for the overall *QuickSmart* group, is still very strong to substantial. This is particularly so for subtraction, multiplication and division. 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).

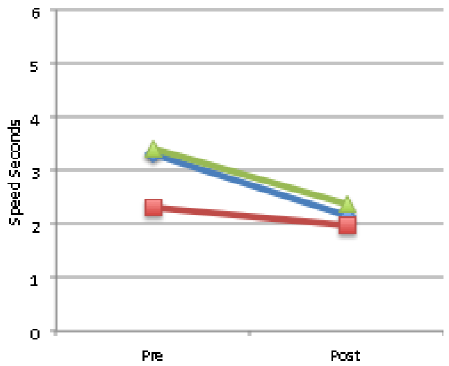
Addition to 20 Speed



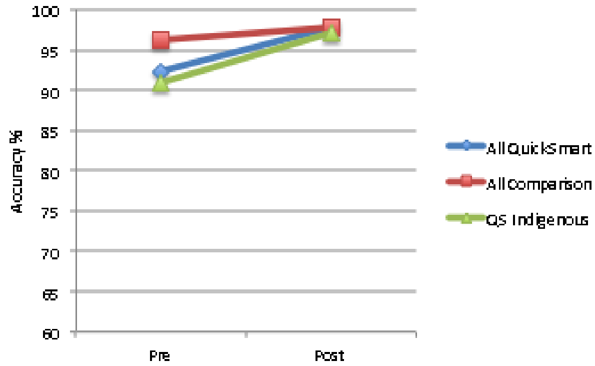
Addition to 20 Accuracy



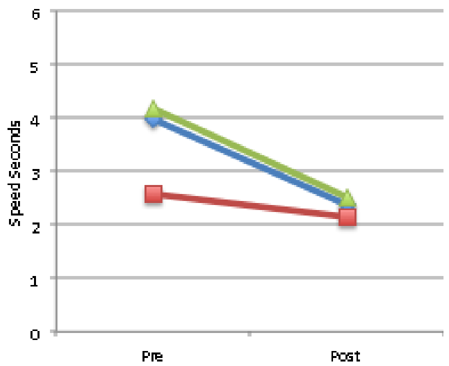
Addition Speed



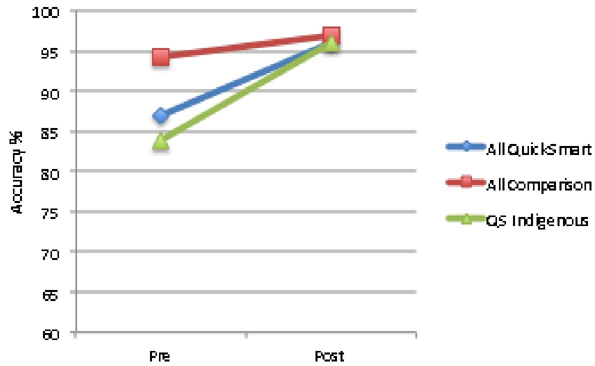
Addition Accuracy



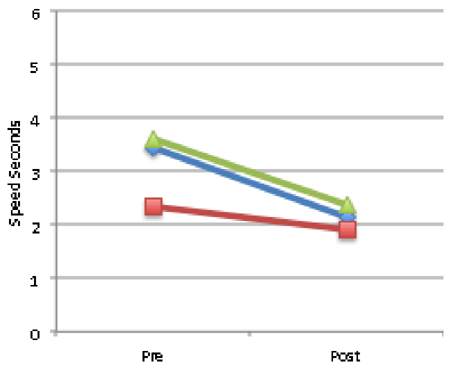
Subtraction to 20 Speed



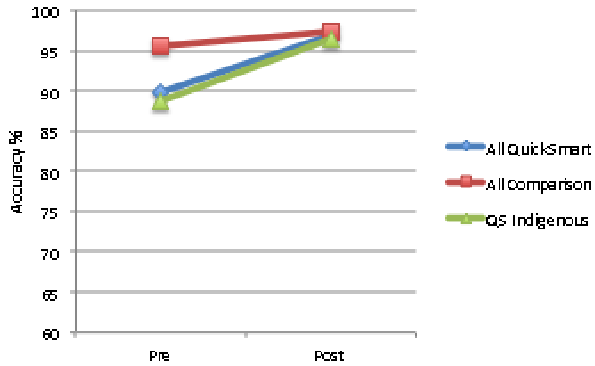
Subtraction to 20 Accuracy



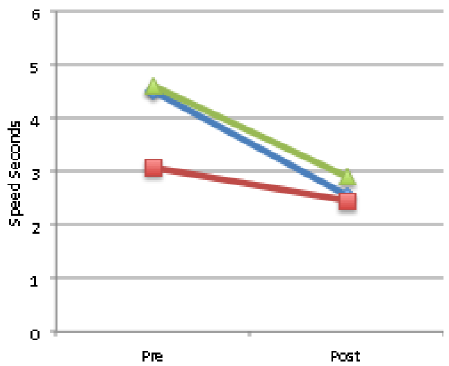
Subtraction Speed



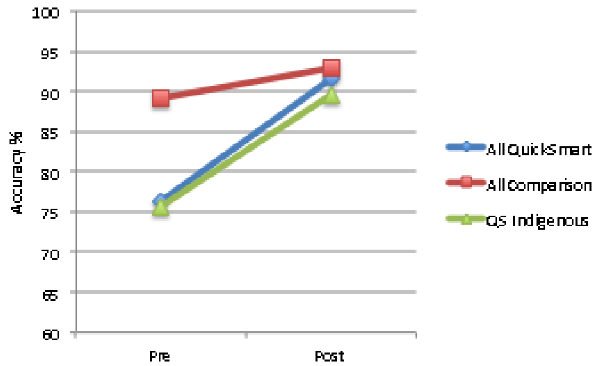
Subtraction Accuracy



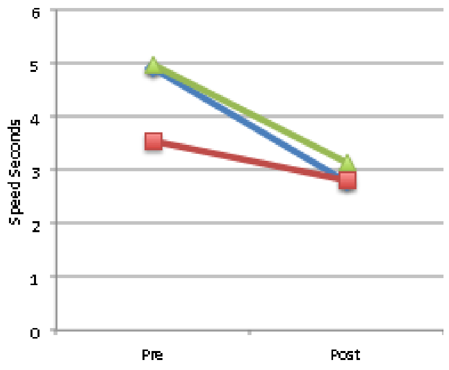
Multiplication Speed



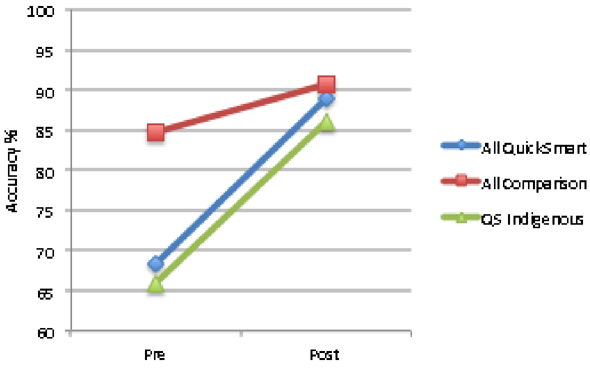
Multiplication Accuracy



Division Speed



Division Accuracy



3.1.3 Students who were unable to complete the pre-intervention test

To complete this section on CAAS results, it is important to note that there were 415 students who the instructors confirmed were not able to complete all the CAAS 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 CAAS assessments at the end of the program. These students' results could not be included in the previous analyses and are presented in Table 14 below.

Table 14: CAAS results where no pre-test data was available - 2011

	N	Mean	Std. Deviation
Addition to 20 Speed	45	1.993	1.057
Addition to 20 Accuracy	45	98.707	2.558
Addition Speed	61	2.44	1.381
Addition Accuracy	61	97.441	3.74
Subtraction to 20 Speed	69	2.704	1.712
Subtraction to 20 Accuracy	69	94.87	8.379
Subtraction Speed	129	2.591	1.439
Subtraction Accuracy	129	96.179	7.615
Multiplication Speed	174	3.656	2.073
Multiplication Accuracy	174	84.703	17.79
Division Speed	415	3.836	2.24
Division Accuracy	415	81.195	19.668

The results in Table 14 are impressive given that these students did not have the skills or confidence to complete the CAAS pre-tests. In addition and subtraction, the average response rates were below 3 seconds and above 94% accuracy. Even though some of these students may not have progressed to multiplication and division during *QuickSmart* lessons, their results are encouraging. In multiplication and division the average response speeds were below 4 seconds and accuracy over 81% at post-test. It is likely that part of this improvement may be due to the fact that: (1) there has been some mutually beneficial development of the common areas of the brain that process the four operations; (2) students have increased their ability to benefit from classroom instruction; and (3) students' overall improved levels of confidence may have led to a 'have a go attitude' that was not present at the beginning of the *QuickSmart* program.

3.1.4 Conclusion on CAAS 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 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. Males performed slightly better in addition accuracy and multiplication accuracy. Females performed slightly better in division accuracy, subtraction accuracy, and in the speed of response for all of the operations. These differences, however, are too small to warrant further investigation.

Indigenous students had lower starting and finishing points in all operations but their overall improvement is very strong to significant.

3.2 Independent Assessments

3.2.1 Why they are used

The *QuickSmart* pre and post assessments include use of independent tests 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.

3.2.2 Results on the PATM Assessments

Table 15 reports the analysis of the PATM data for all students for whom paired data were available. PATM analyses for individual clusters are provided in an Appendix to this report. (Note: Students who were absent at the end of the year were not included in the analysis).

The PATM (2005) Norm Tables were used to convert raw scores from various forms of the PATM to consistent Scale scores, which were used for all subsequent calculations. Two analyses are reported in Table 15. 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 to indicate the magnitude of the change in academic achievement for the *QuickSmart* and comparison students.

Table 15: PATM results - (Scale scores) 2011

	Students with paired data	Average Gain score	Significance	Effect size
All *QuickSmart*	3816	6.918	<0.001*	0.706
All Comparison	1236	4.93	<0.001*	0.438

The results indicate a very strong improvement for *QuickSmart* students. This improvement is greater than that of the comparison group of their average-achieving peers. The gain recorded here for the *QuickSmart* group is also well in excess of the expected yearly growth of students' scores as measured on the PATM assessment of 5 scale score points.

Table 16 reports the same information as Table 15 but shows a comparison of males and females included in the *QuickSmart* program.

Table 16: PATM results - By Gender (Scale scores) 2011

Gender	Students with paired data	Average Gain score	Significance	Effect size
Male QS Students	1809	7.045	<0.001*	0.704
Male Comp Students	634	4.278	<0.001*	0.376
Female QS Students	2007	6.804	<0.001*	0.709
Female Comp Students	602	5.617	<0.001*	0.508

The results indicate that there is no gender-based difference between *QuickSmart* students who completed the PATM test.

Table 17 reports the same information as Table 15 but does so for the scores of Indigenous students included in the *QuickSmart* program.

Table 17: PATM results - Indigenous (Scale scores) 2011

Indigenous students	Students with paired data	Average Gain score	Significance	Effect size
Indigenous *QuickSmart*	417	5.455	<0.001*	0.544

Once again these results show substantial improvement for the Indigenous students who participated in *QuickSmart*. Even though this improvement is not as high as that of the overall *QuickSmart* group, these students were able to report a rate of growth in excess of that achieved by the comparison group. Their improvement is also in excess of the expected yearly growth of students' scores as measured on the PATM assessment of 5 scale score points.

3.2.3 Results on the Victorian On-Demand VCAA Assessment

Table 18 reports the analysis of the VCAA data for all students for whom paired data were available. VCAA analyses for relevant Victorian clusters are provided as an Appendix to this report. (Note: Students who were absent at the end of the year were not included in the analysis).

When looking at the VCAA results, it must be kept in mind that the scale of the On-Demand test is restricted, with most students' scores expected to lie between 2 and 3.5. This restricted range is an artefact of the scaling used in these tests. Specifically, students' achievement at the end of Year Four is pegged to an On-Demand test score of 3.0 and achievement at the end of Year 5 is expected to be 3.5, and so on. For On-Demand results the value 0.25 is equivalent to 6 months growth.

Table 18: VCAA results - (VELS scores) 2011

	Students with paired data	Average Gain score	Significance	Effect size
All *QuickSmart*	636	0.455	<0.001*	0.766
All Comparison	217	0.306	<0.001*	0.475

The results are encouraging. *QuickSmart* students showed an average growth of eight months over the course of the intervention and a strong improvement measured by Effect Size statistics. This is impressive in light of the fact that that most of the low-achieving students included in *QuickSmart* groups would not usually be expected to achieve a level of improvement commensurate to the duration of instruction. Again encouragingly, when *QuickSmart* students' On-Demand scores are compared to those of their average-achieving peers in the comparison group, it is evident that the *QuickSmart* students' results are slightly better.

There were insufficient indigenous students to do an indigenous VCAA analysis.

4 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

Associate Professor Lorraine Graham

5 APPENDIX – Cluster Results

5.1 Standardised Test results by cluster – (Scale scores for PAT, VELS levels for VCAA On-demand tests) 2011

Cluster of Schools		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	p	Effect size
ACT	41	38.685	9.231	47.361	9.506	8.676	<0.001*	0.926
Adelaide CEO	206	40.955	8.21	47.442	8.83	6.487	<0.001*	0.761
Adelaide Hills	144	42.851	8.135	49.924	9.348	7.073	<0.001*	0.807
Ballarat	309	40.528	9.171	47.266	9.729	6.738	<0.001*	0.713
Central Tasmania	91	41.742	6.702	47.616	8.801	5.875	<0.001*	0.751
Horsham	143	43.883	8.854	50.211	9.679	6.328	<0.001*	0.682
Hunter	440	41.096	9.726	47.074	11.222	5.978	<0.001*	0.569
Inner East Melbourne PATM	20	39.425	10.623	49.965	9.053	10.54	<0.001*	1.068
#Inner East Melbourne VCAA	334	2.713	0.565	3.252	0.636	0.538	<0.001*	0.896
Lismore Diocese	212	41.054	7.803	48.915	8.574	7.86	<0.001*	0.959
#Melbourne East (Dandenong Ranges)	153	2.578	0.526	2.939	0.529	0.361	<0.001*	0.684
#Melbourne East (Yarra Valley)	147	2.663	0.637	3.021	0.577	0.359	<0.001*	0.59
Narrabri Numeracy	51	45.992	10.019	53.288	11.014	7.296	<0.001*	0.693
New England Region	404	41.488	10.212	47.909	11.033	6.422	<0.001*	0.604
North Coast Region	757	42.891	9.344	50.799	10.945	7.908	<0.001*	0.777
North Sydney	26	50.319	5.539	53.335	6.474	3.015	0.029*	0.5
North Tasmania	258	41.904	8.764	49.485	10.962	7.581	<0.001*	0.764
Port Augusta	147	43.078	8.461	49.199	9.966	6.121	<0.001*	0.662
Port Pirie/Adelaide Diocese	148	43.935	7.196	52.02	9.125	8.084	<0.001*	0.984
South Tasmania	109	36.748	7.989	43.294	9.226	6.546	<0.001*	0.759
Tasmania (out of region)	12	44.5	4.047	51.8	3.377	7.3	<0.001*	1.959
Wagga CEO	129	46.476	8.199	52.905	9.213	6.429	<0.001*	0.737
Western Australia	77	45.705	9.323	50.961	8.594	5.256	<0.001*	0.586
Western Region	72	46.449	8.719	52.383	10.373	5.935	<0.001*	0.619
Western Sydney	20	37.605	8.291	43.275	13.141	5.67	0.008*	0.516

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

Note 2: some results for Melbourne East (#) are for the VCAA test, all others are PAT test.

5.2 PAT results by demographic (Scale scores) 2011

Demographic		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	*p*	Effect size
All QS Students	**3816**	**42.202**	**9.158**	**49.121**	**10.389**	**6.918**	**<0.001***	**0.706**
All comparison students	**1236**	**55.171**	**10.74**	**60.101**	**11.758**	**4.93**	**<0.001***	**0.438**
Indigenous QS Students	417	40.361	9.453	45.816	10.559	5.455	<0.001*	0.544
Male QS Students	1809	42.082	9.314	49.127	10.659	7.045	<0.001*	0.704
Male comparison students	634	56.442	10.866	60.72	11.85	4.278	<0.001*	0.376
Female QS Students	2007	42.311	9.017	49.115	10.142	6.804	<0.001*	0.709
Female comparison Students	602	53.832	10.448	59.449	11.634	5.617	<0.001*	0.508

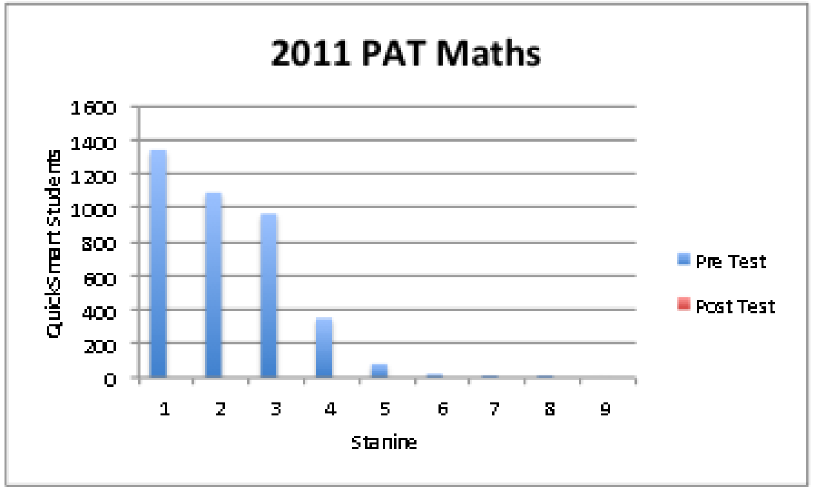
Note: only students who did both ‘pre’ and ‘post’ test are included in the table.

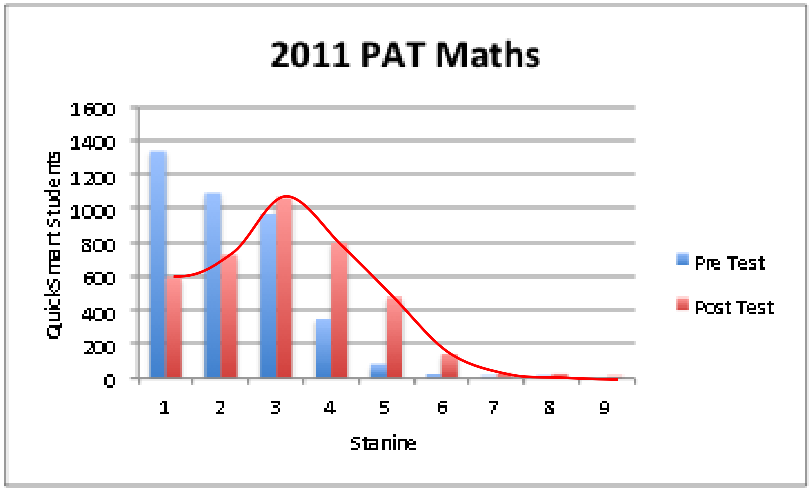
5.3 PAT results by State (except NT)

School		Pre-Intervention		Post-Intervention				
	N	Mean	SD	Mean	SD	Gain	p	Effect size
All QS Students	**3544**	**42.335**	**9.036**	**49.079**	**10.363**	**6.744**	**<0.001***	**0.694**
All Comparison students	**1172**	**55.489**	**10.672**	**60.402**	**11.692**	**4.913**	**<0.001***	**0.439**
ACT QS students	41	38.685	9.231	47.361	9.506	8.676	<0.001*	0.926
ACT Ind QS	1	41.9	.	53.0	.	11.1		
ACT COMP students	10	58.48	9.839	60.78	5.552	2.3	0.424	0.288
NSW QS students	2111	42.521	9.519	49.483	10.847	6.963	<0.001*	0.682
NSW Ind QS	302	40.467	9.723	45.885	10.928	5.419	<0.001*	0.524
NSW COMP students	534	53.668	11.34	58.929	12.893	5.261	<0.001*	0.433
SA QS students	645	42.546	8.096	49.447	9.414	6.901	<0.001*	0.786
SA Ind QS	50	41.152	8.807	47.138	10.375	5.986	<0.001*	0.622
SA COMP students	266	57.227	9.645	62.106	10.013	4.879	<0.001*	0.496
TAS QS students	470	40.743	8.414	47.747	10.357	7.004	<0.001*	0.742
TAS Ind QS	44	39.541	8.925	44.452	9.206	4.911	<0.001*	0.542
TAS COMP students	194	53.28	9.036	57.759	10.247	4.479	<0.001*	0.464
VIC QS students	472	41.498	9.258	48.273	9.766	6.775	<0.001*	0.712
VIC Ind QS	11	40.436	8.758	46.791	8.48	6.355	0.003*	0.737
VIC COMP students	157	55.536	10.125	60.855	11.64	5.319	<0.001*	0.488
WA QS students	77	45.705	9.323	50.961	8.594	5.256	<0.001*	0.586
WA Ind QS	9	36.144	7.931	40.8	6.525	4.656	0.162	0.641
WA COMP students	75	62.261	11.458	65.719	10.757	3.457	<0.001*	0.311

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

5.4 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 in the bottom 4% of the population,
2 represents performance in the lower or 4-10% of the population
3 represents performance in the lower or top 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 higher77-88% of the population
8 represents performance in the higher 89-96% of the population
9 represents performance in 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.