MEMORANDUM May 4, 2016

TO: Lance Menster
Officer of Elementary Curriculum and Development

Annie Wolfe
Officer of Secondary Curriculum and Development

FROM: Carla Stevens
Assistant Superintendent, Research and Accountability

SUBJECT: **THINK THROUGH MATH IN HISD, 2014–2015**

Think Through Math (TTM) is an online, adaptive mathematics program designed to supplement classroom instruction. In 2014–2015, the program was funded by the Texas Education Agency for students in grades 3–8, and schools had the option to purchase the program for students in other grades. This report compares the STAAR mathematics achievement of HISD students in grades 3–8 who enrolled in the TTM program in 2014–2015 with the results of similar students in the same grades who did not use TTM. Comparisons were made for students districtwide, for students based on 2014 STAAR Mathematics performance level, and for students who attended a 2014 Improvement Required (IR) school.

Key findings include:

- A total of 43,997 HISD students used TTM in 2014–2015. Nearly all the students, 99 percent, were enrolled in grades 3–8, the grade levels for which the program was supported by TEA.
- Students enrolled in TTM completed an average of 14 TTM lessons and passed an average of four on-grade level lessons in the academic year.
- Propensity score matching, which matched TTM users with non-TTM users based on key variables, indicated no significant difference in 2015 STAAR Mathematics scale scores between TTM users and non-TTM users.
- Propensity score matching was also used to confirm that there were no significant differences between TTM users and non-TTM users based on 2014 STAAR Mathematics performance or enrollment in an IR school. Specifically, there were no significant differences in 2015 STAAR Mathematics scale scores of matched TTM and non-TTM users who did not meet the 2014 STAAR Mathematics standard, who met but did not achieve the advanced 2014 STAAR Mathematics standard, who met the 2014 STAAR Mathematics advanced standard, or who attended a 2014 IR school.

Further distribution of this report is at your discretion. Should you have any further questions, please contact me at 713-556-6700.

Attachment

cc: Andrew Houlihan
Joshua Udy

HOUSTON INDEPENDENT SCHOOL DISTRICT

RESEARCH

Educational Program Report

THINK THROUGH MATH IN HISD
2014–2015

HISD | Research and Accountability
ANALYZING DATA, MEASURING PERFORMANCE.

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THINK THROUGH MATH IN HISD, 2014–2015

Executive Summary

Evaluation Description

Think Through Math (TTM) is an online, adaptive mathematics program designed to supplement classroom instruction in mathematics. Beginning in August 2012, the program was made available free of charge to students in grades three through eight by the Texas SUCCESS (Students Using Curriculum Content to Ensure Sustained Success) initiative through the Texas Education Agency (TEA). Additional services could be purchased by campuses to serve students through high school Algebra I and geometry. This study was designed to investigate the impact of the Think Through Math program on the State of Texas Assessments of Academic Readiness (STAAR) mathematics achievement of HISD students in grades three through eight who used the program during the 2014–2015 academic year.

Highlights

- A total of 43,997 HISD students used TTM in 2014–2015. Nearly all the students, 99 percent, were enrolled in grades 3–8, the grade levels for which the program was supported by TEA.

- Students enrolled in TTM completed an average of 14 TTM lessons and passed an average of four on-grade level lessons in the academic year.

- Of the students enrolled in TTM in 2014–2015, 28,412, 65 percent, earned scores on both the 2014 and 2015 spring STAAR Mathematics exams and were included in analyses of the program. An additional 28,959 HISD students earned scores on the same exams and did not use TTM and were also used in the analyses.

- Propensity score matching, which matched TTM users with non-TTM users based on key variables such as 2014 STAAR Mathematics scale scores, demographics, special education and gifted/talented status, and enrollment in a 2014 Improvement Required (IR) school, indicated no significant difference in 2015 STAAR Mathematics scale scores between TTM users and non-TTM users.

- The majority of students in the analyses achieved the same standard on the 2015 STAAR mathematics exam that they had achieved on the 2014 STAAR Mathematics exam, at about the same rates among both TTM and non-TTM users. These results were achieved irrespective of the numbers of TTM lessons completed or the number of TTM on-grade level lessons passed by TTM users.

- Propensity score matching was also used to confirm that there were no significant differences between TTM users and non-TTM users based on 2014 STAAR Mathematics performance or enrollment in a 2014 IR school. Specifically, there were no significant differences in 2015 STAAR Mathematics scale scores of matched TTM and non-TTM users who did not meet the 2014 STAAR Mathematics standard, who met but did not achieve the advanced 2014 STAAR Mathematics standard, who met the 2014 STAAR Mathematics advanced standard, or who attended a 2014 IR school.

Recommendations

- TTM data would be more accessible and reliable if it were associated with a single unique identifying number, such as the Texas Student Data System (TSDS) unique ID or the HISD local student ID, rather than based on a combination of user names and identifying numbers provided by another server (Clever). Further, it would be helpful if TTM supported a system that allowed data to be modified without loss of information, and if data were accessible for more than a single academic year. It is recommended that TTM be encouraged to support a system that allows linking to a single student identification number per user and access to records for each individual student for multiple years.

- Currently, the TTM system does not allow easy access to the number of discrete lessons a student uses. For example, of two students who complete 15 lessons, one could have completed 15 discrete lessons and the other could have completed a single lesson 15 times. To allow better measurement and understanding of students' academic progress in the program, it is recommended that TTM be encouraged to routinely collect data on both the number of discrete lessons and the number of discrete on-grade-level lessons a student attempts, completes, and passes.

- In 2014–2015, no significant differences were found in the STAAR Mathematics performance of TTM users compared with the performance of non-TTM users, but in 2013–2014, TTM was shown to be an effective academic support for HISD students in increasing their scale scores on the STAAR Mathematics assessment. Because 2014–2015 issues in data management may have contributed to the contradictory results, it is recommended that the program continue being made accessible to schools and teachers as a supplement to regular instruction in order to allow further evaluation of the effectiveness of the program using a complete data set.

- Further, it is recommended that schools and teachers who choose to use the program strive to monitor and increase students' use of the program regularly and with the purpose of achieving specific mathematics objectives.

Administrative Response

- TTM will continue to be provide free through the 2016-2017 school year by the state of Texas (see http://tea.texas.gov/interiorpage_wide.aspx?id=25769824546).

- Significant to this data is the shift in implementation and assessment of new grades 3-8 mathematics standards during the 2014-2015 school year.

- TTM is accessible to students in grades 3-8, as well as their math teachers, through the HISD HUB's digital resources page.

- The program is intended for use by all students in grades 3-8, and it is recommended that students spend approximately 75 minutes or more using TTM each week. This equates to approximately 1 to 2 lessons per week.

- Previous research (from 2013-2014) has shown that when students "Think 30"—that is, complete and pass 30 lessons before STAAR, their scores are positively impacted.

- In light of the rigorous new mathematics standards that were introduced in grades 3-8 during the 2014-2015 school year, the district has been working towards a more consistent and comprehensive plan for implementing TTM strategically as the primary *Response to Intervention (RTI)* program. It is thus recommended, that campuses and teachers utilize the program with fidelity.

- In addition—and in light of the new Algebra I standards introduced during the 2015-2016 school year—the state of Texas is now also providing TTM for free for all Algebra I students, including re-testers.

- Elementary and Secondary Curriculum and Development will continue to provide information to lead teachers and department chairs on TTM trainings, specialized summer school TTM pathways, and free TTM-hosted webinars.

Introduction

Think Through Math (TTM) is an adaptive, web-based mathematics enrichment program funded through the Texas SUCCESS program provided by the Texas Education Agency (TEA) for students in grades three through eight. Since the lessons are online, students can access the program both at school and during after-school hours, free of charge. The program is also available for campuses to purchase for students in high school who are studying mathematics through Algebra I and geometry.

Typically, a student takes a placement test at the beginning of a school year and, based on the results, is placed on a grade-level "pathway" which consists of approximately 40 target lessons. Additional remediation lessons, are inserted on a student's pathway as needed, and students can begin a new pathway when they finish the grade level assigned. Teachers have significant control on the presentation of the curriculum and can reorder, add, and remove lessons from a student's pathway to meet instructional and/or student needs. The curriculum is designed to supplement rather than replace classroom teaching.

A notable element of the program is the student motivators built into the lessons. Students earn points for all the actions they take in the program. Points can be used in a variety of ways, including to contribute to a class reward such as a pizza party or classroom supplies, to make a cash contribution to the student's choice of a variety of charities, or to enhance a student's online TTM avatar. Students can earn points even for answering questions randomly, so teachers' monitoring of use of the program is crucial. Teachers have ready access to information about each student's progress and can instantly change a student's pathway or send a personal note to a student.

Research completed in 2013–2014 for the state of Texas and for HISD indicated that TTM is an effective support for increasing student performance on the STAAR Mathematics exam. According to the Gibson Consulting Group, reporting on a study for the TEA:

> Advanced statistical modeling, accounting for other observable factors that may influence student outcomes—such as students' prior STAAR-Mathematics performance—showed that students in Grades 3-8 who attempted 20 or more Think Through Math lessons had statistically significant higher STAAR-Mathematics scores than non-users (Garland, et al, n.d., p. 12).

In HISD, 2013–2014 students who used TTM were matched with HISD students who did not use the program based on key factors such as previous STAAR Mathematics scale scores, state school rating, and demographics. Results showed that 2013–2014 HISD students who used TTM achieved significantly higher 2014 STAAR Mathematics scale scores than did similar students who did not.

This report provides demographic and TTM achievement information for HISD students who used the program in 2014–2015 and compares the STAAR 3–8 Mathematics performance of TTM users with the results of similar HISD students who did not use the program. All students who took both the spring 2014 and spring 2015 STAAR Mathematics assessment are included in the analyses. To determine if the TTM program was particularly effective with students with focused needs such as enrichment and remediation, the same analyses were performed for subgroups of students disaggregated by students' spring 2014 STAAR Mathematics performance and attendance at a school with the 2014 TEA accountability rating Improvement Required (IR).

Methods

Data Collection and Analysis

- Think Through Math achievement data for student work completed by April 17, 2015 came from TTM. Students who were identified as having started the program and students who completed the initial TTM placement test were included as TTM users.

- TTM achievement is reported as the number of lessons TTM users completed and the number of on-grade level lessons they passed. Completed lessons were those that students finished but did not necessarily pass. Completed lessons included target lessons, specifically aligned to the grade level curriculum, and remedial or administrative lessons, inserted to allow students to negotiate the program and to provide lessons on content students had not yet mastered. On-grade level lessons passed were those lessons specifically designed to address grade level content on which students were successful in the summative assessment. Data for each category were provided by TTM.

- Demographic data were drawn from PEIMS Fall 2014 Resubmission files. Limited English Proficient (LEP) students included those identified as LEP within the last two years (codes 1, F, and S).

- Improvement Required (IR) schools were those identified by the Texas Education Agency in the 2014 Accountability Ratings. School ratings, which include Met Standard, Met Alternative Standard, and Improvement Required, are based on results on four indices, which include a range of academic performance indicators. The IR rating is defined by the state as, "*Improvement Required.* Unacceptable rating assigned to districts, campuses, charter operators, and alternative education campuses (AECs) that miss the target on one or more performance indexes" (TEA, 2014, page 13).

- Data on STAAR performance came from data files from the Texas Education Agency. Scored versions of the 2013–2014 and 2014–2015 first administrations of the regular STAAR, both English and Spanish, and STAAR L (the linguistically accommodated test for English language learners) were used for the analyses. Students who had earned scores on both the spring 2014 STAAR Mathematics and spring 2015 Mathematics exams, both those who had used TTM in 2014–2015 (28,412 students) and those who had not (28,959 students) were included in the analyses.

- Propensity score nearest neighbor matching was used to compare the performance of students who took both the spring 2014 and 2015 STAAR Mathematics assessments and used TTM in 2014–2015 with the performance of other students in the district who took the same tests. Propensity score matching was designed to allow causal inferences based on observational data (Cohen, 1988). Students in grades three through eight were matched on spring 2014 STAAR Mathematics scale score, 2014–2015 enrollment in a 2014 Improvement Required (IR) school, grade level, gender, race/ethnicity, limited English proficiency (LEP) status, economic disadvantage, special education status, and gifted/talented status. For each comparison, a probit regression analysis indicated significant differences between the groups initially. All students in each comparison group were included in the matching procedure and, following the matching analysis, none of the bias reached the five percent level, indicating no significant differences between the matched groups.

- In this report, numbers were rounded to the nearest whole number in the text, and to the nearest tenth in the tables. Numbers were rounded up if the next digit was five or higher and were not changed if the next digit was lower, so 11.49 was recorded as 11.5 in a table and 11 in the text, while 11.50 was recorded as 11.5 in the table and 12 in the text.

- For percentages associated with demographics, percentages in the text are reported as percentage of TTM users or non-TTM users who share a given characteristic. In the tables, percentages are reported as a distribution of a given characteristic within the group of TTM users or the group of non-TTM users. Percentages reported in the text can be reproduced by using the corresponding table of demographics, selecting a single demographic characteristic, and dividing the number of students in the chosen group, TTM user or non-TTM user, by the sum of the number of TTM users and non-TTM users who shared the same characteristic.

Data Limitations

Of the total number of TTM users, 1,757 TTM students (four percent) used multiple TTM accounts, sometimes associated with different ID numbers and/or different schools. For analyses, identifiable students were matched with their local ID numbers and the numbers of TTM lessons were summed and associated with the first school assigned by TTM, resulting in some lessons being credited to schools at which they were not completed.

Due to technical issues in loading student information from HISD to TTM at the beginning of the 2014–2015 school year, some student TTM achievement data was lost. Students who began working with TTM materials before the correct upload was finalized were credited with incorrect totals of discrete lessons they completed. For example, according to the TTM file, 1,875 students completed between one and 112 lessons, but zero discrete lessons. TTM does not regularly report on numbers of discrete lessons that students complete so resolving the issue would have taken more time than was available at the end of the academic year. In order to document the achievement of as many 2014–2015 TTM users as possible while avoiding including inaccurate data, only TTM lessons completed and TTM on-grade-level lessons passed are reported in this evaluation. To further clarify, lessons completed and on-grade-level lessons passed are not discrete lessons; i.e., students could complete and pass the same lesson multiple times.

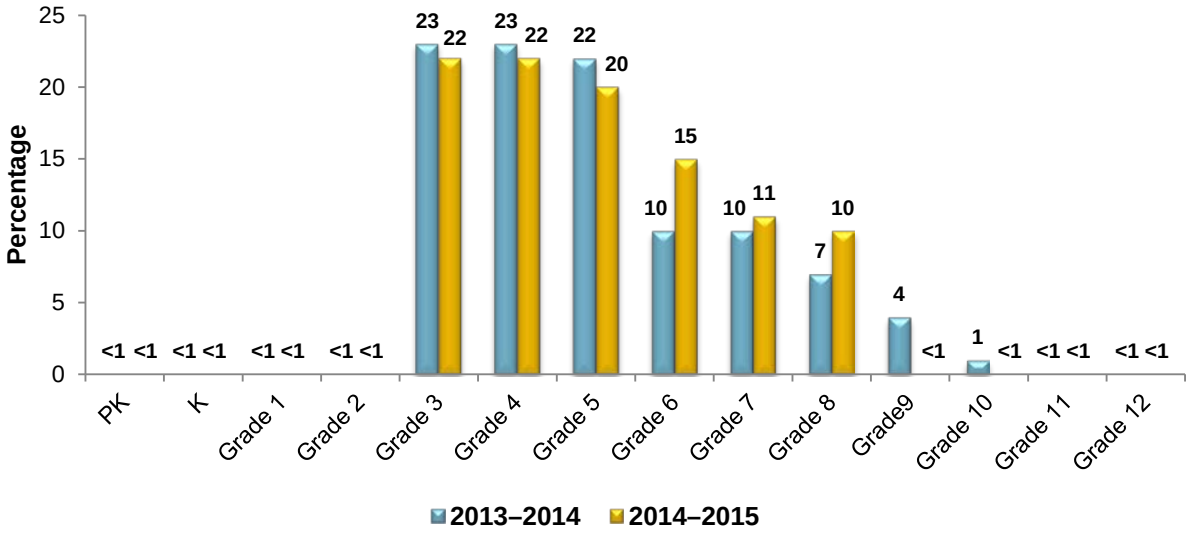
Results

How many HISD students used TTM in 2014–2015 and what were their demographics?

- A total of 43,997 HISD students were identified as TTM users and were matched with demographic data in 2014–2015. In 2013–2014, 51,863 HISD students met the same criteria (Department of Research and Accountability, 2014), a 15 percent decrease in the number of participants between the years.

- Shown in **Table 1** (page 19) and illustrated in **Figure 1**, though students at every grade level participated in TTM both years, in 2014–2015, 99 percent of TTM participants were in grades 3–8, the grades targeted by the program, while in 2013–2014, 95 percent of TTM students were in the same grades.

Figure 1. Percentage of TTM students at each grade level, 2013–2014 and 2014–2015



Note: Percentages may not equal 100 due to rounding.
Sources: PEIMS Fall Resubmission and TTM files, 2013–2014 and 2014–2015

- The majority of TTM users were in elementary school grades three through five both years, 64 percent in 2014–2015 and 68 percent in 2013–2014. Nearly 36 percent were in middle school in 2014–2015 and 27 percent were in middle school in 2013–2014.

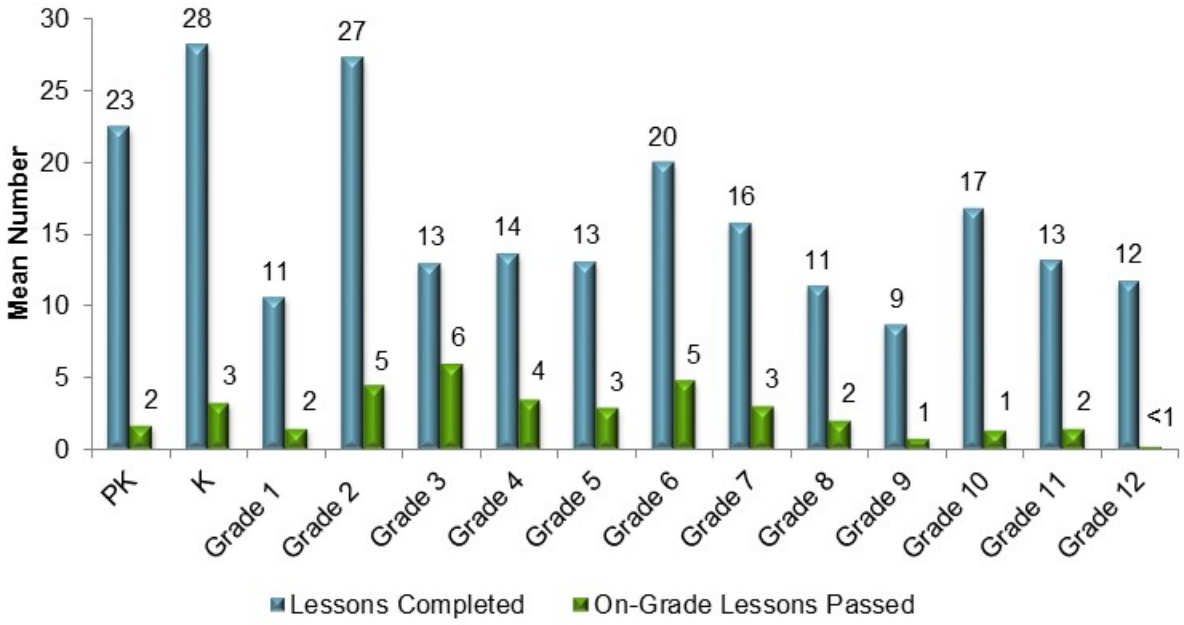
- As detailed in Table 1 (page 19), 13 percent of TTM users attended 2014 Improvement Required (IR) schools, while in 2013–2014, 14 percent of TTM participants attended the same schools.

- The demographics of TTM users in 2014–2015 largely paralleled those of 2013–2014 TTM users, with the largest exception being the percentage of economically disadvantaged students. In 2013–2014, 83 percent of HISD TTM users were economically disadvantaged while 76 percent were economically disadvantaged in 2014–2015. More detail about demographics of TTM users can be found in Table 1 (page 19).

- 2014–2015 TTM achievement, documented by number of lessons completed and number of on-grade level lessons completed at each grade level, is illustrated in **Figure 2** and detailed in **Table 2** (page 20). Students in HISD completed an average of 14 TTM lessons (on grade-level and remedial, including repetitions of lessons) in 2014–2015, with the highest average numbers earned in kindergarten and grade two, and the lowest average number in grade nine.

- Though TTM provided approximately 40 on-grade level lessons for each grade level, students in HISD passed only an average of four on-grade level lessons (including repetitions of lessons). The highest average number of on-grade level lessons passed was six, for students in grade three.

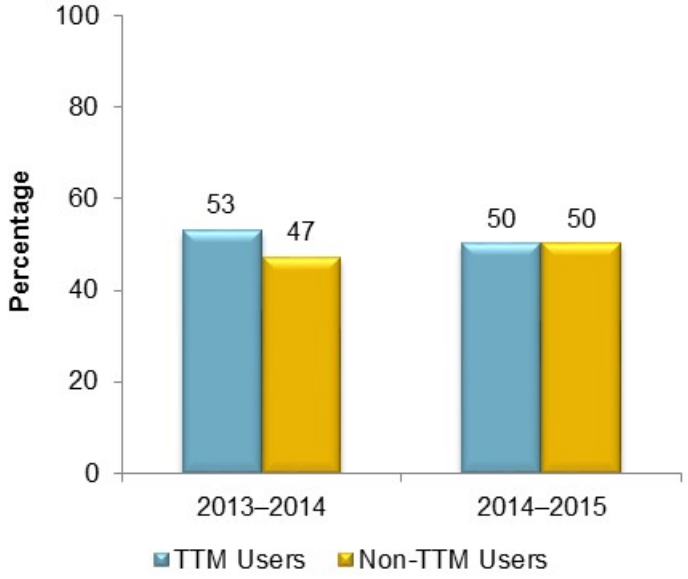
Figure 2. Average number of TTM lessons completed and average number of on-grade level TTM lessons passed by grade level, 2014–2015



Sources: PEIMS Fall Resubmission and TTM files, 2014–2015

- Of the 43,997 HISD students who used TTM in 2014–2015, 28,412 took both the spring 2014 and 2015 STAAR Mathematics assessments. Another 28,959 HISD students took the same exams at the same times but did not use TTM in 2014–2015. Shown in **Figure 3**, about half the students who took both exams used TTM and about half did not. For comparison, in 2013–2014, 53 percent of students who took both the 2013 and 2014 STAAR exams used TTM and 47 percent did not.

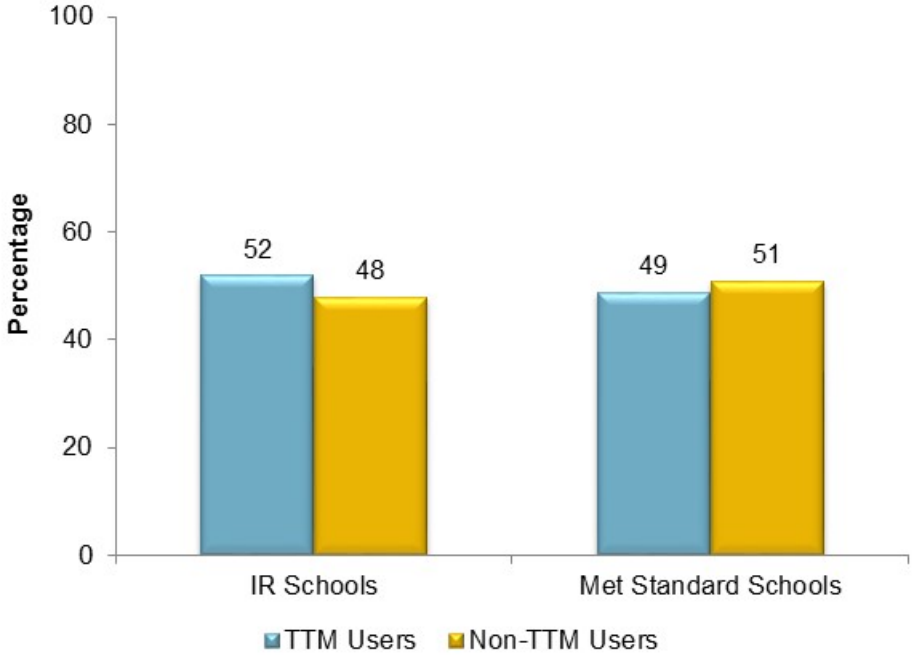
Figure 3. Percentage of TTM users and non-TTM users among 2013–2014 students who took both the 2013 and 2014 STAAR Mathematics assessments, and among 2014–2015 students who took both the 2014 and 2015 STAAR Mathematics assessments



Sources: PEIMS Fall Resubmission and TTM files, 2013–2014 and 2014–2015

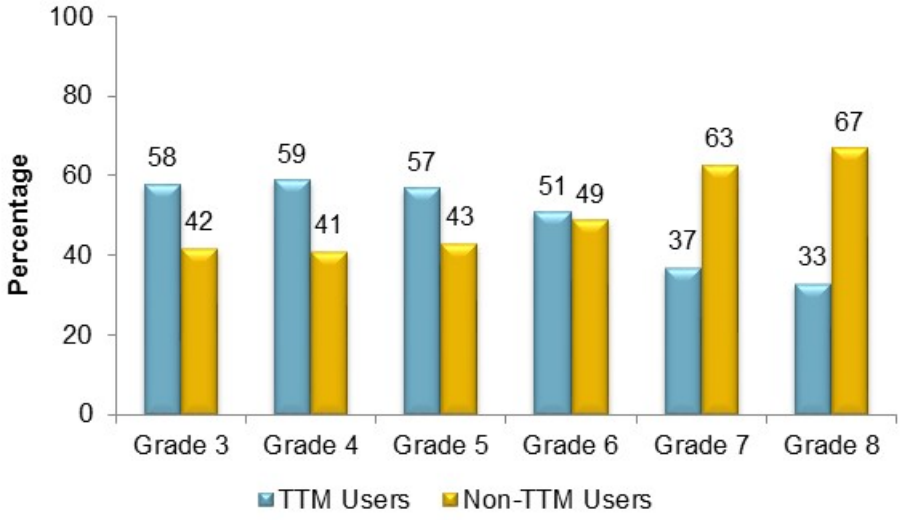
- Demographic information for 2014–2015 students who were included in the analyses of academic performance, including numbers that allow calculation of the results in **Figures 4–7** (pages 10–12) can be found in **Table 3** (page 21). Shown in **Figure 4** (page 10), of students who attended 2014 IR schools and took both STAAR Mathematics tests, a total of 7,138 students, 52 percent used TTM and 48 percent did not, while at schools that met the standard, with a total of 50,233 students, a slightly smaller percentage, 49 percent, used TTM while 51 percent did not.

Figure 4. Percentage of TTM users and non-TTM users among students who took both the spring 2014 and 2015 STAAR Mathematics assessments, by 2014 school accountability rating



Sources: PEIMS Fall Resubmission, TEA accountability ratings, and TTM files

Figure 5. Percentage of TTM users and non-TTM users among students who took both the spring 2014 and 2015 STAAR Mathematics assessments, by 2014–2015 grade level



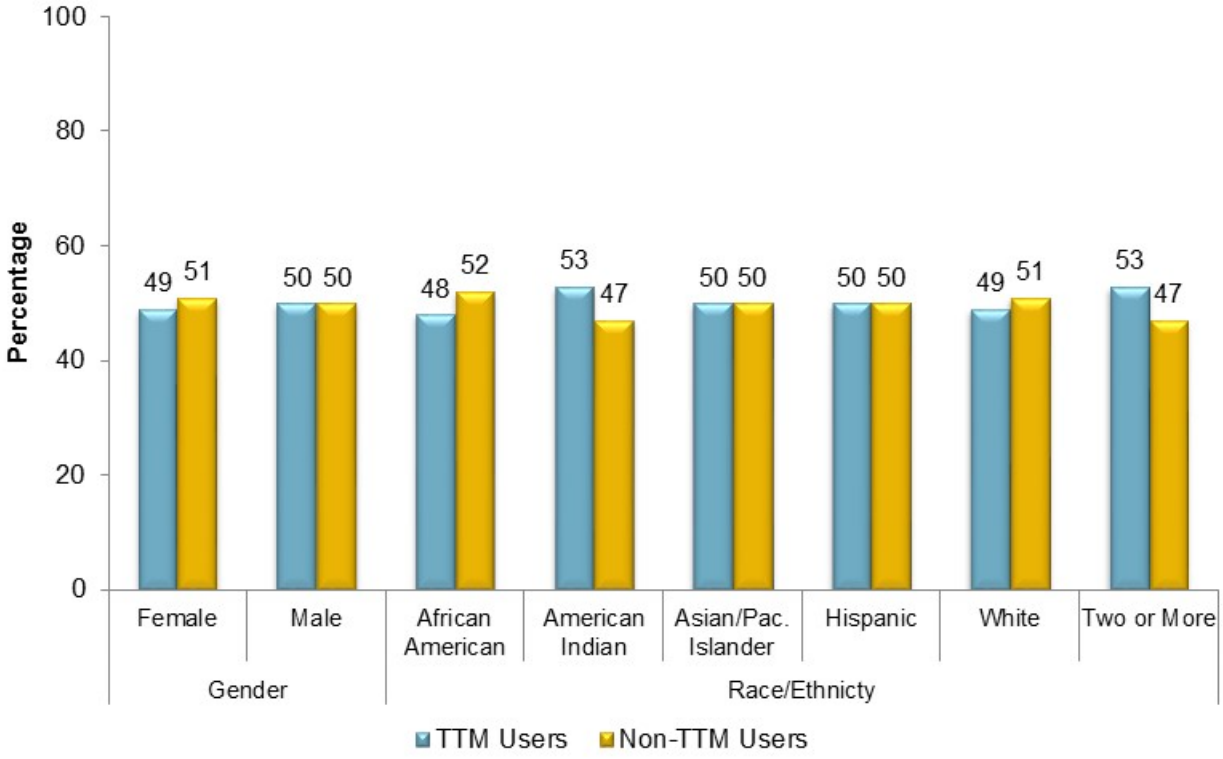
Notes: Students in grade three took the grade three level STAAR Mathematics test in both 2014 and 2015, indicating that they had been retained in third grade. Percentages may not equal 100 due to rounding.

Sources: PEIMS Fall Resubmission and TTM files

- Illustrated in **Figure 5** (page 10), in the elementary grades three through five, close to 60 percent of students who took both the spring 2014 and 2015 STAAR Mathematics exams were enrolled in TTM, while in the middle school grades seven and eight, fewer than 40 percent of students who tested both years were enrolled in the program.

- By gender and race/ethnicity, shown in **Figure 6**, TTM users and non-TTM users were relatively equally represented in each grouping. The lowest percentage of TTM users by race/ethnicity was for African Americans at 48 percent, and the highest was for American Indian students and students of Two or More race/ethnicities, at 53 percent.

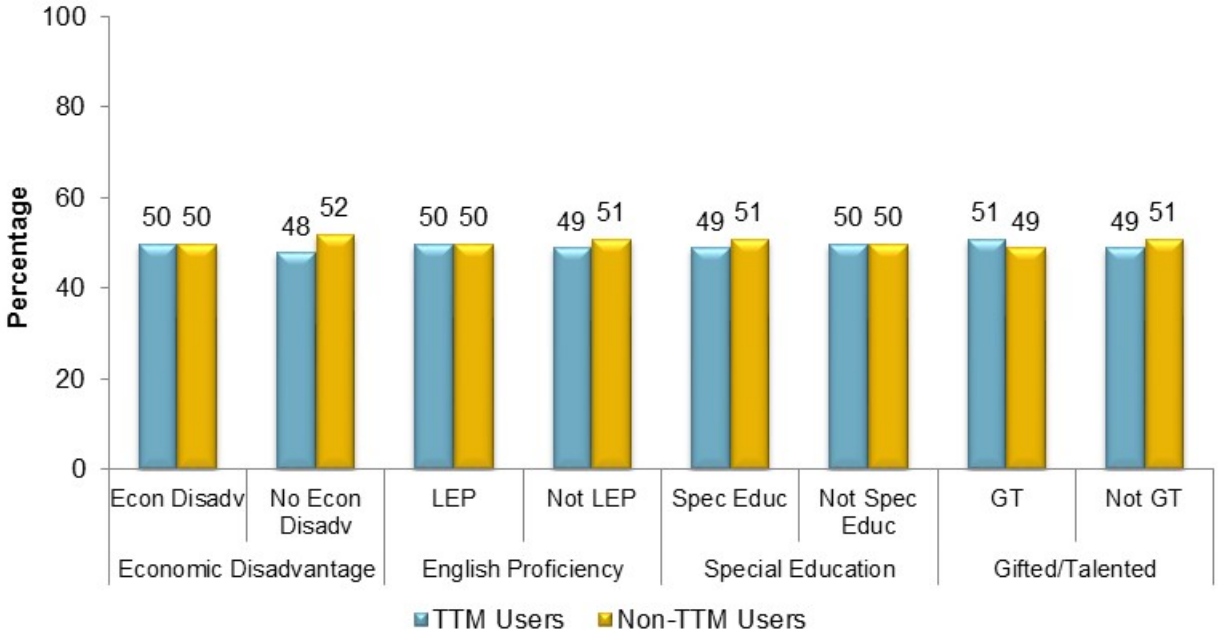
Figure 6. Percentage of TTM users and non-TTM users among students who took both the spring 2014 and 2015 STAAR Mathematics assessments, by gender and race/ethnicity



Note: Percentages may not equal 100 due to rounding.
Sources: PEIMS Fall Resubmission and TTM files

- Illustrated in **Figure 7** (page 12), when grouped by economic disadvantage, English proficiency, special education status, or gifted/talented status, generally half of students who took both the spring 2014 and 2015 STAAR Mathematics exams used TTM and half did not. The biggest difference in percentage between the groups was for students who were not economically disadvantaged (48 percent of students who were not economically disadvantaged were TTM users and 52 percent were non-TTM users).

Figure 7. Percentage of TTM users and non-TTM users among students who took both the spring 2014 and 2015 STAAR Mathematics assessments, by economic disadvantage, English proficiency, special education status, and gifted/talented status

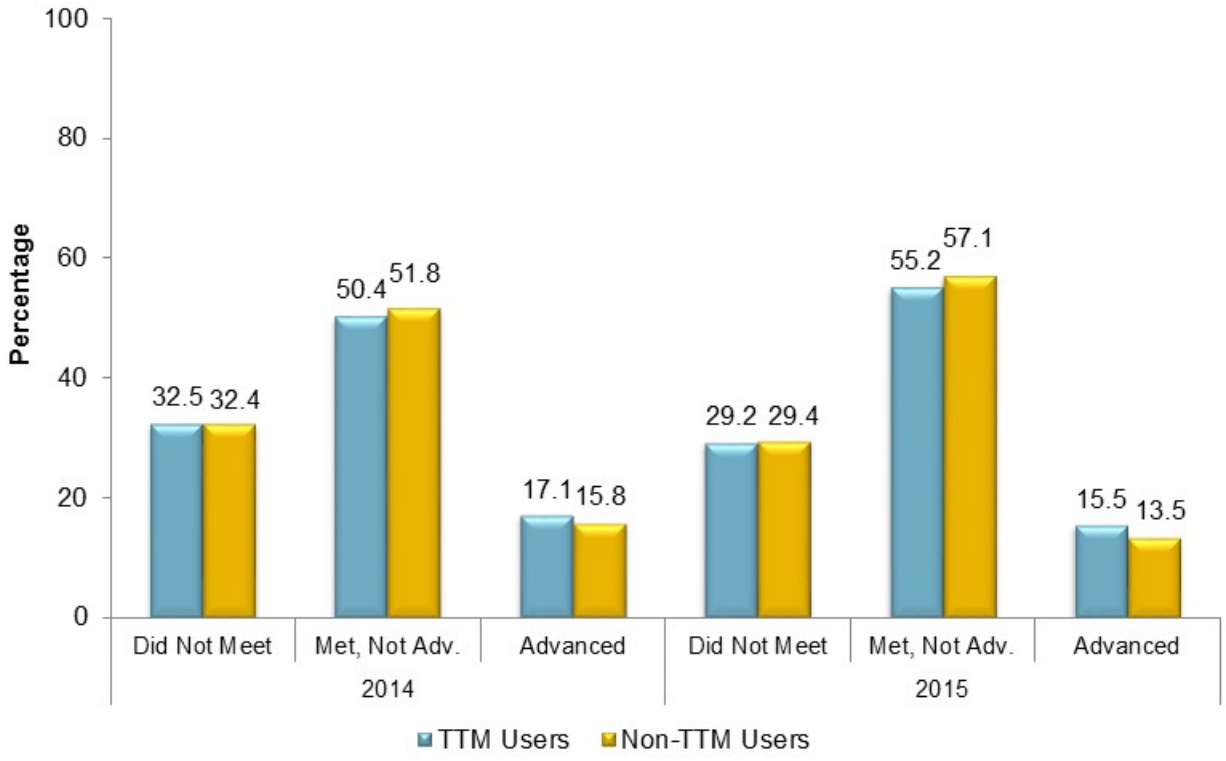


Note: Percentages may not equal 100 due to rounding.
Sources: PEIMS Fall Resubmission and TTM files

What was the STAAR Mathematics performance of HISD students who used TTM compared with the performance of HISD students who did not use the program in 2014–2015?

- Depicted in **Figure 8** (page 13) and detailed in **Table 4** (page 22) and **Table 5** (page 22), the STAAR Mathematics performance of TTM users largely parallelled that of non-TTM users in both 2014 and 2015. In both years, a slightly lower percentage of TTM users than non-TTM users met the standard to pass the exam but did not achieve the advanced standard, and a slightly higher percentage of TTM users than non-TTM users met the advanced standard.

Figure 8. Spring 2014 and spring 2015 STAAR Mathematics performance of students who took both assessments, by use of TTM



Note: Percentages may not equal 100 due to rounding.
Sources: 2014 and 2015 spring STAAR Mathematics and TTM files

- Shown in **Table 6** (page 23), the STAAR Mathematics mean scale scores of TTM and non-TTM users differed only slightly in both 2014 and 2015. In both years, the mean scale scores of non-TTM users were somewhat higher than those of TTM users, the standard deviations were slightly lower, and the ranges were somewhat larger.

- Significance of the difference between the 2015 STAAR Mathematics scale scores earned by TTM and non-TTM users was tested using propensity score nearest neighbor matching. For the analysis, spring 2015 STAAR Mathematics scale scores were compared based on matching students on variables which included spring 2014 STAAR Mathematics scale scores, 2014–2015 enrollment in a 2014 IR school, grade level, gender, race/ethnicity, economic disadvantage, LEP status, special education status, and gifted/talented status. All 57,371 students in the sample were included in the analysis. Shown in **Table 7** (page 23), students enrolled in TTM earned an average of less than one scale score point less than matched students not enrolled in the program earned. Students who used TTM in 2014–2015 had spring 2015 STAAR Mathematics scale scores that did not differ significantly from those of matched students who did not enroll in the program.

- The number of TTM lessons students completed and the number of TTM on-grade level lessons students passed (Figure 2, page 8, and Table 2, page 20) did not offer enough advantage to TTM users to differentiate their 2015 STAAR Mathematics scale scores from the scale scores of similar non-TTM users.

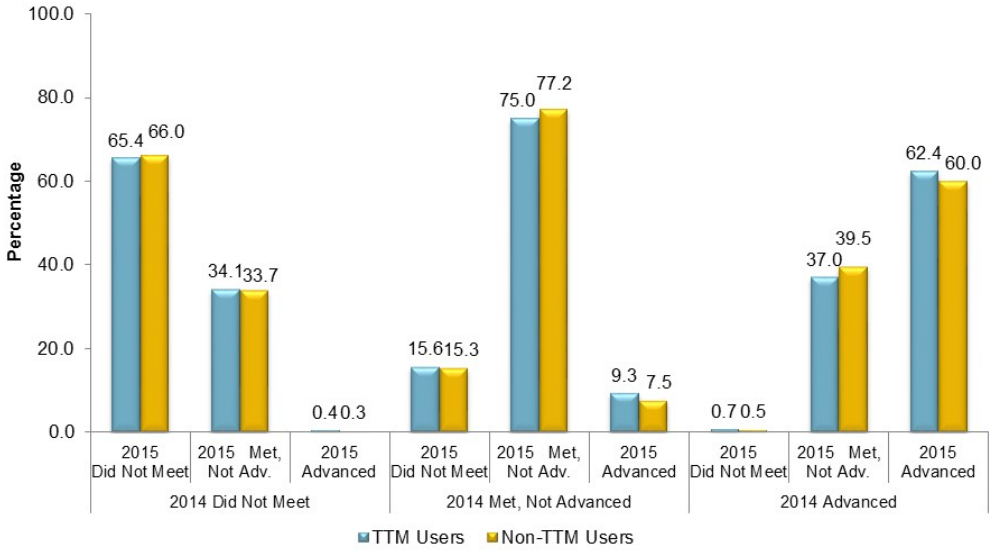
- **Table 8** (page 24) lists 2015 STAAR Mathematics results of TTM and non-TTM users divided into subgroups based on performance on the 2014 STAAR and also by attendance at a 2014 IR school. For each subgroup, 2015 STAAR Mathematics results were similar between TTM users and non-TTM users.

- 2015 STAAR Mathematics results for subgroups of TTM and non-TTM users based on 2014 STAAR Mathematics performance are illustrated in **Figure 9** (page 15). The largest difference found, 2.5 percentage points, was between students who had achieved the advanced standard on the 2014 STAAR Mathematics exam and who met the standard but did not meet the advanced standard on the 2015 test.

- **Figure 10** (page 15) depicts the same information in Figure 9, performance of 2014–2015 TTM and non-TTM users on the 2015 STAAR Mathematics exam by subgroups based on 2014 STAAR Mathematics performance, reformatted to form a "heat map" to highlight trends in students' performance. Red indicates students who either failed to meet the passing standard both years or who failed to meet the standard in 2015 after passing the mathematics exam in 2014; green indicates students who maintained their passing or advanced standard both years; yellow indicates students whose performance rating went down, but who still passed the exam; and blue indicates an increase in performance level between 2014 and 2015.

- In each subgroup in Figure 10, the majority of students achieved the same performance level in 2015 that they had achieved on the 2014 STAAR Mathematics exam, at approximately the same percentages between TTM and non-TTM users. TTM was associated with slightly higher rates of students achieving or maintaining the advanced standard for each subgroup of students, but the difference was the smallest, 0.1 percentage point, for students who had not met the passing standard on the 2014 assessment.

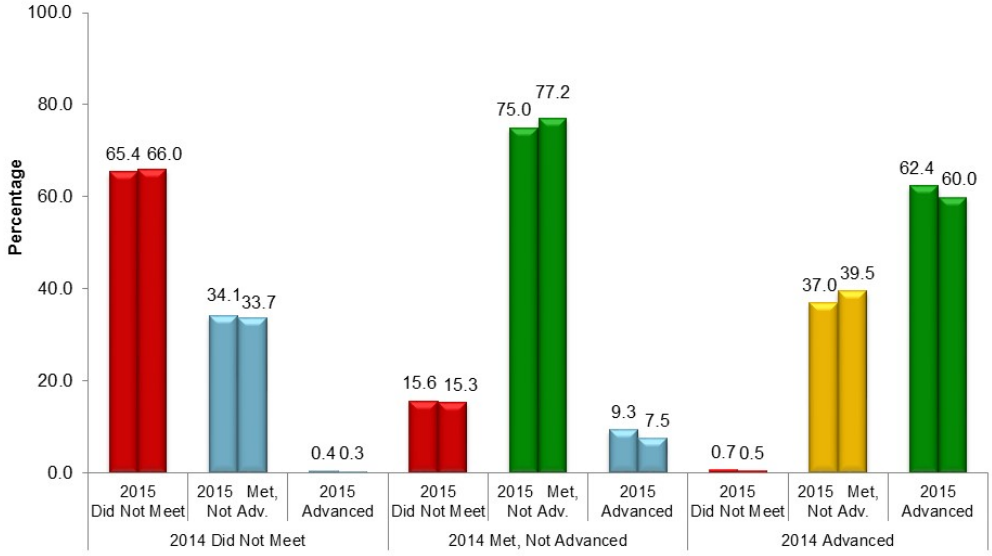
Figure 9. Spring 2015 STAAR Mathematics performance of subgroups of HISD students based on spring 2014 STAAR Mathematics performance, by use of TTM



Note: Percentages may not equal 100 due to rounding.

Sources: 2014 and 2015 spring STAAR Mathematics and TTM files

Figure 10. "Heat Map" of spring 2015 STAAR Mathematics performance of subgroups of HISD students based on spring 2014 STAAR Mathematics performance



Notes: Red indicates students who either failed to meet the passing standard both years or who failed to meet the standard in 2015 after passing the mathematics exam in 2014; green indicates students who maintained their passing or advanced standard both years; yellow indicates students whose performance rating went down, but who still passed the exam; and blue indicates an increase in performance level between 2014 and 2015.
TTM users' performance is depicted in the first bar and non-TTM users' performance is shown in the second bar of each pair.
Percentages may not equal 100 due to rounding.

Sources: 2014 and 2015 spring STAAR Mathematics and TTM files

- Average mean scale scores earned by each subgroup, based on 2014 STAAR Mathematics performance or for attendance at a 2014 IR school, are provided in **Table 9** (page 25). The mean scale score for non-TTM users in each subgroup was higher than the mean scale score for TTM users for both years. However, interestingly, the lowest score in the range of 2015 STAAR Mathematics scale scores for TTM users was higher than the lowest score in the range for non-TTM users in each subgroup.

- Propensity score nearest neighbor matching was performed for each subgroup with TTM and non-TTM users being matched based on spring 2014 STAAR Mathematics scale scores, 2014–2015 enrollment in a 2014 IR school, grade level, gender, race/ethnicity, economic disadvantage, LEP status, special education status, and gifted/talented status. All students in each subgroup were included in the analyses. Regardless of the number of TTM lessons students used, the results verified that there were no significant differences in 2015 STAAR Mathematics scale scores between TTM users and non-TTM users in each of the matched subgroups (**Table 10**, page 26).

Discussion

Like in 2013–2014, the Think Through Math program was relatively widely used in HISD in 2014–2015. Though there was a 15 percent drop in the number of TTM users between the years, from 51,863 in 2013–2014 to 43,997 in 2014–2015, these students included about half of the HISD students who took both the STAAR 2014 and 2015 Mathematics assessments. Students in every grade level participated in the program, but the vast majority (95 percent in 2013–2014 and 99 percent in 2014–2015) were in grades three through eight, the grade levels for which TTM was funded by the Texas Education Agency.

Unlike in 2013–2014, use of the TTM program in 2014–2015 was not associated with significant gains on the STAAR Mathematics exam for students who used TTM. Using propensity score matching, TTM and non-TTM users were matched on factors including 2014 STAAR Mathematics scores, attendance at a 2014 IR school, demographic factors, and participation in programs for English Language Learners, special education, and gifted/talented students. The number of TTM lessons students completed and the number of on-grade level lessons they passed did not offer enough advantage to TTM users to differentiate their 2015 STAAR Mathematics scale scores from the scale scores of similar non-TTM users when they were grouped districtwide, by previous year's performance on the 2014 STAAR Mathematics exam, or by attendance at a 2014 IR school.

The reasons for the change in impact of the TTM program are worth exploring. Since the program had been in use in the district since 2012, a variety of people undoubtedly had experience with it. Students may have experienced the program's motivational system of awarding points for clicking in lessons, and earned awards like enhancements for their TTM avatars, opportunities to contribute to select charities, and class parties. They may have been familiar enough to know how to reap the motivational benefits of the program without putting in the thought needed to learn the mathematics in the lessons.

Teachers and administrators also had opportunities to benefit from direct experience with the program and from the experience of their colleagues. With the extensive monitoring required to prevent students "gaming" the TTM motivation system, it is conceivable that teachers could have increasingly focused their TTM assignments on only very specific objectives or on only students most likely to work independently,

providing less general access to the program. On the other hand, with the increasing use of technology and the rising popularity of the "flipped classroom," it is possible that teachers increased their use of supplemental online programs like TTM for homework, with the corresponding breadth of time and attention students put into the assignments outside the classroom.

A compelling explanation could be found in data collection and reporting methods in 2014–2015. Transfer of student information between HISD and TTM was not finalized before the beginning of the school year, though students did begin working with the program early in the academic year. The documentation of TTM work for students who began early was lost when the transfer was finalized, and the students' records for the year were compromised so that numbers of discrete lessons they worked with could not be calculated. As a result, the number of discrete lessons could not be reliably calculated for use in this report. Thus, the lesson counts used in the analyses in this report very likely included duplicate lessons. As an extreme example, TTM estimated that there are approximately 40 on-grade-level lessons for each grade 3–8. Estimating 40 lessons at each grade, plus 40 for high school lessons that are also available, yields a total of approximately 280 discrete lessons available to TTM users in grades three through eight. Nine TTM users completed (and passed) more than 280 on-grade-level lessons in 2014–2015. One completed 1,087 on-grade-level lessons and passed 1,070 of them. Though large numbers of lessons completed and passed could be an indication of time on task, they may or may not be an indication of significant achievement in learning mathematics. Students were responsive to the rewards for working in TTM and were not limited to the number of times they could access, complete, or pass any single lesson. The loss of documentation of TTM students' utilization of the program from the beginning of the academic year and the lack of reliability in determining the breadth of mathematical content students addressed through the program could have contributed to finding a lack of impact of the TTM program in 2014–2015.

All of these potential explanations for a lack of impact of TTM in 2014–2015 are subject to modification. Students who are "gaming" the system can be held accountable by their teachers monitoring their progress, even daily if necessary. Changes in use of the program based on professional experience should be an advantage for impact of the program and can be documented to allow further analysis. And finally, data collection and sharing methodologies are fixable.

Though TTM was not shown to impact STAAR Mathematics scale scores for HISD students in 2015, the state of Texas, along with HISD, found that the TTM program had a positive impact on 2014 student performance in mathematics. Continued use of the program within the district, particularly if it is funded by the state, would be helpful in further exploring the conditions under which the program may be used to the advantage of HISD students and which students may benefit from the program. Looking forward, teachers and administrators who choose to use the program with their students should be encouraged to track their adherence to, and variations from, the parameters recommended by the provider. The TTM company recommends that students use the program with fidelity, specifically, that they follow an assigned "pathway" and complete—and preferably pass—TTM lessons weekly throughout the school year, that students receive significant monitoring as they work through the program, and that teacher help be readily accessible. Data documenting the use of these parameters, along with reliable data for student utilization and progress in the program, could provide opportunities to identify parameters most useful for making TTM a productive supplement to mathematics instruction for HISD students.

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Table 1. Demographic Characteristics of Students Who Used TTM, 2013–2014 and 2014–2015

	2013–2014		2014–2015	
	N	%	N	%
School Attended				
IR (2014) School	7,058	13.6	5,770	13.1
Non-IR School	44,805	86.4	38,227	86.9
Grade Level				
Prekindergarten	5	<0.1	19	<0.1
Kindergarten	6	<0.1	23	0.1
Grade 1	6	<0.1	23	0.1
Grade 2	101	0.2	24	0.1
Grade 3	11,944	23.0	9,774	22.2
Grade 4	11,781	22.7	9,673	22.0
Grade 5	11,407	22.0	8,628	19.6
Grade 6	5,115	9.9	6,627	15.1
Grade 7	5,098	9.8	4,702	10.7
Grade 8	3,676	7.1	4,284	9.7
Grade 9	2,143	4.1	164	0.4
Grade 10	352	0.7	22	0.1
Grade 11	122	0.2	22	0.1
Grade 12	107	0.2	12	<0.1
Gender				
Female	25,345	48.9	21,493	48.9
Male	26,518	51.1	22,504	51.1
Race/Ethnicity				
African American	13,652	26.3	10,739	24.4
American Indian	109	0.2	91	0.2
Asian/Pacific Islander	1,609	3.1	1,504	3.4
Hispanic	32,448	62.6	27,838	63.3
White	3,610	7.0	3,422	7.8
Two or more	435	0.8	403	0.9
Economic Disadvantage				
Economic Disadvantage	43,257	83.4	33,443	76.0
No Economic Disadvantage	8,606	16.6	10,554	24.0
Limited English Proficiency (LEP)				
LEP	20,626	39.8	17,799	40.5
Not LEP	31,237	60.2	26,198	59.5
Special Education				
Special Education	3,740	7.2	3,207	7.3
Not Special Education	48,123	92.8	40,790	92.7
Gifted/Talented (GT)				
GT	10,055	19.4	8,795	20.0
Not GT	41,808	80.6	35,202	80.0
Total	**51,863**	**100.0**	**43,997**	**100.0**

Note: Percentages may not total 100 due to rounding

Sources: PEIMS Fall Resubmission and TTM files, 2013–2014 and 2014–2015

Table 2. TTM Achievement of Students Who Used TTM, 2014–2015				
	N	%	Mean # Lessons Completed	Mean # On-Grade-Level Lessons Passed
School Attended				
IR (2014) School	5,770	13.1	12.8	1.4
Non-IR School	38,227	86.9	14.6	4.3
Grade Level				
Prekindergarten	19	<0.1	22.5	1.7
Kindergarten	23	0.1	28.2	3.3
Grade 1	23	0.1	10.6	1.5
Grade 2	24	0.1	27.3	4.5
Grade 3	9,774	22.2	13.0	6.0
Grade 4	9,673	22.0	13.7	3.5
Grade 5	8,628	19.6	13.1	2.9
Grade 6	6,627	15.1	20.0	4.8
Grade 7	4,702	10.7	15.8	3.1
Grade 8	4,284	9.7	11.4	2.1
Grade 9	164	0.4	8.7	0.8
Grade 10	22	0.1	16.8	1.4
Grade 11	22	0.1	13.2	1.5
Grade 12	12	<0.1	11.8	0.3
Gender				
Female	21,493	48.9	12.9	3.5
Male	22,504	51.1	15.8	4.3
Race/Ethnicity				
African American	10,739	24.4	13.2	2.6
American Indian	91	0.2	17.7	5.6
Asian/Pacific Islander	1,504	3.4	31.6	20.3
Hispanic	27,838	63.3	13.0	2.7
White	3,422	7.8	20.4	10.7
Two or more	403	0.9	22.4	10.7
Economic Disadvantage				
Economic Disadvantage	33,443	76.0	12.9	2.5
No Economic Disadvantage	10,554	24.0	19.0	8.5
Limited English Proficiency (LEP)				
LEP	17,799	40.5	13.4	2.6
Not LEP	26,198	59.5	15.0	4.9
Special Education				
Special Education	3,207	7.3	13.9	1.0
Not Special Education	40,790	92.7	14.4	4.2
Gifted/Talented (GT)				
GT	8,795	20.0	20.0	11.0
Not GT	35,202	80.0	12.9	2.2
Total	**43,997**	**100.0**	**14.4**	**3.9**

Note: Percentages may not total 100 due to rounding

Sources: PEIMS Fall Resubmission and TTM files, 2014–2015

Table 3. Demographic Characteristics of HISD Students Who Took the Spring 2014 and 2015 STAAR Mathematics Assessments and Were Used in Analyses, by Use of TTM

	TTM Users		Non-TTM Users		Total
	N	%	N	%	N
School Attended					
IR (2014) School	3,733	13.1	3,405	11.8	7,138
Non-IR School	24,679	86.9	25,554	88.2	50,233
Grade Level					
Grade 3	304	1.1	217	0.7	521
Grade 4	8,504	29.9	5,830	20.1	14,334
Grade 5	7,555	26.6	5,797	20.0	13,352
Grade 6	5,561	19.6	5,299	18.3	10,860
Grade 7	3,822	13.5	6,429	22.2	10,251
Grade 8	2,666	9.4	5,387	18.6	8,053
Gender					
Female	14,040	49.4	14,517	50.1	28,557
Male	14,372	50.6	14,442	49.9	28,814
Race/Ethnicity					
African American	6,589	23.2	6,999	24.2	13,588
American Indian	52	0.2	46	0.2	98
Asian/Pacific Islander	934	3.3	925	3.2	1,859
Hispanic	18,543	65.3	18,617	64.3	37,160
White	2,051	7.2	2,156	7.4	4,207
Two or more	243	0.9	216	0.7	459
Economic Disadvantage					
Economic Disadvantage	22,016	77.5	22,145	76.5	44,161
No Economic Disadvantage	6,396	22.5	6,814	23.5	13,210
Limited English Proficiency (LEP)					
LEP	11,915	41.9	11,728	40.5	23,643
Not LEP	16,497	58.1	17,231	59.5	33,728
Special Education					
Special Education	1,025	3.6	1,066	3.7	2,091
Not Special Education	27,387	96.4	27,893	96.3	55,280
Gifted/Talented (GT)					
GT	5,893	20.7	5,650	19.5	11,543
Not GT	22,519	79.3	23,309	80.5	45,828
Total	**28,412**	**100.0**	**28,959**	**100.0**	**57,371**

Notes: Students in grade three are those who repeated the grade; they were enrolled in grade three for both the spring 2014 and 2015 STAAR Mathematics assessments. Percentages may not total 100 due to rounding.

Sources: Spring 2014 STAAR Mathematics, Spring 2015 STAAR Mathematics, 2014–2015 PEIMS Fall Resubmission, and 2014–2015 TTM files

Table 4. Spring 2014 STAAR Mathematics Results for All HISD Students Who Also Took the Spring 2015 STAAR Mathematics Assessment, by Use of TTM

	Total	Did Not Meet the 2014 Phase-In 1 Standard		Met the 2014 Phase-In 1 Standard but not the 2015 Advanced Standard		Achieved the 2014 Advanced Standard	
	N	N	%	N	N	N	%
TTM Users	28,412	9,220	32.5	14,324	50.4	4,868	17.1
Non-TTM Users	28,959	9,375	32.4	14,995	51.8	4,589	15.8
Total	**57,371**	**18,595**	**32.4**	**29,319**	**51.1**	**9,457**	**16.5**

Notes: Percentages may not equal 100 due to rounding.
Sources: 2014 STAAR, 2015 STAAR, and TTM files

Table 5. Spring 2015 STAAR Mathematics Results for All HISD Students Who Also Took the Spring 2014 STAAR Mathematics Assessment, by Use of TTM

	Total	Did Not Meet the 2015 Phase-In 1 Standard		Met the 2015 Phase-In 1 Standard but not the 2015 Advanced Standard		Achieved the 2015 Advanced Standard	
	N	N	%	N	N	N	%
TTM Users	28,412	8,307	29.2	15,693	55.2	4,412	15.5
Non-TTM Users	28,959	8,508	29.4	16,550	57.1	3,901	13.5
Total	**57,371**	**16,815**	**29.3**	**32,243**	**56.2**	**8,313**	**14.5**

Notes: Percentages may not equal 100 due to rounding.
Sources: 2014 STAAR, 2015 STAAR, and TTM files

Table 6. Spring 2014 and Spring 2015 STAAR Mathematics Mean Scale Scores for All HISD Students Who Took Both the Spring 2014 and 2015 STAAR Mathematics Assessments, by Use of TTM

	Spring 2014 STAAR Mathematics Scale Scores			Spring 2015 STAAR Mathematics Scale Scores		
	Mean	SD	Range	Mean	SD	Range
TTM Users	1539.1	158.3	754 – 2138	1585.6	144.5	931 – 2229
Non-TTM Users	1556.3	155.1	754 – 2181	1600.8	142.6	771 – 2236

Sources: 2014 STAAR Mathematics, 2015 STAAR Mathematics, and TTM file

Table 7. Propensity Score Matching Results for All HISD Students Who Took Both the Spring 2014 and 2015 STAAR Mathematics Assessments, by Use of TTM

	Mean 2015 STAAR Mathematics Scale Score				
	TTM Users (N=28,412)	Non-TTM Users (N=28,959)	Difference	S.E.	*t*
Before Matching	1585.65	1600.80	-15.16	1.20	-12.64*
Matched	1585.65	1586.42	-0.77	2.49	-0.31

Note: * indicates p<.001.

Table 8. Spring 2015 STAAR Mathematics Results for Subgroups of HISD Students Who Also Took the Spring 2014 STAAR Mathematics Assessment, by Use of TTM

Students	Total N	Did Not Meet the 2015 Phase-In 1 Standard N	%	Met the 2015 Phase-In 1 Standard but not the 2015 Advanced Standard N	%	Achieved the 2015 Advanced Standard N	%
Failed 2014 STAAR Mathematics							
TTM Users	9,220	6,034	65.4	3,148	34.1	38	0.4
Non-TTM Users	9,375	6,185	66.0	3,164	33.7	26	0.3
Total	**18,595**	**12,219**	**65.7**	**6,312**	**33.9**	**64**	**0.3**
Passed but Did Not Achieve Advanced on 2014 STAAR Mathematics							
TTM Users	14,324	2,240	15.6	10,746	75.0	1,338	9.3
Non-TTM Users	14,995	2,299	15.3	11,575	77.2	1,121	7.5
Total	**29,319**	**4,539**	**15.5**	**22,321**	**76.1**	**2,459**	**8.4**
Achieved Advanced Standard on 2014 STAAR Mathematics							
TTM Users	4,868	33	0.7	1,799	37.0	3,306	62.4
Non-TTM Users	4,589	24	0.5	1,811	39.5	2,754	60.0
Total	**9,457**	**57**	**0.6**	**3,610**	**38.2**	**6,060**	**64.1**
Attended a 2014 IR School							
TTM Users	3,733	1,795	48.1	1,766	47.3	172	4.6
Non-TTM Users	3,405	1,599	47.0	1,685	49.5	121	3.6
Total	**7,138**	**3,394**	**47.5**	**3,451**	**48.3**	**293**	**4.1**

Note: Percentages may not equal 100 due to rounding.

Sources: 2014 STAAR, 2015 STAAR, and TTM files

Table 9. Spring 2014 and Spring 2015 STAAR Mathematics Mean Scale Scores for Subgroups of HISD Students Who Took Both the Spring 2014 and 2015 STAAR Mathematics Assessments, by Use of TTM

Students	Spring 2014 STAAR Mathematics Scale Scores			Spring 2015 STAAR Mathematics Scale Scores		
	Mean	SD	Range	Mean	SD	Range
Failed 2014 STAAR Mathematics						
TTM Users	1382.3	88.8	754 – 1572	1472.0	96.5	931 – 2103
Non-TTM Users	1403.5	90.8	754 – 1572	1490.8	100.5	771 – 1931
Passed but Did Not Achieve Advanced on 2014 STAAR Mathematics						
TTM Users	1561.2	78.6	1392 – 1777	1598.0	103.0	1005 – 2103
Non-TTM Users	1581.2	79.2	1392 – 1777	1616.8	105.7	931 – 2103
Achieved Advanced Standard on 2014 STAAR Mathematics						
TTM Users	1771.2	106.5	1615 – 2138	1764.6	127.1	1359 – 2229
Non-TTM Users	1787.3	106.3	1615 – 2181	1773.4	126.1	1015 – 2236
Attended a 2014 IR School						
TTM Users	1480.8	143.4	754 – 2064	1529.6	122.0	931 – 1976
Non-TTM Users	1496.6	139.0	833 – 2138	1550.2	120.3	868 – 2024

Sources: 2014 STAAR Mathematics, 2015 STAAR Mathematics, and TTM file

Table 10. Propensity Score Matching Results for Subgroups of HISD Students Who Took Both the Spring 2014 and 2015 STAAR Mathematics Assessments, by Use of TTM

Students	Mean 2015 STAAR Mathematics Scale Score		Difference	S.E.	*t*
Failed 2014 STAAR Mathematics	**TTM Users (N=9,220)**	**Non-TTM Users (N=9,375)**			
Before Matching	1471.97	1490.76	-18.79	1.44	-13.00*
Matched	1471.97	1471.48	0.49	3.03	0.16
Passed but Did Not Achieve Advanced on 2014 STAAR Mathematics	**TTM Users (N=14,324)**	**Non-TTM Users (N=14,995)**			
Before Matching	1598.00	1616.78	-18.78	1.22	-15.40*
Matched	1598.00	1600.07	-2.07	2.50	-0.83
Achieved Advanced Standard on 2014 STAAR Mathematics	**TTM Users (N=4,868)**	**Non-TTM Users (N=4,589)**			
Before Matching	1764.58	1773.39	-8.81	2.61	-3.38*
Matched	1764.58	1768.99	-4.41	5.26	-0.84
Attended a 2014 IR School	**TTM Users (N=3,733)**	**Non-TTM Users (N=3,405)**			
Before Matching	1529.64	1550.16	-20.52	2.87	-7.14*
Matched	1529.64	1535.95	-6.31	4.64	-1.36

Note: * indicates p<.001.