

Report on the 2011–2012 Reasoning Mind Implementation at Dallas ISD

October 21, 2012

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Reasoning Mind

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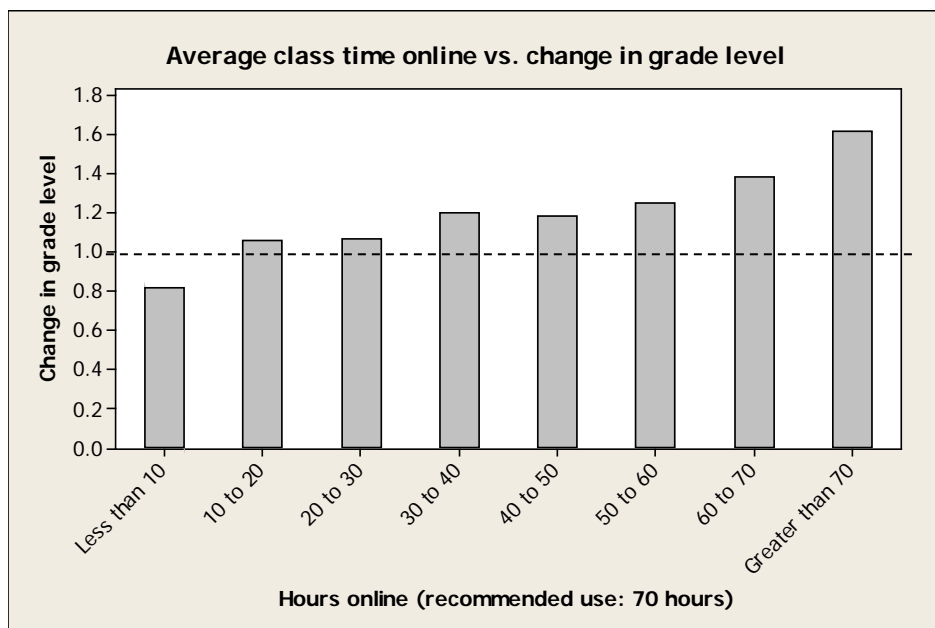
Executive Summary

Dallas ISD first partnered with Reasoning Mind in the 2009–2010 school year, enrolling 2,321 3rd and 4th grade students. In 2010–2011, enrollment at the district expanded to 3,352 students; seeing strong results for these students, the district made the bold decision to implement Reasoning Mind in 2011–2012 with all of the district’s 2nd graders, with the aim of adding additional grade levels each year until the program was fully implemented in all covered grades.

Dallas ISD students have 90 minutes a day scheduled for mathematics, which translates into 262 hours of instruction a school year. At the 2nd grade level, Reasoning Mind is an intensive supplemental program, intended to be used for 70 hours over the course of the year. Thus, the Reasoning Mind target time represents about 25% of the total time allotted for mathematics. The actual time spent on Reasoning Mind averaged 32 hours, approximately 1/8 of the students’ total mathematics instructional time.

One of the ways to evaluate an instructional program is by examining student scores on the Iowa Test of Basic Skills (ITBS), administered yearly to Dallas ISD students. In the 2011–2012 school year, Dallas ISD 2nd graders showed growth on the ITBS compared to their performance in 1st grade, with the number of students in the cohort on or above grade level increasing by 4.7 percentage points. As a result, this year’s 2nd graders did better on the test than any other group since at least 2008. This record was set despite increasing proportions of economically disadvantaged students in the district: the number of 2nd graders qualifying for free lunch by direct certification (the most economically disadvantaged subgroup of students) increased by 9 percentage points from the preceding cohort.

In order to better determine the contribution of Reasoning Mind to these trends, one can examine the correlation between use of the program and growth on the ITBS. As the graph below illustrates, the total number of hours students spent in Reasoning Mind was strongly predictive of growth on the ITBS.



This correlation is highly statistically significant ($p < 0.001$). According to a regression analysis, *every 10 hours online are associated with a difference of 0.123 grade levels of growth*. Students who spent more than 70 hours online grew an average of 1.6 grade levels in just one year. Similar correlations held for students of each ethnicity, including Hispanic and African American students.

These results speak to the excellent effort that Dallas ISD students and teachers put into using the Reasoning Mind program, ensuring that time spent online was productive and led to meaningful learning.

In addition to time online, implementation fidelity served as separate lever to improve student outcomes. A regression analysis shows that *every point increase in implementation fidelity was associated with a difference in growth of 0.19 grade levels*. Surveys of Dallas ISD staff showed that Reasoning Mind provided strong support in this effort, with teachers giving the support a rating of 4.4 out of 5.

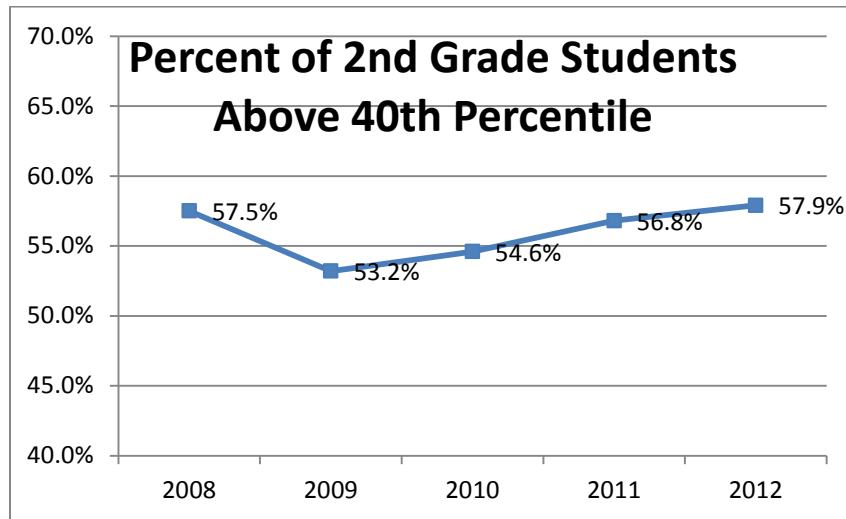
Surveys showed an overwhelming approval for using Reasoning Mind among school staff, with 80% of principals and 86% of teachers saying that they want to continue with the program. Teachers also found that the program improved students' independent learning skills (84%), strengthened their reasoning skills (85%), and increased students' enjoyment of mathematics (90%). Many teachers and principals also commented on Reasoning Mind's early introduction of algebraic concepts and the positive implications of this for algebra readiness.

In conclusion, these results demonstrate that when Dallas ISD schools implement Reasoning Mind with fidelity, the result is strong student growth. These results are particularly promising because Reasoning Mind is designed to give students a solid foundation over the course of several years, beginning in 2nd grade and culminating in the 5th grade core curriculum. Thus, with a focus on bringing students through the full program, Dallas ISD can ensure that student learning in Reasoning Mind is cemented and will lead to success in Algebra I.

Dallas ISD's Overall Performance on the ITBS

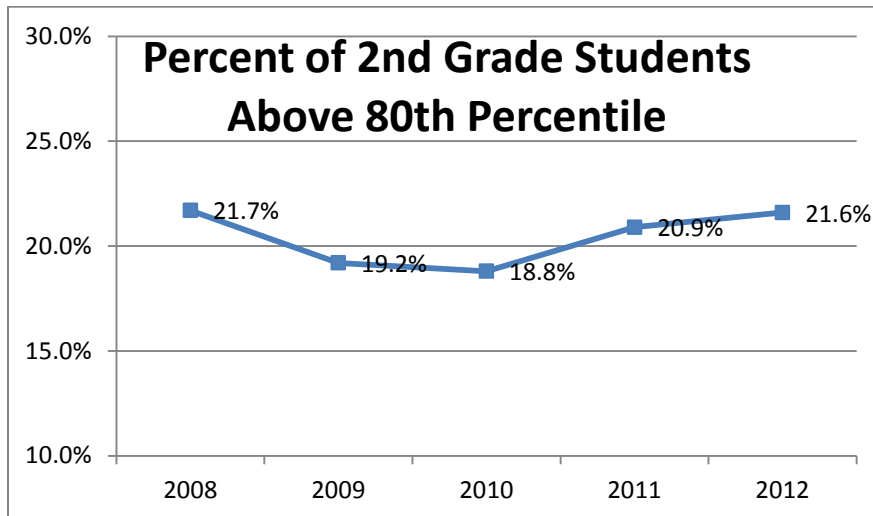
Summary. In this section, we discuss overall trends in Dallas ISD's performance on the ITBS. These trends indicate that 2012 was a year of improvement for Dallas ISD, preserving gains from previous years and bringing ITBS scores up to historical highs. However, it is important to keep in mind that Reasoning Mind was only one of the factors influencing ITBS scores, and thus one must be careful in ascribing causation when observing overall trends.

Longitudinal trends. The graph below shows the percentage of 2nd grade students at or above the 40th percentile for the last five years.



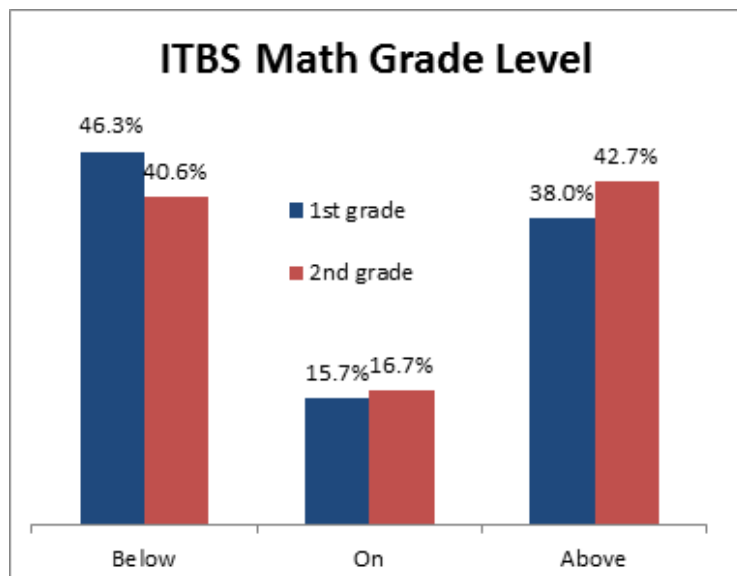
As the graph shows, Dallas ISD's ITBS performance dropped from 2008 to 2009, and has since then been recovering. The year 2012 marks the first time the performance exceeds that of 2008.

A similar trend holds for top-performing students: those above the 80th percentile. The results here for 2012, while not above those for 2008, are essentially the same. Thus, the district has recovered from the dip in 2nd grade math performance experienced several years ago.



During the last year, Dallas ISD experienced some demographic changes. While the ethnic breakdown of 2nd grade students this year corresponds to that of the previous cohort (73% Hispanic, 22% African American, and between 3% and 4% White), the socioeconomic breakdown is quite different, with 54% of students in the most disadvantaged socioeconomic category (“free lunch by direct certification”), compared to 45% in the previous cohort. Thus, Dallas ISD should be commended for improving student performance even as poverty rates have increased. As discussed below, there is substantial evidence indicating that the district-wide implementation of Reasoning Mind in the 2nd grade meaningfully contributed to this success.

Improvement from 1st grade. Another angle to consider is how much students have improved in their relative standing from 1st grade. On this measure, too, the 2012 cohort of 2nd graders has done well.



These results indicate that by the end of 2nd grade, Dallas ISD had been successful in moving a large number of students from below grade level to on grade level, and a large number of students from on grade level to above it.

As the table below shows, these results also largely hold for individual ethnic and socioeconomic¹ categories.

		<i>Below Grade Level</i>	<i>On Grade Level</i>	<i>Above Grade Level</i>
Hispanic (n=8114)	1 st grade	48.7	16.0	35.3
	2 nd grade	40.0	17.3	42.7
African American (n=2432)	1 st grade	45.0	15.7	39.3
	2 nd grade	48.6	16.0	35.4
White (n=442)	1 st grade	15.8	9.7	74.4
	2 nd grade	13.1	11.3	75.6
Non-disadvantaged (n=798)	1 st grade	23.1	13.3	63.7
	2 nd grade	19.3	14.2	66.5
Reduced lunch (n=427)	1 st grade	35.1	15.9	49.0
	2 nd grade	30.0	17.8	52.2
Free lunch by application (n=3922)	1 st grade	46.8	16.5	36.7
	2 nd grade	38.6	16.5	45.0
Free lunch by certification (n=5982)	1 st grade	49.9	15.5	34.6
	2 nd grade	45.5	17.2	37.3

The only category that showed a drop is African American students. While this drop may be an artifact of testing or demographic changes, it could also be an actual drop in performance. However, as discussed later (see the section “The Effect of Reasoning Mind Use on ITBS Scores”), Reasoning Mind use was associated with comparable gains among African American students as for the district’s population at large, and therefore is not the cause of the drop.

¹ The four socioeconomic categories are, in order from least to most economically disadvantaged, (i) non-disadvantaged, (ii) reduced lunch, (iii) free lunch by application, and (iv) free lunch by direct certification.

The Effect of Reasoning Mind Use on ITBS Scores

Investigating causality. The best way to investigate causal connections is a randomized controlled trial. In the absence of randomization, it is always challenging to describe causal links.

Fortunately, because Reasoning Mind gathers and logs all data on use, it is possible to determine precisely how much time each student spent using the program. This allows us to ask whether usage of the program correlates to more growth on the ITBS. While this method isn't a randomized experiment, it provides a much better understanding of the program's impact than would otherwise be possible.

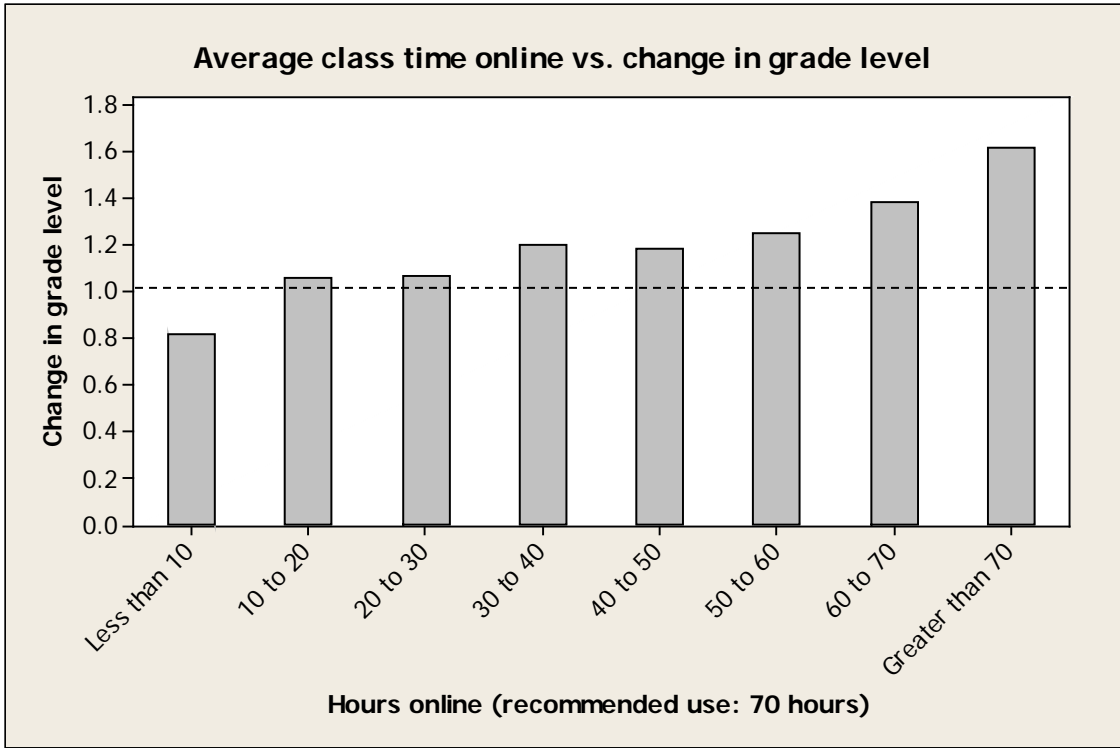
Measures of use. The simplest measure of use is *time online*. This is the raw time students spent logged into Reasoning Mind.

Another measure is the number of *objectives completed* by students. The average Dallas ISD student completed 18 objectives, which is just over 50% of the total number of objectives in Reasoning Mind's 2nd grade curriculum, which is 35. The "objectives completed" measure is interesting because it measures not only time spent on the program, but also how productively this time was spent. In particular, teachers who implement Reasoning Mind well monitor their students' work with the program, ensuring that they are on task; this leads students to work more productively, mastering more objectives in the same amount of time.

Finally, one can measure use of the system through *metrics of implementation fidelity*. These metrics are based on Reasoning Mind Program Coordinators' observations of classes. This measure is less precise, since it is based on human observations; however, they also take into account the greatest number of factors. Thus, they provide an important angle.

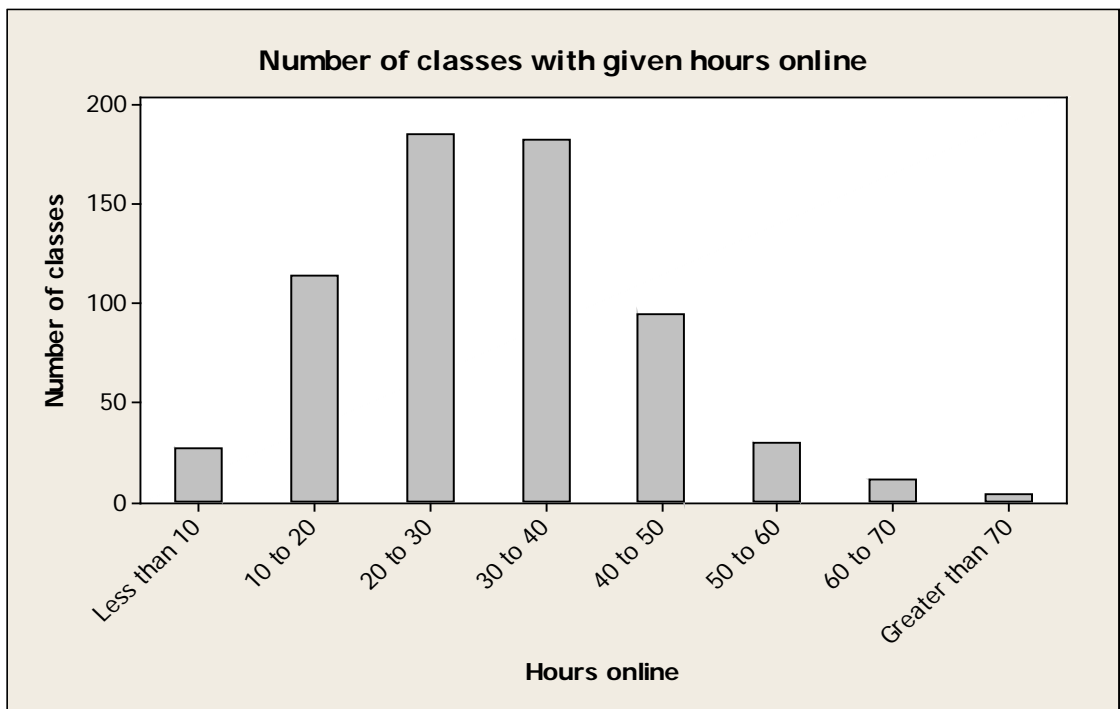
In this section, we'll discuss the first two metrics – hours online and objectives completed. Metrics of implementation fidelity will also be discussed, but in the section on overall fidelity of implementation ("Dallas ISD's Implementation Fidelity," beginning on p. 14).

Hours online. In order to see the relationship between use of Reasoning Mind and improvement on the ITBS, we can break classes into groups based on how many hours their students spent in Reasoning Mind and see how this impacted their change in ITBS grade level. We get the following picture:



Notice that students who used Reasoning Mind fewer than 10 hours actually lost ground on the test: they grew fewer than 1 grade level from 1st to 2nd grade. By contrast, students with 30–50 hours online grew 1.2 grade levels in one year, and those with over 70 hours grew an average of 1.6 grade levels (!) in just one year.

Below is the breakdown of the number of classes in each time range:



One can also consider data individually for each student and do a linear regression, controlling for school effects by introducing categorical variables. *One finds that every 10 hours of Reasoning Mind use is associated with a difference of 0.123 grade levels of growth.*

The next question to address is whether all groups of students benefitted from using Reasoning Mind equally, or if some groups were unaffected by the program. For this, we can run similar analyses on various subgroups of students. The results confirm that use of Reasoning Mind had a substantial impact on virtually all major demographic subgroups.

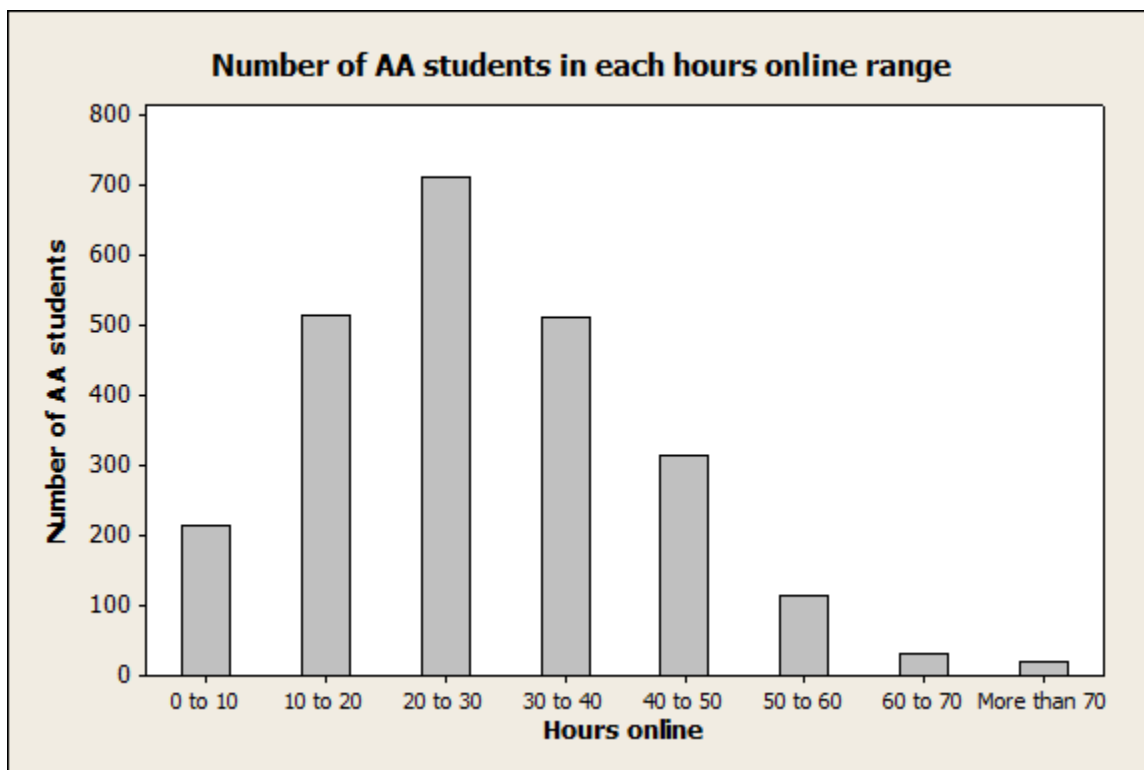
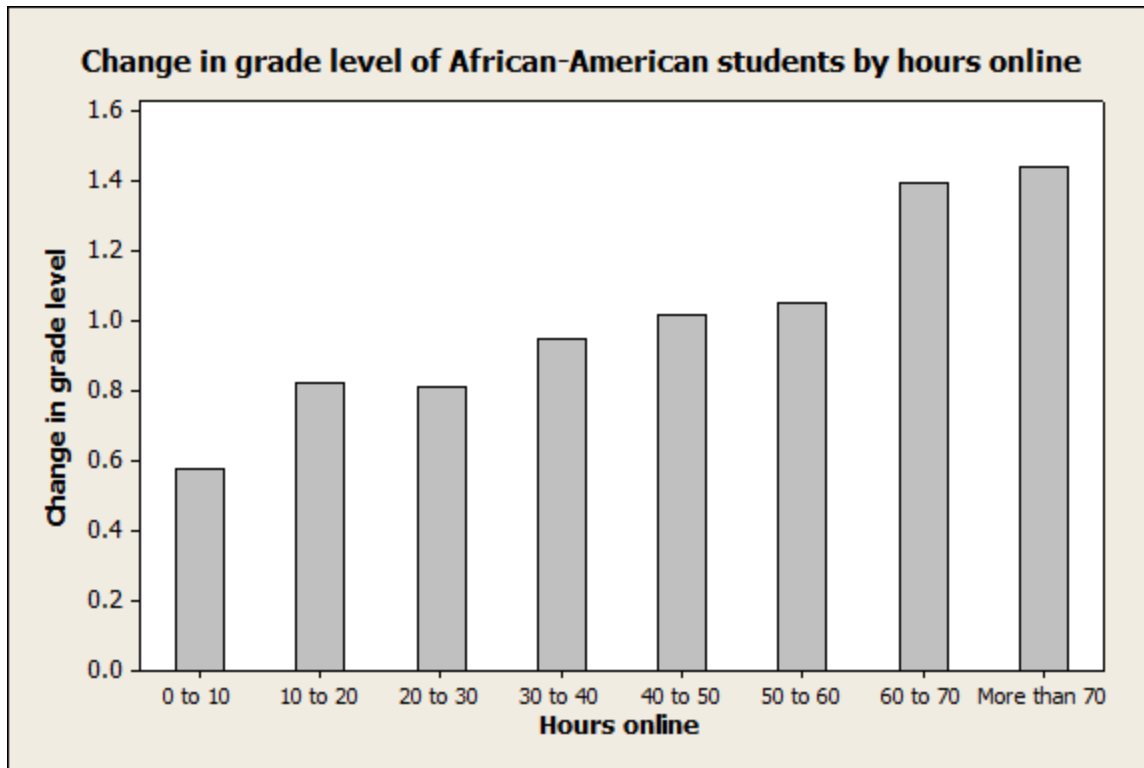
	Grade level growth per 10 hours of Reasoning Mind	Intercept ²	R squared (%)	p-value
Hispanic (n=8114)	0.129	0.7513	19.01	<0.001
African American (n=2432)	0.09	0.6435	21.64	<0.001
White (n=442)	0.096	0.8363	24.12	<0.001
Below grade level (n=4519)	0.131	0.7032	20.84	<0.001
On grade level (n=1863)	0.105	0.8446	28.48	<0.001
Above grade level (n=4747)	0.128	0.7168	21.79	<0.001
Non-disadvantaged (n=798)	0.119	0.7974	25.94	<0.001
Reduced lunch (n=427)	0.05	1.0136	43.77	0.159
Free lunch by application (n=3922)	0.131	0.7362	20.96	<0.001
Free lunch by certification (n=5982)	0.119	0.7036	19.34	<0.001

Notice that these results show that Reasoning Mind use had roughly the same correspondence (~0.11 grade levels of growth more per 10 hours of use) for each category, and the p-values are uniformly less than 0.001, showing that the correlation is highly statistically significant. In particular, Reasoning Mind use correlated with great achievement just as strongly for the most disadvantaged students (free lunch) as it did for others.

Another notable finding here is that Reasoning Mind was just as effective for struggling students – those below grade level – as it was for students who are on or above grade level.

Each subset shows the same picture as the overall graphs. African American students, for example, demonstrated a clear benefit from Reasoning Mind use, and the extent of their growth is the degree to which they used the program.

² This is the y-intercept – i.e., the predicted grade level increase from 1st to 2nd grade for students who didn't use Reasoning Mind at all.



The one category showing different results was that of reduced lunch students. Here, the p-value was 0.159, indicating that not statistically significant correlation was found. It is unknown why this category is so different from the others; possibly, because it is the smallest (with 427 students), it is more susceptible to statistical fluctuations and influences from outside factors.

Objectives completed. The objectives completed measure provides arguably a better proxy for implementation fidelity than hours online, since it captures how productively students worked with the Reasoning Mind system.

One would expect for objectives completed to correlate to overall achievement on the ITBS, since stronger students will move faster through the curriculum, getting through more material. However, this does not at all guarantee that these students will improve at a faster *rate* – in an ineffective program, stronger students will do better (and progress further), but this will not translate into greater *growth* of their scores. Therefore, objectives completed is a good measure to use in studying whether Reasoning Mind use impacted *change* in student achievement.

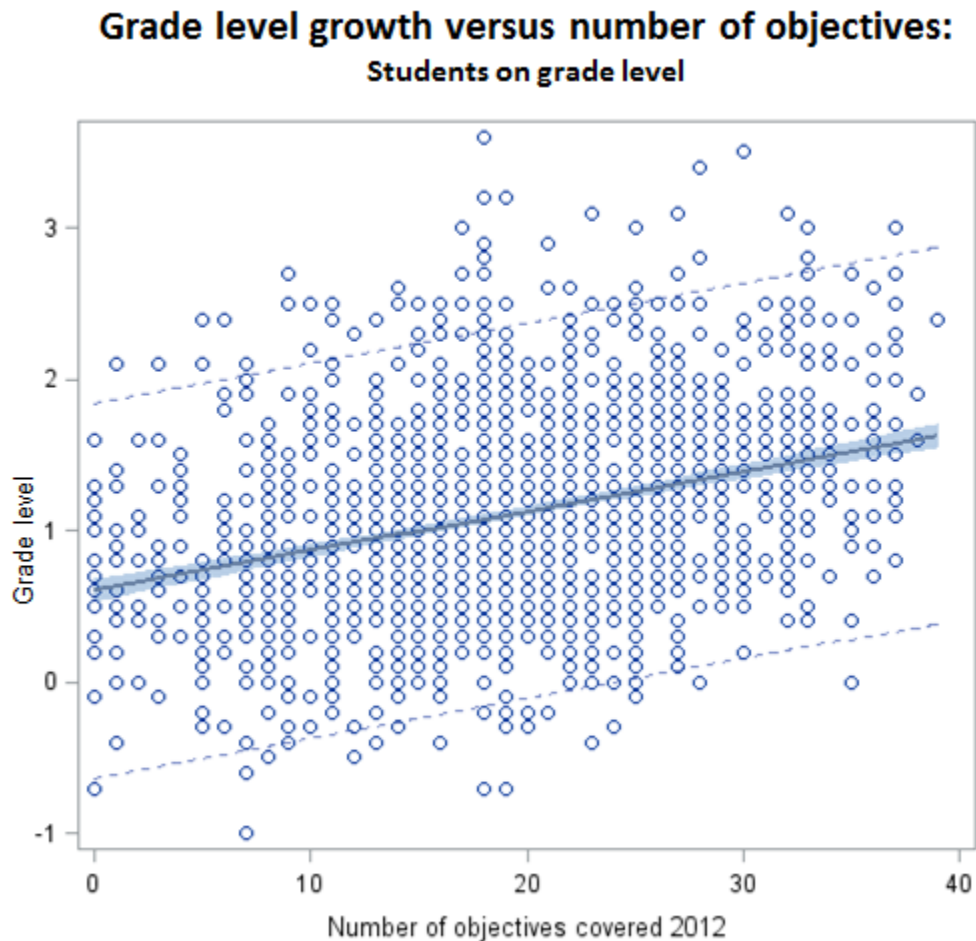
As it turns out, this measure shows even stronger correlation with improvement in students’ performance. Completing 10 additional objectives is associated with an increase in grade level of 0.317. The average Dallas ISD student completed 18 objectives, while the entire 2nd grade curriculum has 35.

This correlation holds for all major subgroups of students, including reduced lunch. The table below provides the findings.

	Grade level growth per 10 objectives of Reasoning Mind	Intercept	R squared (%)	p-value
Hispanic (n=8114)	0.323	0.5694	25.62	<0.001
African American (n=2432)	0.271	0.4582	26.67	<0.001
White (n=442)	0.248	0.6734	30.06	<0.001
Below grade level (n=4519)	0.355	0.5495	29.33	<0.001
On grade level (n=1863)	0.337	0.5399	34.34	<0.001
Above grade level (n=4747)	0.355	0.3856	29.9	<0.001
Non-disadvantaged (n=798)	0.274	0.6539	31.08	<0.001
Reduced lunch (n=427)	0.304	0.5865	49.05	<0.001
Free lunch by application (n=3922)	0.311	0.5875	26.71	<0.001
Free lunch by certification (n=5982)	0.32	0.5089	25.94	<0.001

Notice that here, even the group of reduced lunch students shows a substantial (and very statistically significant) correlation.

The graph below is an example of what the data looks like. This graph shows all students who are on grade level (excluding as outliers those with more than 40 objectives completed), and fitting a line (without categorical variables).



Conclusions. These findings show that students who used Reasoning Mind very little showed a drop in ITBS performance, growing less than a year from 1st to 2nd grade. Meanwhile, students who used Reasoning Mind more – whether measured by hours online or objectives completed – grew more than one year; at the extreme end, students using Reasoning Mind more than 70 hours grew 1.6 grade levels in one year. The correlation of Reasoning Mind usage with greater growth in grade level held not only overall, but also for each major subgroup (by ethnicity, socioeconomic status, and prior performance).

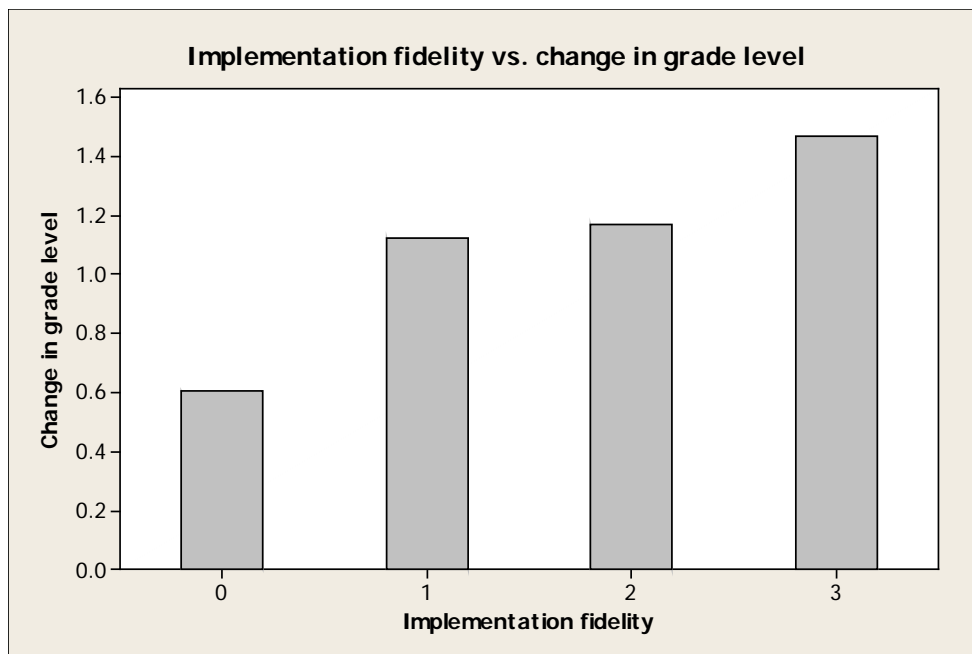
Dallas ISD's Implementation Fidelity

Measure of implementation fidelity (IF). In each observation, a Reasoning Mind Program Coordinator identifies the strength of the implementation across 10 categories:

- Data-driven decisions
- Lesson planning
- Instructional methods
- Learning modes
- Teacher engagement
- Procedures
- Incentive systems
- Notebooks
- Independent learning
- Student engagement

These observations use a standard protocol to ensure their consistency and accuracy, and each component is measured on a four-point scale, recorded in a database, and aggregated over time.

Impact of implementation fidelity. As shown through a regression analysis of Dallas ISD data, implementation fidelity correlates with ITBS grade level growth ($R^2=3.8\%$, $p<0.001$). Although the variation explained by IF is low (as can be expected, since no other variables were controlled for in the regression model³), the effect is highly statistically significant. According to this analysis, a one-point increase in implementation fidelity is associated with an increase of 0.19 in grade level growth.



³ We decided against controlling for school effects, since the number of teachers is of the same order of magnitude as the number of schools. Adding school variables would over-fit the model.

As shown in the chart above, low implementation fidelity corresponded to about a half-year of growth, whereas high implementation fidelity corresponded to a year and a half.

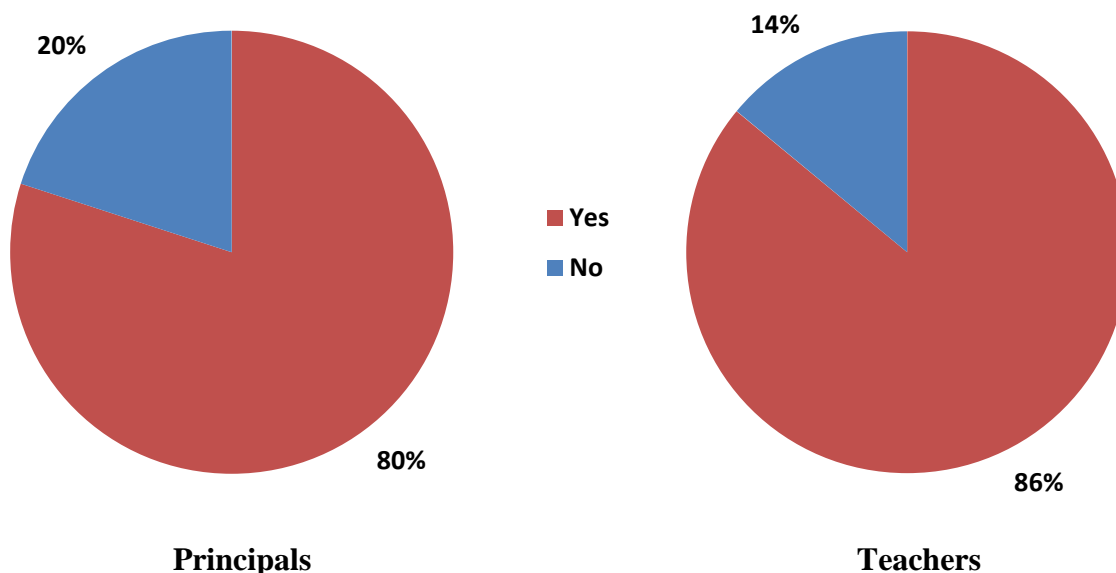
Teacher and Principal Opinions of Reasoning Mind

Summary. At the end of the 2011–2012 academic year, Reasoning Mind distributed surveys to a randomly selected subset of Dallas ISD principals and teachers; 60 principals and 102 teachers completed the surveys.

The findings showed that teachers and principals overwhelmingly wanted to continue using Reasoning Mind. Moreover, the results confirmed that teachers and principals found Reasoning Mind’s support to be of high quality.

Continuing with the program. The desire to continue using Reasoning Mind demonstrates a commitment to the program despite first-year challenges. Of those surveyed, the overwhelming majority reported that they would like to have Reasoning Mind on their campus again.

Would you like to have the Reasoning Mind program on your campus again?



Reasoning Mind’s support. Teachers and principals gave high marks to Reasoning Mind’s implementation support. The table below shows their rating of Reasoning Mind’s support on a 1 to 5 scale.

	Principal Rating	Teacher Rating
Overall support	4.0 out of 5	4.4 out of 5
Professionalism	4.5 out of 5	4.8 out of 5
Responsiveness	4.6 out of 5	4.8 out of 5
Knowledge	4.6 out of 5	4.8 out of 5

For more detail on how teachers viewed Reasoning Mind’s support, please refer to Appendix A, which lists all teacher responses when asked about their Reasoning Mind Program Coordinator.

Principal-reported advantages. As one would expect given their positive view of Reasoning Mind, principals reported many advantages of the program. The advantages reported include:

- Engaging students
- Personalizing instruction
- Supporting classroom learning
- Building math vocabulary
- Increasing the rigor of instruction
- Providing robust data
- Developing higher-order thinking skills
- Freeing teachers to work one-on-one with students
- Providing enrichment for more advanced students
- Identifying and addressing students’ weak areas
- Teaching algebraic concepts

Here are some quotes from principals:

“The advantage is the consistency of the program to diagnose the students individual needs IMMEDIATELY. If the program is taught as designed--ALL children would show growth.”

“I think it challenges the students and creates a logical sequence for learning. Students enjoy the program and how interactive it is.”

“Students are intrigued and focused due to software, incentives and have learned to use the visuals prepared by instructor. This is a life-long skill they can use (note taking, use of glossary, and use of visuals).”

“It allows students to work self-paced and to master concepts before going to the next skills. Teachers are able to meet with students that are not doing well since they are able to see which students need more help.”

Teacher-reported advantages. Teachers reported a large number of advantages of the program. One of the areas teachers commented on is the impact the program had on their practices. Reasoning Mind trains teachers on effective methods for teaching mathematics and implementing blended learning. This professional development, in combination with comprehensive reporting tools, led 77% of teachers to report that Reasoning Mind helps them be more effective in the classroom. Please refer to Appendix A for the full list of teacher responses to the question, “Does Reasoning Mind help you be more effective in the classroom?”

As the results below demonstrate, teachers found that Reasoning Mind benefitted students in a wide variety of ways.

Student Skill	Teachers Rated Improved or Significantly Improved
Reasoning skills	85%
Independent learning	84%
Non-standard thinking abilities	81%
Confidence in mathematical ability	86%
Enjoyment of mathematics	90%

Moreover, teachers found that the program's benefits extended beyond mathematics. Of the teachers surveyed, 65% stated that Reasoning Mind improved or significantly improved the reading comprehension of their students.

As one teacher wrote,

“After 18 years of teaching, I now know where my passion in teaching lies and it is in teaching RM. If I am unable to teach RM next year, I will look for a different job outside of teaching. This is one of the last jobs where you can really teach and make a difference in Elementary schools.”

Please refer to Appendix A for the full list of teacher responses to the question, “In your opinion, are there advantages to using Reasoning Mind compared to a traditional curriculum?”

Conclusion. Teachers and principals found many advantages to Reasoning Mind. In particular, they found Reasoning Mind's implementation support to be strong and sufficient to the purpose. As a result, the overwhelming majority stated that they would like Reasoning Mind on their campuses again.

Student Attitudes

Reasoning Mind usually administers anonymous student attitude survey at the end of each year. This is an effective way to gauge student attitudes to mathematics and learning as well as get feedback on their experiences with Reasoning Mind. Consistently, these surveys show that over 90% of students like Reasoning Mind and over 70% like math *more* than they did before using the program.

There is a substantial body of research indicating that students' dispositions towards learning strongly influence their future performance in school. This is certainly true of mathematics, which many students dislike and find intimidating. It is particularly important to work on economically disadvantaged students' attitudes towards mathematics, since these students often end up with the mistaken impression that math is not for them, limiting their future career options.

Unfortunately, student reading and writing skills in the 2nd grade are usually not sufficiently developed to gather meaningful input through surveys. For this reason, Reasoning Mind only surveys students beginning in 4th grade. For 2nd graders, student attitudes are measured through classroom observations by Program Coordinators as well as through feedback collected from teachers.

Classroom observations of Dallas ISD 2nd graders in the 2011–2012 school year confirmed that students were very engaged, enjoyed learning in the system, and improved their attitudes to mathematics as a subject. As reported in the preceding section, 90% of teachers said that Reasoning Mind increased students' enjoyment of mathematics.

An additional indicator of the high level of student engagement is their extensive use of Reasoning Mind in their spare time outside of school; please refer to the section “Student Use of Reasoning Mind Outside of School Hours” (on p. 20) for details.

Finally, yet another source of data to assess students' attitudes is a large volume of e-mail messages sent by students to the RM Genie, the animated character that guides students in their learning in RM City. The Genie is seen by students as both a friend and a mentor figure. Many of them form a strong bond with the Genie and write to it about their likes and dislikes in RM City. Of course, the Genie writes back to students and at times chooses to initiate conversations on its own. For example, the Genie might remind a student that she hasn't turned in her homework. Student messages to the Genie represent an illuminating window into how students view their studies in Reasoning Mind.

Overall, Dallas ISD students sent 34,529 messages to the Genie in the 2011–2012 school year. Here are some examples of these emails:

dear Genie I hope we will teach us a lesson soon. oh and thanks for the bonus points you gave me but i will get better soon to study you know to get better at it well genie i hope i see you soon and don't forget to send me a message

Dear, RM Genie I want you to know that I am going to miss you when its summer and tell [Name removed] that I am going to miss her too Yours truly, [Name removed]

Hi Mr. Genie I love your web site! Some people don't like math but I do. A lot of people I know like math! Thank you for making this web site!

thanks genie im loving rmcity and thanks for teaching me stuff you r cool man.

Im so sorry I didnt turn it in please forgive me your friend, [Name removed]

[In response to the email: "Dear [Name removed], I'm disappointed that you didn't turn in the homework due today (assignment #2). I know that in the future, you'll make sure to do your homework. Your friend, The Genie."]

HI RM Genie! i hope u have a good time teaching kids how to do math.Me and my friend [Name removed] loves playing RM City!Even i think you are a great teacher for teaching kids about math!
Sincerly, [Name removed]

A randomly selected collection of 100 messages is included in Appendix B. You can review this collection to get an unbiased first-hand sense for student attitudes towards the Genie and Reasoning Mind.

Student Use of Reasoning Mind Outside of School Hours

Because Reasoning Mind is an online program, students can use it at any time from any computer with an Internet connection. This allows some students to study beyond regular class time. Two questions would be most relevant in relation to the district-wide use of Reasoning Mind by 2nd graders in the 2011–2012 school year:

1. Did students actually take advantage of this opportunity and voluntarily continue their math learning in Reasoning Mind in their spare time?
2. If so, was such out-of-school studying associated with meaningful gains in student achievement, as measured by ITBS scores?

We first address Question #1. There were 10,737 2nd grade students at Dallas ISD who were identified as logging into program outside of school. Of these students, 7,745, or 72%, logged in for at least a minute. This is highly significant, given that teacher surveys indicate that only about 20–30% of Dallas ISD students have home computers connected to the Internet. This is in line with nation-wide averages for economically disadvantaged students.

We then chose a cut-off point to filter out students who only used the program a little bit outside of school hours; the cut-off was set to three hours, which is about 10% of the average online time students worked in Reasoning Mind over the school year. A total of 2,394 2nd graders spent at least three hours in Reasoning Mind outside of school. Interestingly enough, this constitutes 22% of the entire group and is close to the estimated percentage of students that have regular access to Reasoning Mind from outside of school. Thus, it's conceivable to speculate that the great majority of students that had the opportunity chose to spend meaningful time in Reasoning Mind – effectively extending their school day.

Even more significant is that the average out-of-school usage time for these students was eight (!) hours. In other words, these students logged from out of school about 25% of the average student annual learning time.

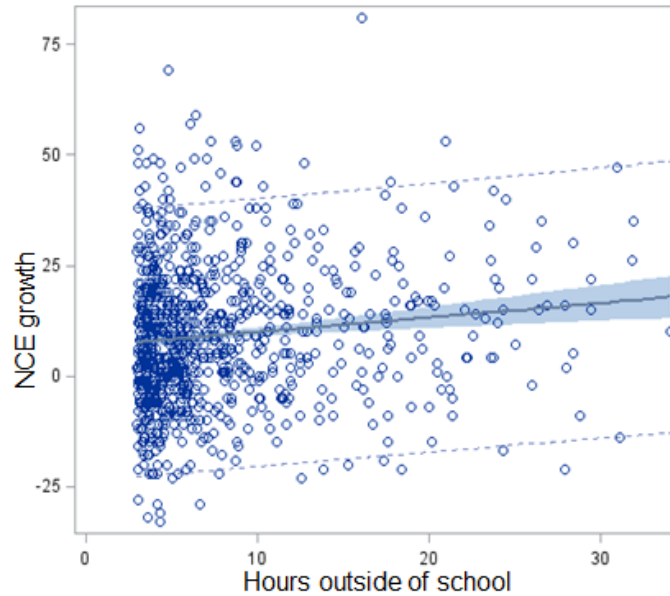
We now turn to Question #2. To answer this question, we performed regression analysis for the subgroup of the 2,394 students, selecting those who were below grade level at the end of 1st grade. There was a total of 979 such students. The rationale for selecting this particular subgroup is twofold. First, students who are below grade level are of special concern to the district. Second, an argument could be made that it's predominantly the stronger students (who are often more motivated) who chose to study in Reasoning Mind after school hours. The fact that 979 of the 2,394 students (41%) happen to be below grade level puts this argument to rest.

Note: To make the fit more accurate we removed the extreme outliers, 34 students who spent between 35 and 107 hours in Reasoning Mind from outside of school.

The regression coefficient for the group of 979 students is 0.33, meaning for every extra three hours spent on Reasoning Mind at home, they experienced an NCE growth of one point. Thus, if a student spent just one hour a week on Reasoning Mind at home, he or she experienced an NCE growth of 10 points. The average student in this subgroup started at the 27th percentile; for such a

student, this would mean percentile growth of 18 points from the 27th percentile to the 45th percentile, and the difference between failing and passing the ITBS.

NCE Growth vs. Hours Online Outside of School



This correlation is quite significant, and supports the hypothesis that out-of-school studying in Reasoning Mind produced meaningful gains in student achievement as measured by ITBS scores.

Making the Most of Reasoning Mind's Data

Reasoning Mind's database. The analyses done in this report were possible only because of the immense volume of data that is logged by Reasoning Mind. That same data can also be a powerful resource of school districts implementing the program.

Every second that a student spends in Reasoning Mind is captured. In the moment when a student submits an answer, the student's solution is recorded, the student's accuracy is updated, the student's state of knowledge is reevaluated, and the system artificial intelligence algorithm decides what to do next. This is not only an important mechanism for online instruction; it is a powerful resource that the district can use.

Getting data. For the majority of data needs, district leaders can use Reasoning Mind's administrator interface. This is a user-friendly interface that administrators can use at any time, logging in to obtain access to many reports on the progress of schools, classes, and individual students. For example, administrators can find:

- Average hours online for schools, teachers, classes, or even individual students
- Accuracy
- Performance on advanced problems (the so-called levels "B" and "C")
- Number of objectives completed
- Diagnosed objectives (i.e., topics that have been flagged as problematic)
- Many other relevant indicators and metrics

Moreover, the reports allow administrators to drill down to the level of every screen, animation, and problem worked by every single student (!). Therefore, at any moment, a central administrator can know anything from the schools with the highest time online to how a specific child answered a problem on division five minutes ago. It is like an open door policy to every classroom that can be explored without leaving the office.

Data on in-class observations by Program Coordinators is meticulously logged by Reasoning Mind staff in internal information systems. While this data is not available through the administrator interface, Reasoning Mind staff can easily build reports and provide them to district leaders.

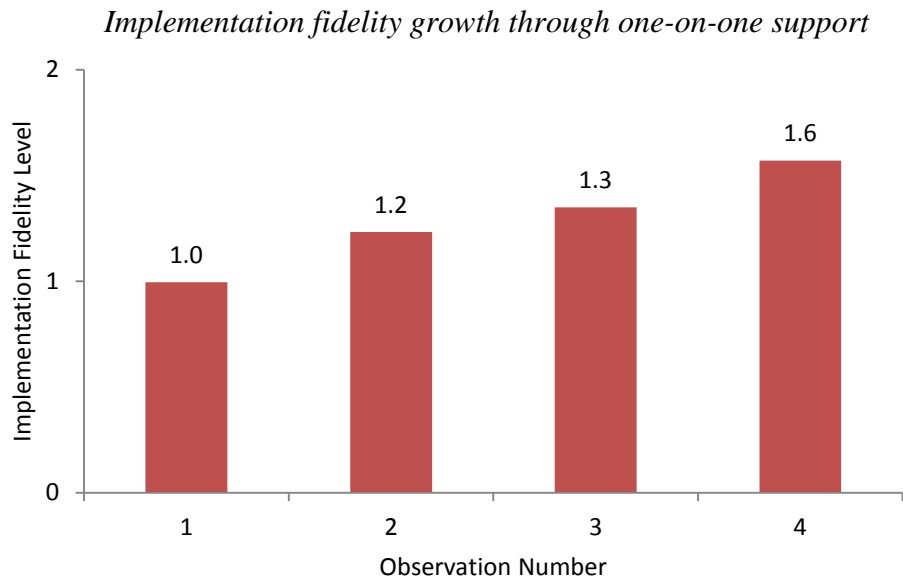
Finally, for more complex data needs, Reasoning Mind's technical team can program direct queries to the database. If the district is interested in the additional hours spent online outside of school, correlations between classroom management and student progress, or pretest-posttest analyses, Reasoning Mind can provide it.

Quality of data. Reasoning Mind metrics have been shown to correlate strongly with ITBS performance. A regression analysis (with categorical variables) on the correlation between ITBS NCE and student accuracy on A-level (fundamental) problems shows that every percentage point difference in accuracy is associated to a 1.17 increase in NCE; the analysis yields a p-value of <0.001 and an R^2 of 50%. Hours online, objective completion, and implementation fidelity also prove to be predictive. Therefore, student growth toward district goals becomes immediately available at any moment.

Informing instruction. The most important aspect of these metrics is that teachers and school leaders can influence them. Reasoning Mind captures student misunderstanding as it is

happening so teachers can intervene before misconceptions take root. Similarly, Reasoning Mind captures aggregate accuracy, time online, and implementation quality so that administrators can intervene before negative trends form.

These interventions can have a substantial effect on student learning. In Dallas ISD, for example, the average implementation fidelity improved 60% as Program Coordinators observed classes and provided feedback. The graph below illustrates how teachers improved with every class visit by a Program Coordinator.



Therefore, by closely monitoring the information available and using the data to inform administrative intervention, Dallas ISD can become one of the nation’s most data-driven and adaptive districts.

Conclusion

Dallas ISD has made a considerable investment of time, money, and effort in implementing Reasoning Mind on a district-wide scale. The goal of this investment is to effect measurable and meaningful gains in student learning.

Reasoning Mind is a 501(c)(3) non-profit organization whose mission is to improve students' proficiency in mathematics. As such, the relationship between Reasoning Mind and Dallas ISD is not a "customer-vendor" relationship, but rather much more – a partnership, with all sides working closely together towards a common goal and accountable to each other for results.

Together, Reasoning Mind and Dallas ISD have shown that student growth follows directly from time on the program and implementation fidelity. On those campuses where the program was implemented with fidelity, students showed twice as much growth as those without significant time on Reasoning Mind. We expect that with cumulative years of Reasoning Mind, Dallas ISD students will reach extraordinary levels of mathematical proficiency and set the example for hundreds of other districts across the country.

Appendix A: Teacher Survey Comments

In this appendix, we provide the complete list of Dallas ISD teacher responses to relevant questions on the end-of-year teacher survey.

In your opinion, are there advantages to using Reasoning Mind compared to a traditional curriculum?

Hands-on and using 21st century technology.

It is a benefit as an additional/supportive role.

I really think using the shorthand in problem solving provided an excellent tool for the students.

It expands the thinking and it is very interactive!!

It helps students with vocabulary and note taking. It also engages them because it is on a computer. It allows students to become more computer literate.

It can be used as a pre-teaching, re-teaching, independent practice, or reinforcement tool.

It can give instant feedback and adjust to students needs individually much more efficiently than I can

Definitely holds the students interest more than a teacher walking around a room. RM also allows for students to have important math information presented multiple ways.

Students love the games and the genie so they want to get more on the computer.

The kids are more interested, because they are working on the computer.

My students are very motivated, they love going to RM city!!

working on own level

It is easier for me to work one-on-one or with a small group, when the other students are on the computer.

For younger kids I think they need a reader basal and math as well ask reading.

Keeps students interested.

Resources are online.

I like that it is interactive and keeps students busy

computer based is more fun

Students like being on the computer and RMCity is fun.

Yes because the students are self-paced. Do it is made different for each child.

It kept the majority of the students more focused.

RM allows the learner to actually see and experience manipulating the problem so that they can work it out while understanding why the answer is the answer.

I like the foundational skills and logical shorthand processes that are introduced in RM. They help me teach my regular curriculum.

Yes and no. If the teacher were able to control the content of RM according to the ISD's curriculum, it'd improve a lot the academic achievement.

The order in which the curriculum is set, the student uses the skills previously learned. Also, the program spirals to review previously seen material.

More engaging and kids love to use technology

Students get to see math in a different way.

But only if the students are on grade level otherwise difficult.

structure and they can pretty much work on their own pace with me "helping out"

The use of technology and the kids love it.

You can meet the needs of the students better. You can also see where they struggle and provide additional assistance.

They learn how to use an online learning program

Covers all the required objectives but is also very engaging to the students.

It does expand the concepts students learn, above and beyond the regular curriculum.

It is more advanced

Students allowed to work on appropriate level and at their own pace.

I guess there are advantages that the students are able to work at their own pace.

Of course there are always advantages. RM has students get involved with computers as a means of study. RM incorporates a fun way to get involved and prepared for algebraic thinking. RM also spirals knowledge (as does the curricula), which has students see concepts prior to actual introduction in the classroom. This helps when we go over these concepts because they are now part of their background knowledge (or at least have been exposed to them) when we go into discussion in class.

Yes the biggest advantage is the ability to help a student exactly at the moment he needs help and not having to wait until the next assessment results come back.

The students are working independently and motivated to work. This provides an excellent opportunity for having effective small groups. The activity log reports allow me to directly see where students are making mistakes and how to help them prior to setting up the small groups.

STUDENTS ARE LEARNING SKILLS INDEPENDENTLY.

Yes, Self-directed, foster critical reading and thinking. Helps students to monitor their own learning and creates a love of math.

RM promoted independent learning and ownership.

The students get more engaged and learn more.

the curriculum is more challenging

The students enjoy learning with Reasoning Minds.

Made my students more computer savvy

Allow students the ability to work on grade level skills at an individualized ability level.

It reinforces grade level concepts.

Program allows advanced students to be introduced to more rigorous math activities that are challenging.

We did not replace our traditional curriculum

We used RM and Texas Math

Additional exposure to math concepts. Peer sharing.

Reasoning Minds offers instant effective feedback from students response.

New and not boring for the students. Different approach to learning.

We use both RM City and a traditional curriculum but I found myself using the shorthand methods for problem solving since students were being exposed to it and I found that once it was learned (most)students caught on.

Students get even more engaged with the pictures, games and incentives from RM

RM takes time away from the classroom instruction. It is not aligned with the CPG.

Students are able to use modern technology to learn math skills. It makes learning math fun!!

Gives you step by step information

It would be great if it followed the same curriculum, still it helps students.

The colorful graphics hook the interest of the child. Note taking skills are encouraged.

It keeps students engaged doing not only math, but reading too. They also learn to be more independent and learn to take notes.

The ability of students to self-pace, allowing them to gain at least a nodding acquaintance with concepts which would not be taught in a regular Grade 2 Math Class.

Keeps students motivated! Makes learning math fun. Students compete with each other to be the best. Teacher incentives with this program truly engages the students and highly motivates them to do their best.

My Program Coordinator...

I did not like the carbon copy being sent to principal when we were communicating. It appeared as if I was not going to take the classes that were added to a full load for the 2011-2012 school year.

Tracey was very helpful and she always had positive feedback and suggestions.

She is very helpful

One suggestion- [Name removed] should introduce himself to the class at the first observation. I think that would put the students at ease, and they would be more receptive. Honestly, some of my students were scared. He is quite tall, and with the kids sitting in chairs, he towered over them. I think just a few words introducing himself and explaining what he's doing would have been helpful and set the stage.

She has been very helpful, and gone out of her way to get answers and support for me.

I am very thankful to have access to Maria. She is a big help with implementing the program.

Kervin always got back to me quickly. He was always helpful in explaining how to find what I was looking for and answering questions the class and I had.

I don't consider this survey a valid one because it is too general and does not do justice to the recent coordinator.

Ms. Prentice was great!

My problems was not with my PC it was the actual time allotted to use the computers to give students the true effect of enjoying and learning what a great learning concept this program could have been on their learning experience. They were introduced to the RM but wasn't allowed to really adapt to it's actual benefit to their learning.

Mr. Penn-Hall is attentive, professional, supportive, and courteous.

He was very knowledgeable and professional.

The coordinator that we have had this year have been wonderful. I believe because we have had so many changes this year between coordinators and on the campus level, visit were difficult to schedule.

She has been very supportive in answering my questions, giving suggestions without hesitation or in a demeaning way. Before she leaves, she would always ask if there was anything I needed or would like for her to go over, or if there was some way she could help in any way. She always left open the opportunity to call her for any reason, great or small.

Kind and professional person

Kervin is a wonderful coordinator. I don't have any negative comments regarding his performance

She was always ready to help me.

Ms. Joseph is extremely professional and is always available to answer any questions that arise.

I'm very satisfied with the support our coordinator has given us.

Corinne was an excellent coordinator. I looked forward to her visits. My students got to know her and was very comfortable answering questions.

Tracey was a great program coordinator. She was very helpful even the time that I was out on medical leave. She was the best.

He was always prompt and responsible.

Does Reasoning Mind help you be more effective in the classroom?

It helps students to use technology to enhance their learning in the core curriculum.

I am learning new ways of teaching.

It helps with teaching certain objectives in the classroom prior to having it in RM.

It's something they can do when they come into the lab.

This really isn't a yes or no question. If anything it supplements or pre/reteaches concepts.

It allows me extra time to work with students who really need additional time.

It's really nice to start to introduce a lesson and the class says "I did that in RM City!" this really helps with the more difficulty concepts, you are almost being given additional time for re-teaching without having taught originally. You get to see the holes/gaps in learning and can quickly work to get them filled.

It is another method of reviewing concepts the students might not have understood the first time.

higher vocabulary skills in math

I used the genie's rules to discuss other topics. I would ask the students if they read and understood the theory in science.

I'm a self-contained teacher. I was doing RM class 3 times a week for two classes. I was frustrated trying to catch up with my classroom's curriculum.

It helps me invest the students in something

I had no problem the students knew the schedule and I was able to follow the CPG by the Dallas ISD as well as the RM City. I tried to do a spiral of what we were learning in class and in RM City.

I could always return to a moment or a lesson that they had experienced with a problem visited in RM City to get them to understand a concept that I was teaching from the CPG of their main prescribed curriculum and we could bring the connection into play so that they got the concept.

It took a while to adjust to the time required for RM, but once I realized I had regular intervention time available I started addressing weaknesses in my students learning while they were in the lab.

It helps my students see a match concept in a different way.

It helps more independent students to advance more.

The kids really look forward to it and gives them structure

It reinforces what is being taught in the classroom.

It helps me incorporate technology into my teaching.

It helps but taking the time from instruction and the CPG alignment hurt them a bit

It has really given me new strategies for teaching math.

STUDENTS ARE REMEMBERING CONCEPTS AND ARE APPLYING THEM IN CLASS DURING OUR MATH LESSONS.

It is another way to reach the students. I am able to support them in a fun way with RM. They loved it and were excited about it.

Help develop comprehension in English.

It gives me the time to provide small group instruction while students are working on computers.

It helps me getting them ready for Algebra.

Please tell us anything else about your experience with the Reasoning Mind program.

RM should hire me to be their "poster child" teacher for DISD. I have always said that I have not seen any other program that DISD has used in the last 18 years that works as well as this one. I think we need Reasoning Science, and Reasoning Social Studies real soon.

Do not like that there is time limit on the program and the time is not built into the schedule by the District or the Principals

Students are very excited to get to the lab, challenge, and go to the game room, shopping and Genie's House.

I enjoyed it and my students really looked forward to earning free time to buy things for their "place".

I have enjoyed myself this year. I have learned a lot. Thank you for the experience.

The student's name on the screen is in white and is very difficult to see. It needs to be larger and in a different color, Also, the print showing the objective needs to be larger.

Implementation was incredibly difficult. 135 students shared 24 net books. 2 broke. We also used desk top computers when available. We did not have a computer lab to use. We shared classrooms. It was a difficult year. We have to change it for next year.

We need more incentives provided by RM. I was using out-of-pocket money to motivate the students to do well.

Way to over-complicated as far as the teacher expectations are concerned and the observations, online assignments, in-person trainings, etc. Remember that as teachers our time is very limited.

I like RM but with it aligned with our CPG's

I have noticed that the students are using the self-management of learning. I do not have to tell them what to do. If they have a question then they ask. They know they have to read the theory and the genie's solution.

It was a great experience, I saw growth in the students week by week in some area of their learning experience.

I believe I achieved much with the time and obstacles I had placed within my path during this school year. Yet, I am thankful that my students had the introduction to another way of learning.

I think RM is outstanding and benefits my students.

It is a great program, it helps students to learn individually and the advantage of learning the language ,my students are very limited in English.

It seems to me It's a great tool to teach Mathematics.

Love it!

The one thing that I did not like was the initial training I got. I had to do it online and honestly it was horrible. I was lost and confused most of the time.

I wish it was used throughout the district in lieu of the "workbooks". To me students learn better.

I like the use and application of the ruler, pencil, eraser for geometry. I think those are excellent skills to learn. They liked the way they can interact.

The competitions against their friends are very useful and motivate them to improve. that kind of contest are the type they learn and have some fun.

I welcome technology but it has to be aligned with the program we use in the classroom. It would be wonderful to teach fractions and then have the kids go to the computer lab and match fractions with the pictures, or study the clock and then students find a clock on RM and match the time.

The program has a lot of "segments, lines and curves". However, that concept is NOT covered in our second grade curriculum and certainly not tested at the end of the year.

This Program helps prepare our children for 21st Century computer skills and learning opportunities. It provides "equality" in learning between the "haves" and "have nots".

remove some topics and expand other, like remove lines and chains, and expand adding or subtract, multiply or divide

Next time, please do not change the system in the middle of the year. It is too confusing to the teacher and students.

I enjoy it!

add more audio options for low readers.

There are some screens have audio. Low readers need them on all screens until there reading improves.

Great Program

I am glad I had the opportunity to experience the program this year.

At the beginning of RM I must admit I was very lost! As time passed I got to learn the curriculum and now absolutely love it!

It is a learning experience for me as well as the students.

Please include

- 1)Money
- 2)Clocks
- 3)2d and 3d shapes

I love how this program encourages and teaches independence.

Appendix B: One Hundred Randomly Selected Dallas ISD Student Emails to the Genie

These emails were randomly selected from the tens of thousands of emails Dallas ISD students wrote to the Genie in the 2011–2012 school year.

I cant go on GUIDED STUDY.

I love math soooooooooo much

helo+har uduwing

genie i love rmcity it is a great place

can you put new games

genie you are a cool kid

hi genie

You are the best teacher of rmcity.org

WHAT ARE YOUOOOOOOOOOOOOOOOOOOOOOOOO DOING

genie rocs

porque estas bebe

genie why are there no moves

Hello

how are you doing. from [Name removed]

hi I love you

can i sale my pictir to [Name removed]

eyrefsdkhfuefd...*(The remaining message was truncated due to gibberish.)*

Genie please leave all of your doors at the Genie house unlocked so i can see your whole house.(:

do you like ants i hate them!!

thank you for doing rmcity. from [Name removed]

genie i want to know who u realy are <3

Hi Genie I'm great to see you today you are the best loving genie.Give [Name removed] SHE IS THE BEST WOMEN I HAD EVER AND SHE IS THE BEST MATH SCIENCE TEACHER I HAD EVER HAD AND SHE IS BEAUTIFUL

A

hola ms.malave:)

estoy estudiando mucho.....

Te voy a dar 1,00 dolares

elizabethnngxtrzsefstwfx...*(The remaining message was truncated due to gibberish.)*

hay geni y love you

[Name removed] you stank and smell like toes

[Name removed]

[Name removed]

i love you

23+234=

i lost my 128 dumbo streaks

may I come to your house

Hey Genie! Can I go to your house?

YOU ARE A GOOD TEACH.

Genie can you tell [Name removed] to let us have free time today and tomorrow.

Hey where is genie what are you doing

PLEASE PLEASE PLEASE PLEASE PLEASE PLEASE PLEASE PLEASE PLEASE

HAY GENIE HOW DO I SEND MESSAGES TO MY FRIENDS

genie i love you

gtsdgsfkdsghfshbfhng...*(The remaining message was truncated due to gibberish.)*

GHHHHHHVFGGENIE CAN YOU TEXT ME RIGHT NOW IM SAD BECAUSE I NEVER
HEARD FROM YOU. FROM [Name removed]

Good

your so awesome genie!!

you are the nicest friend i ever had.

THANKS

Hi

hi genie :)

hi!!!!

GIVE ME 100 BONUS POINTS

what is your CAT doing

Can you please tell our teacher to let us have free time.

I can't go to GUIDED STUDY.

ljgkjkgjgjdkj...*(The remaining message was truncated due to gibberish.)*

what you tell

GENIE YOU HAVE GIVEN ME WONDERFUL THINGS TO DO

i love rmcity a lot genie love [Name removed]

dfdfhghhkvfgfv...*(The remaining message was truncated due to gibberish.)*

Ayudamegenie

thank you genie for giving all my students bonus points you are the best genie

3066129LUNHFGVU...*(The remaining message was truncated due to gibberish.)*