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An examination of an online tutoring program's impact on low-achieving middle school students' math achievement

July, 2015

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An examination of an online tutoring program's impact on low-achieving middle school students' math achievement

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Support for this study was provided solely by The Center for Educational Partnerships. The opinions expressed herein are those of the authors, and do not necessarily reflect the views, position, or policy of Old Dominion University.

Abstract

The purpose of this study was to determine the impact of Focus Eduvation’s (FEV) synchronous online tutoring service on struggling middle-school students' math achievement. The online tutoring was provided as a response to intervention (RTI) Tier 3 support (intensive, individualized intervention) in schools implementing a school-wide math program that addresses Tier 1 (high-quality classroom instruction) and Tier 2 (small group interventions). We employed quasi-experimental, within- and between-group designs to examine impacts for 120 students in two schools to measure the supplemental program's impact on math assessment scores. We also conducted qualitative analyses of student and tutor post-session commentary. The findings suggest that the tutoring contributed to statistically significant gains in student assessment scores post-intervention. Online tutors’ descriptions of their practices centered on ongoing progress monitoring of student learning, delivery of guided practice to students, the use of multiple explanations, and representations of target concepts. Student perceptions of the online tutoring were predominately positive in nature.

Contents

Introduction 5

Theoretical Framework 6

Relevance of the study and research questions 7

Methods 7

Participants 7

Description of services 8

Data sources 8

Analytic approach 9

Matching procedures. 9

Table 1 10

Covariate descriptive statistics & equivalency checks by tutoring status before matching (n=341) .. 10

Table 2 11

Covariate descriptive statistics & equivalency checks by tutoring status after matching (n=147) 11

Results 12

Within-group outcomes 12

Table 3 13

Paired-samples results for mean outcome scores by school 13

Figure 1. Comparison of pre- and post-intervention scores for students receiving services in School One. 13

Figure 2. Comparison of pre- and post-intervention scores for students receiving services in School Two. 14

Between-group outcomes in School One 14

Table 4 15

Analysis of Covariance for outcome scores for School One 15

Figure 3. Comparison of within-group effect size estimates for tutored vs. matched non-tutored students in School One. 15

Tutoring descriptions 15

Student perceptions. 16

Findings, Discussion, and Conclusions 17

References 20

Introduction

Instructional tutoring has an extensive history in American education. Tutoring services are presented in a variety of formats and serve an array of purposes, though the overall goal of tutoring is generally to improve student achievement. This report examines the impact of an online tutoring program on struggling middle school students' math achievement, tutor descriptions of their online tutoring practices and student perceptions of tutoring experiences as they occurred in real-time. The tutoring was provided as a Tier 3 support to enhance overall effectiveness of a school-wide math reform effort, PowerTeaching Math (PTM), a program funded under the U.S. Department of Education's *Investing in Innovation* scale-up initiative. This initiative is focused on the dissemination of research-based educational programming to high need schools. PTM is grounded in research on cooperative learning, and focuses on team work among students within a structured cycle of instruction (Slavin, 1995). There is an extant body of research showing positive achievement effects for the instructional program, particularly among adolescent students (Nunnery, Chappell, and Arnold, 2013). Online math tutoring, provided by Focus Eduvation (FEV), was piloted in this context as a Tier 3 intervention for a sub-set of students who struggled the most with mathematics.

FEV is an online learning and educational technology company that provides custom, interactive, online tutoring services for K-12 students. Although FEV offers tutoring for all core subjects, math tutoring comprises over 70% of their services. FEV's services consist of synchronous, one-to-one, prescribed tutoring provided through chat, instant messaging, and virtual whiteboard technology to offer students the help they need to gain a better understanding of concepts and, in turn, help improve achievement.

FEV offers a differentiated, engaging environment where skills are enhanced through sharing of curricular materials, practice problems and visuals, and graphic features which aid communication and collaboration between students and tutors. FEV tutors have a minimum of a four-year degree and two years teaching or tutoring experience, undergo background checks to ensure a safe environment, and are subject to an extensive quality and performance system to provide constructive, effective academic interaction. In-session assessments allow tutors to maintain student progress by specific skill in a formative manner and post-tests allow for an examination of students' overall growth.

Theoretical Framework

The literature on tutoring services is vast and results of tutoring vary widely. However, a review of the literature reveals that many tutoring programs have been successful in improving student outcomes. There is no specific model of effectiveness, but researchers mostly agree that successful tutoring programs share some common characteristics (Fashola, 1998; Wasik, 1998; Gordon, 2003; Sanderson, 2003). These characteristics include well-trained, focused tutors providing services, one-to-one tutoring experiences, a structured but flexible prescribed instructional plan, continual assessment to inform instructional efforts, and consistency in receiving tutoring services (Fashola, 1998; Wasik, 1998; Topping, 2000; Gordon, 2003; Sanderson, 2003). Fashola (1998) summarized the issue concisely: programs that "provide greater structure, a stronger link to the school-day curriculum, well-qualified and well-trained staff, and opportunities for one-to-one tutoring seem particularly promising" (p. 55), and these should be foundational elements of any tutoring program.

Although common characteristics of effective tutoring have been identified in the literature, much of the focus has been on literacy rather than math. With many school districts and funding agencies requiring research-based evidence on the effectiveness of strategies, the need for sound research on math tutoring more specifically is clear. One earlier analysis of educational outcomes of math tutoring revealed relatively large effect sizes in improving student achievement (Cohen, Kulik, and Kulik, 1982). Huang (2013) compared tutoring influences on performance across countries, controlling for social and educational differences among them, and found that tutoring significantly increased national mean performance in mathematics. However, other researchers have concluded that not enough is known about the effect of tutoring on math scores (Ritter, Barnett, Denny, and Albin, 2009; Baker, Rieg, and Clendaniel, 2006). Furthermore, some studies have found promising evidence to suggest that interactive online math tutoring in particular may result in learning and achievement benefits for students (Beal, Walles, Arroyo, and Woolf, 2007; Chappell, Nunnery, Pribesh, and Hager, 2011; Nguyen and Kulm, 2005), but less is known about how these programs function as Tier 3 interventions in contexts that carefully structure Tier 1 and 2 supports. This study explores how online mathematics tutoring impacted student achievement outcomes and perceptions in the context of a wider reform that provided primary and secondary supports, and functioned to augment that effort as a tertiary intervention.

Relevance of the study and research questions

This study adds to the body of knowledge surrounding online math tutoring by exploring how outcomes of tutored middle school students compare to those of students exposed only to their schools' business-as-usual math instruction. We addressed the following research questions in this study: 1) How does FEV's online math tutoring affect math scores of low achieving students? 2) How do online mathematics tutors describe their pedagogical practices and student learning? 3) What are students' perceptions of FEV's online math tutoring services?

Methods

We employed a mixed-method approach, using quantitative methods to address the tutoring's impact on math scores and qualitative methods to examine tutor and student commentary regarding services. We used a quasi-experimental, pre-test/post-test design (Leedy and Ormrod, 2010) to analyze within-group changes in achievement scores for students in each school, with separate analyses conducted for each school. Additionally, we conducted a causal comparative matched sample design to compare tutored students' achievement to that of non-tutored students in one participating school. Model-guided and inductive coding qualitative techniques were used to analyze tutor descriptions of their online tutoring practice and student perceptions of the program (Zhang and Wildemuth, 2009).

Participants

Students from two middle schools participated in this study. School One is a large, rural school in southern Virginia and School Two is a large rural school in central Kansas. Both of these schools were also serving as pilot schools for a school-wide math program, PTM, as part of an *Investing in Innovation* scale-up grant through the U. S. Department of Education. The tutoring occurred during year two of the five year program.

All student participants in the study, both treatment and comparison, earned below passing scores on either the state standardized mathematics assessment for the 2012-2013 academic year (School One), or failed the FEV program specific pretest assessment at the beginning of the 2013-2014 academic year (School Two). Forty-nine grade six students from School One and 70 grade seven and eight students from School Two received tutoring during the 2013-2014 academic year. Students began receiving services in October, 2013 and attended tutoring twice a week for 20 weeks. An additional 292 grade six students in School One who did not receive tutoring services were included in the between-group analyses for that school.

Attendance records indicated that participants in School One attended an average of 28 sessions that were thirty minutes in length. On average, School One students received 14 hours of tutoring. Sixty tutors provided services for these students, with students working with about six tutors each throughout the program. Participants in School Two attended an average of 38 sessions lasting 37 minutes sessions, or about 23 hours of tutoring per student. A total of 61 tutors provided services for these students, with students working with an average of 8 tutors over the duration of the program. Tutoring services were provided in pull-out fashion during normal math class time for participating students.

All students in both schools were exposed to the school-wide math program, PTM. In School One, all students also received remediation in core subjects in a tiered Response to Intervention (RTI) style. No other services were offered to non-tutored students in School One. In School Two, only those non-tutored students with identified disabilities received additional math services; other non-tutored students did not receive any additional instruction in math.

Description of services

FEV administers diagnostic assessments that allow program and school personnel to develop individualized learning objectives for each student receiving services. Based on these learning objectives, a learning plan is created for each student. Learning plans are aligned with the school's curricular standards and scope and sequence to ensure that the services meet the student's and school's specific needs. The custom learning plans serve as the foundation for the program, though the plans are flexible enough to accommodate minor changes over the duration of the program. FEV articulates the goal of providing a differentiated, engaging environment where skills are enhanced through sharing of curricular materials, practice problems and visuals, and graphic features which aid communication and collaboration between students and tutors.

Data sources

We used scores from the 2013 and 2014 administrations of the Virginia *Standards of Learning (SOL)* assessment for participating students as pre-test and post-test for School One and FEV-administered pre-tests and post-tests for School Two (state level assessments were unavailable for School Two due to a moratorium on testing in 2014).

Additionally, FEV collects tutor generated summaries of each online tutoring session, as well as responses to open-ended items from students that solicit their perceptions of the tutoring services. These summaries and responses were provided along with assessment data and were used to explore themes related to tutor practices and student perceptions of the tutoring they received. The data examined in this study were collected by the tutoring agency and provided to us through a data use agreement with the two schools.

Analytic approach

We conducted paired samples *t*-tests for each school using pre-treatment and post-treatment scores to determine within-group changes in each school. Tutored students in School One were also matched with non-tutored students (see matching procedures below) and between-group differences were examined using an Analysis of Covariance (ANCOVA). We also computed Cohen's *d* within-group effect size estimates for tutored and comparison students using the correction for dependence method (Morris and Deshon, 2002).

Matching procedures.
The propensity score matching approach (Guo & Fraser, 2010) was used to match the grade six tutored students in School One with non-tutored students. A total of 407 students were enrolled in grade six mathematics and were included in the initial matching procedures. Sixty-six students were removed from the sample because they did not have achievement scores for both 2013 and 2014. Ultimately, 341 students were included in the matching procedures, with 49 in the treatment group and 292 in the comparison group.

Propensity scores were estimated by the predicted probabilities of a logistic regression model (Guo & Fraser, 2010) with the FEV program status as the criterion variable and the following covariates serving as predictor variables: minority status, economically disadvantaged status, disability status, student in recovery status, gender, and 2013 *SOL* scaled score. Student demographics were those assigned by the division/state. Descriptions are as follows: minority status, all students not categorized as White (Black or African American, Hispanic, and multi-racial); economically disadvantaged, students eligible for free or reduced-price lunch; disability status, any student identified with a learning, physical, emotional, behavioral, or mental disability; and student in recovery status, any student who has participated in a remediation program (Virginia Department of Education [VDOE], 2012).

The overall model fit of the logistic model was supported, $\chi^2(8, N = 341) = 14.76$, $p = .07$. The 1-to-2 nearest neighbor matching approach (Guo & Fraser, 2010) was utilized to match each tutored student with two non-tutored students with the smallest absolute differences of the estimated propensity scores. As a result, 49 tutored students were matched with 98 non-tutored students.

Prior to the matching procedure, the tutored and the non-tutored groups differed significantly on the minority, economically disadvantaged, recovery, and 2013 achievement scores predictors (see Table 1). After the matching procedure, the tutored students were statistically equivalent to the non-tutored students on all covariates except the recovery predictor and the baseline achievement score, with the non-tutored group having more students in recovery and a higher mean 2013 *SOL* scaled score (see Table 2). The overall group equivalencies improved with the propensity score matching and we proceeded with the analyses using the recovery indicator and the 2013 mean *SOL* scaled score as covariates in our ANCOVA to control for the pre-treatment differences.

Table 1

Covariate descriptive statistics & equivalency checks by tutoring status before matching (n=341)

Covariate	Tutored (overall n=49)	Non-Tutored (overall n=292)	Equivalency Analysis
Minority	32	120	$\chi^2 = 9.96$*
Economically disadvantaged	37	161	$\chi^2=7.15$*
Disability	8	43	$\chi^2= .09$
Recovery	32	63	$\chi^2= 39.93$**
Female	27	155	$\chi^2 = .07$
2013 *SOL* Scaled Score	49 (m=383.08)	292 (m=468.97)	$t = 15.72$**

*Statistically significant at the .01 level

**Statistically significant at $p < .001$

Table 2

Covariate descriptive statistics & equivalency checks by tutoring status after matching (n=147)

Covariate	Tutored (overall n=49)	Non-Tutored (overall n=98)	Equivalency Analysis
Minority	32	59	$\chi^2 = 0.36$
Economically disadvantaged	37	74	$\chi^2=0.00$
Disability	8	21	$\chi^2= 0.54$
Recovery	32	44	$\chi^2= 5.45$*
Female	27	45	$\chi^2 = 1.10$
2013 *SOL* Scaled Score	49 (m=383.08)	98 (m=406.90)	$t = 5.42$**

*Statistically significant at the .05 level

**Statistically significant at $p < .001$

For questions two and three, we analyzed 84 tutor generated session summaries and 84 post-session commentaries by students across both schools. These data were analyzed using NVivo, a qualitative data analysis software program that enables users to create a flexible node structure where similar data may be coded throughout analysis to assist in the iterative construction of categories and themes (Patton, 2002). Both model-guided and inductive coding were employed in the analysis (Zhang & Wildemuth, 2009). Analysis of tutor summaries of online sessions was guided by practice components of the tutoring model and the literature on pedagogical strategies for mathematics remediation. Student comments were analyzed to identify students' emic perceptions of the program. The codebooks developed for analyses of tutor and student comments appear in Appendix A. Several strategies were employed to enhance the trustworthiness of findings emerging from this process: a) two researchers analyzed each data source; b) researchers met frequently to establish, clarify and revise codes and categories; c) an electronic audit trail was maintained; d) a program model provided referential adequacy; and e) findings were contextualized within the broader literature on mathematics learning and pedagogy (Shenton, 2004). These strategies extend the credibility, confirmability, transferability and dependability of the findings. Further, representativeness indices were calculated to provide information about the extent to which themes emerged across individuals, and how prevalent each was throughout the discourse. These indices provided context related to the number of sources with statements coded to each theme at least once, and the salience of themes in terms of the number of references generated across participants accruing to a single code.

Results

Within-group outcomes

Scores on the FEV-administered pre-tests indicated that participating students in each school had below-passing averages. School One had no students with passing averages on FEV pre-test assessments and no students with passing scaled scores on the prior year's math *SOL*. School Two had no students with passing averages on the FEV pre-test assessments.

At the end of the program, 30 (61.2%) of the School One students had passing scaled scores on the math *SOL*. Before exposure to the program, the mean score for participating students in School One on the 2013 Virginia *SOL* math assessment was 383.08, below the proficiency cut score. The average score on the Virginia 2014 *SOL* mathematics assessment for the same students in School One was 405.96, which is above the 400 cut score for proficiency in Virginia (VDOE, 2012). Within-group differences from pre-intervention to post-intervention for School One showed significant improvement in scores for the group, with a mean improvement of 22.88 points (t = 5.99, p < .001). Within-group effect size estimates for School One were d = +0.95 for tutored students.

At the end of the program, 15 (30%) of the tutored students in School Two had passing averages on FEV administered post-tests. Although the post-test average for School Two was below the passing level (M = 53.03), students in School Two did show significant improvement in achievement, with a mean gain of 26.16 points (t = 10.11, p < .001). The within-group effect size estimate for tutored students in school Two was d = +1.47. Table 3 reports pre-intervention and post-intervention means, mean differences, and probability values for both schools. Figures One and Two illustrate the gains in achievement for each school.

Table 3

Paired-samples results for mean outcome scores by school

	n	Pre-test Mean *(SD)*	Post-test Mean *(SD)*	Mean difference	*p*
School One	49	383.08 (11.31)	405.96 (26.36)	22.88	<.001
School Two	50	26.87 (11.68)	53.03 (16.76)	26.16	<.001

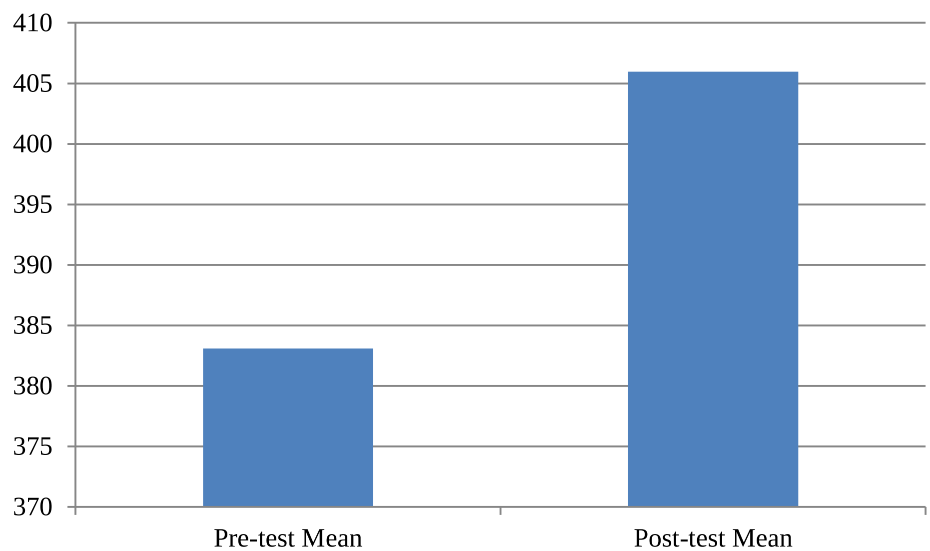

Figure 1. Comparison of pre- and post-intervention scores for students receiving services in School One.

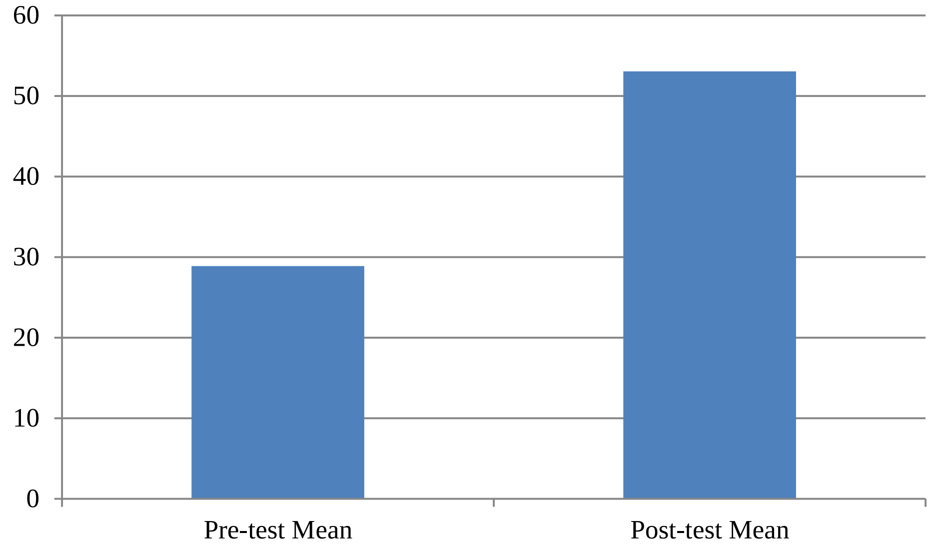

Figure 2. Comparison of pre- and post-intervention scores for students receiving services in School Two.

Between-group outcomes in School One

The ANCOVA indicated non-significant differences between the 2014 *SOL* scaled post-test scores for the tutored group and the matched, non-tutored group, F=1.66 (*1,144*), p = .20. This means that the non-tutored group's statistically significantly higher baseline score advantage was narrowed post-intervention, after controlling for recovery status and 2013 *SOL* scaled score. It is worth noting, however, that both groups had statistically significant within-group increases in scores from pre-test to post-test, indicating significant growth for both groups (within-group results for comparison group: t=2.35, p = .02). Table 4 reports between group comparisons by treatment status. Within-group effect size estimates were d = +0.95 for tutored students, and d = +0.24 for non-tutored students (see Figure 3).

Table 4

Analysis of Covariance for outcome scores for School One

	Pre-test Mean* (*SD*)	Observed Post-test Mean (*SD*)	Adjusted Post-test Mean (*SE*)	*F*	*p*
Tutored students	383.08 (11.31)	405.96 (26.36)	409.28 (5.74)	1.66	.20
Comparison students	406.90 (40.48)	424.20 (65.95)	422.54 (8.26)		

*Pre-test mean difference between tutored and comparison students was statistically significant at the .001 level.

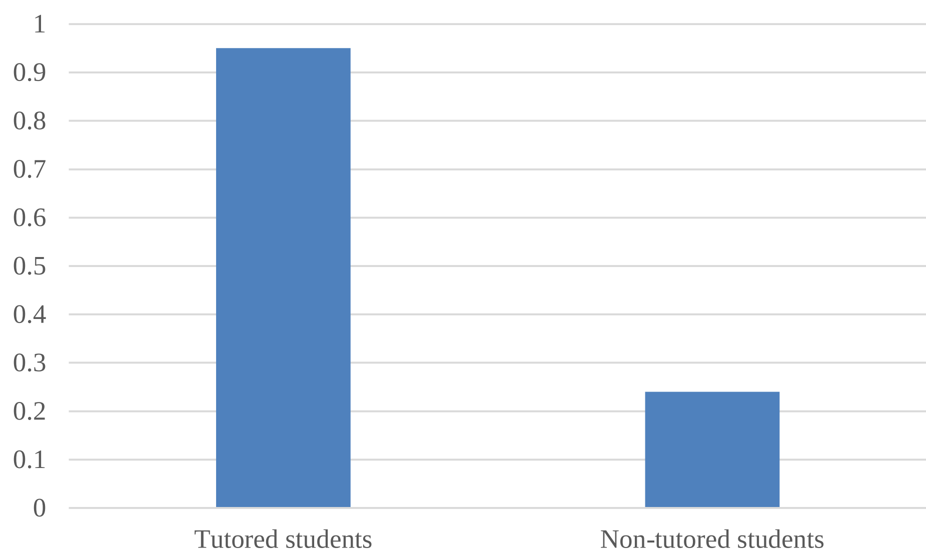

Figure 3. Comparison of within-group effect size estimates for tutored vs. matched non-tutored students in School One.

Tutoring descriptions

Tutor session log data across both sites revealed that almost all tutors discussed implementing pre and post assessments of student learning during each session, and analyzed these data to guide the instruction provided in the session. Many of the tutors also provided descriptions of their reflections on student learning during independent practice, and provided individualized differentiation as needed. Almost all tutors described the delivery of guided practice to students, and many discussed the use of multiple explanations and representations of target concepts. Tutors described interventions focused on accessing prior knowledge, modeling ("showed him how to multiply the decimal number with example"), explaining the steps in mathematical processes ("explained all the five steps to find the square root of the irrational numbers), identifying both process and operational errors ("another problem of similar kind was worked by the student with minor mistakes, which she corrected on tutor's advice"), and scaffolding through the use of questions or prompts ("tutor helped the student by providing hints to get the right answer").

Tutor reflections on student learning were prevalent throughout the summaries and included articulation of students' post-lesson content mastery, session scores, and identification of prior knowledge that was necessary for success. Identification of various types of student difficulties as well as leverage points for further instruction were often present, as exemplified by the following tutor comments: "The student struggled with multiplying the decimals, but corrected himself and was fast while learning," and "Student was able to translate the given image and could reflect the image over different axis on the coordinate plane with ease."

Student perceptions

Analysis of student post-session commentary on the tutoring sessions revealed both positive and negative perceptions. Positive comments outnumbered negative comments by a ratio of three to one. Most of the positive student commentary was general in nature, expressing gratitude for the assistance, a fondness for the tutor, or social greetings. The general nature of student responses is not surprising given the age level of students and the open ended nature of the prompt to simply comment on the session. However, even within this unstructured environment, approximately 40% of students spontaneously indicated that they found the session to be helpful for their mathematics learning, and about a quarter of students identified specific learning outcomes of the session. For example, one student commented, "Good session—now I understand integers." Another noted, "Now I get irrational numbers and rational numbers." A smaller percentage of students made specific statements indicating they left the session feeling more confident in the material, as the following comments illustrate: "He made it seem so easy, because it is" and "It is easy once you learn it."

Student negative commentary about the tutoring sessions was far less frequent than positive commentary, but was often more specific in nature. The two most prevalent themes of negative response to tutoring were related to pacing of the sessions and the desire for more explanation. Students who made comments about pacing were far more likely to say the session went too slow rather than too fast. Due to the general nature of much of the commentary, it was unclear whether this related primarily to the speed of connection or to the actual pedagogical pacing. However, some students did specifically articulate that too much time was spent on tutor explanation, and not enough on student work. For example, one student noted, "He doesn't let me work out the problem even when he tells me to solve it on my own." Of students that did desire more explanation, there was a desire for greater clarity of explanation, as expressed by the following student: "This tutor was great, just needs to work on explaining a little bit more and showing his work more clearly."

Findings, Discussion, and Conclusions

The findings of this study suggest that well-designed and implemented synchronous online mathematics tutoring may be effective for students in high need settings who are struggling with mathematics. Our findings support the extant literature on online math tutoring and provide further evidence that the strategy can be successful in improving math achievement of underperforming middle school students when compared to their non-tutored peers. Although the propensity score matched comparison analysis did not reveal a statistically significant difference in the adjusted means between tutored and non-tutored students, within-group effect size estimates indicated a large relative advantage for tutored students in School One (d = +0.95 for tutored versus d = +0.24 for non-tutored students), and a large absolute gain for tutored students in School Two (d = +1.47). It is worth noting that these results were observed in a context where the schools were implementing a well-resourced and proven instructional model that addresses Tier 1 and Tier 2 RTI supports.

Tutor-described practices suggested good fidelity of implementation of the model and alignment with the literature. Almost all tutors discussed the use of formative assessments of student learning before, during, and after each session, to guide the instruction provided in the session and set goals for future sessions. These findings are consistent with the goals of the program studied here as well as the literature on the benefits of systematic, ongoing progress monitoring as a core principle of effective remediation for students who struggle with mathematics (Fashola, 1998; Fuchs et al., 2011). Tutors described the delivery of guided practice to students, and many discussed the use of multiple explanations and representations of target concepts. These approaches described by tutors are consistent with literature in the field that links instructional explanations and representations with development of student mathematics understanding (Charalambos, Hill, and Ball, 2011; Hiebert et al., 1997). These qualitative findings point to some of the mechanisms at work behind the achievement results, and suggest some specific directions for practice in online mathematics tutoring as a Tier 3 intervention. Specifically, these tutors described attending persistently to student pre and post data to guide their instructional moves, and to providing multiple scaffolded opportunities for the students to engage with the mathematics at their individual levels.

Student commentary further supported the use of online mathematics tutoring that is data-driven, individualized, and focused as an intervention for students who struggle. Although a great deal of the student post-session commentary was general in nature, it was overwhelmingly positive. More importantly, even within the context of a fairly unstructured prompt, some students identified specific learning outcomes of the sessions. This suggests that online mathematics tutoring that embeds consistent progress monitoring may engage students in thinking about their own math learning as a process for enhancing achievement. A possible implication for practice is to consider how to include specific prompts for students to co-reflect on their learning with their online tutors.

Student perceptions of the pacing of online tutoring were mixed, which could be a function of the wide variety of reasons students are assigned to Tier 3 math interventions. For example, for some students the achievement gap may be due to processing issues, and thus require more explanation, while for others, attentional issues may demand a faster pace. Furthermore, the expressed desire on the part of at least some students for more time to work out problems on their own resonates with the literature that describes tutoring effectiveness as a function of knowing how to employ strategic questioning before telling or giving answers to students (Donnelly, 2013). Similarly, a number of students expressed the desire for more autonomy in the online tutoring process, from the desire to move faster or slower, to work more independently or with more support, and to select a preferred tutor for each session. These are ideas that are valuable to consider in developing online tutoring platforms, particularly for middle school students who are typically in a location along the developmental trajectory that makes choice and control of learning especially desirable (Midgley, Anderman & Hicks, 1995).

It should be noted that we did not randomly assign students to treatment, so it is not possible to definitively attribute outcomes to the tutoring program. Further, the generalizability of the results is limited in that both samples included very low-performing students from rural populations, and both schools were already engaged in a substantial school-wide math instruction improvement initiative. Nonetheless, this study provides promising evidence that a well-designed and implemented synchronous online tutoring program can augment the effectiveness of a robust, research-proven classroom model of mathematics instruction.

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APPENDIX A

Table A1

Codebook for Student Tutoring Session Comments

Category	Codes	Examples
Social interaction with tutor	1. Statements expressing thanks for the session 2. Statements expressing a general positive attribution to the session or tutor 3. Social greetings	1. "thanks for working with me" 2. "I love your teaching" 3. "talk to you on Tuesday"
Learning benefits	1. Statements indicating the student found the tutor to be helpful to them 2. Statements that the student constructed a specific mathematical understanding 3. Statements indicating student left session feeling confident about material 4. Statements that the student liked the website or tools	1. "He worked with me really well. He was nice and helped me a lot." 2. "Good session I now understand integers" 3. "now I get irrational number and rational numbers" 4. "He made it seem so easy , because it is" 5. "I like the white board"
Learning challenges	1. Pacing is too slow 2. Pacing is too fast 3. Desired more explanation/clarification 4. Desired more active participation 5. Problems with website and/or connectivity	1. "very slow, pick up the pace" 2. "I feel like this is helping me but I also feel like my tutor rushes me" 3. "The tutor was great, just needs to work on explaining a little bit more, and showing his work more clearly" 4. "it was good but he needs to let me do some work by myself" 5. "at one point the thing didn't let me type that's why I took so long"

Table A2

Codebook for Analysis of Online Math Tutor Logs

Categories	**Codes**	**Illustrative Language**
Assessment of student's prior knowledge	1. Analysis of pre-test data	1. *Posted the Pre-test questions for the student to solve. The test consisted of 10 problems. [Student]attempted 8 problems, and solved 5 of them correctly. Student was not familiar with concept of Pythagorean theorem*
Online tutoring interventions to support student understanding	1. Accessing prior knowledge 2. Modeling 3. Explaining steps in mathematical processes 4. Pointing out student mistakes to the student 5. Providing scaffolding through questioning or prompts	1. *Started session by giving warm up problem on dividing decimals with whole number* 2. *Showed him how to multiply the decimal number with example* 3. *Explained all the five steps to find the square root of the irrational numbers* 4. *Another problem of similar kind was worked by the student with minor mistakes, which she corrected on tutor's advice.* 5. *Tutor helped the student by providing hints to get the right answer*
Tutor reflection on student learning	1. Articulation of student's post-lesson content mastery 2. Identification of student difficulties, mathematics 3. Identification of technological issues impacting learning 4. Description of student learning behaviors 5. Reflection on student mathematical understanding during lesson 6. Recommendations for future teaching/learning	1. *Attempted 8 problems and solved 5 of them correctly. He scored 50% in the session.* 2. *The student faced difficulty in multiplying and adding the numbers.* 3. *The student struggled with writing on the whiteboard* 4. *The student struggled with multiplying the decimals, but corrected himself and was fast while learning.* 5. *Student was able to translate the given image and could reflect the image over different axis on the coordinate plane with ease.* 6. *He needs more practice in multiplication of Fractions.*