



The Impact of Modes of Instruction and Classroom Activities on the 2019 NAEP Fourth Grade Number Properties and Operations Mathematics Assessment

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Abstract: This study presented a secondary analysis of the National Assessment of Educational Progress (NAEP) dataset. The paper examined the influence of teacher discussions about goal setting and attainment with students and adjusting teaching strategies, on the impact of fourth-grade mathematics number properties and operations achievement scores. To gain a better understanding of the impact of teacher-related strategies on mathematics achievement of fourth-grade students, this study used a quantitative descriptive research design to analyze secondary data extracted from the 2019 NAEP data set. The findings of this study relative to fourth-grade students include: achievement results are not positively influenced by [1] an increased frequency teachers set goals with students, [2] an increased frequency teachers discuss student progress toward goals, [3] an increased frequency teachers discuss student current level of performances or [4] an increased frequency of teachers adjust teaching strategies to meet student needs. These findings indicate that teacher discourse related to student goal setting and adjusting teaching strategies do not have an impact on NAEP mathematics scores. Contrary to what has often been assumed, these research findings indicate discourse frequency between teachers and students regarding goals and academic progress is not an indicator of mathematics achievement.

Keywords: NAEP, Mathematics Achievement, Fourth grade, Goal setting, Discourse.

INTRODUCTION

When a person has a worthy ambition or pursuit, a goal is set to achieve it. This may occur formally by writing it down and reflecting on the action steps, or informally through holding the goal top of mind. Students often set goals at the direction of their teachers or based on a personal desire to achieve a desired result. Goal setting can positively impact student achievement (Martin & Elliot, 2015), however with factors such as teacher experience and skill and various goal-setting methodologies, it can be challenging to discern which factors have the greatest impact on goal attainment and if the act of setting academic goals impacts student achievement.

The National Assessment of Educational Progress (NAEP) gathers data from teachers regarding the frequency of setting and monitoring goals with students. The connection between the goal-setting data and student achievement data will be explored. Specifically, the focus of the research will include how teacher instructional behaviors, primarily pertaining to goal setting, impact student mathematics scores.

Various teacher characteristics and behaviors are noted to have a positive impact on student achievement. When instructed by teachers with certifications in mathematics, degrees related to mathematics, and coursework related to mathematics, high school students are shown to achieve at higher rates on a given mathematics assessment (Wayne and Youngs, 2003). Additionally, the feedback teachers provide to students is one of the most powerful influences on learning and achievement (Hattie, 2009). Further, in a study by Martin and Elliot (2015) the act of students

setting a personal best (PB) target prior to taking a mathematics assessment resulted in a significantly greater achievement gain by the PB group over the control group.

Achievement goal theory (Ames, 1992) focuses on what drives individuals to achieve a goal and categorizes actions into mastery approach or avoidance and performance approach or avoidance. Mastery approach focuses on acquiring a command of a subject, while mastery avoidance is reflective of evading a misunderstanding of the material at hand. Performance approach is inclusive of demonstrating one's ability, whereas performance avoidance individuals circumvent challenges to avoid appearing incompetent. Much research related to achievement goal theory has occurred; however, limited research exists regarding the specific teacher involvement in the student goal-setting process. Particularly, what specific teacher behaviors and which goal-setting methodologies impact student attainment of goals. Given the dearth of research about teacher actions and interaction, a need exists for this research.

Elementary teachers will benefit from this study as the link between teacher goal setting and fourth grade student achievement on the NAEP assessment are explored. This will advance the understanding as to the impact specific teacher behaviors have on student goal achievement and will reveal drivers and restraints to the process. These findings will offer information to teachers on structuring classroom interactions and incorporating goal-setting processes to assist students in reaching their desired results.

The research examined questions including how teacher goal setting with students impacts student mathematics achievement. Research consideration was also given to the adjustment of teaching strategies, discussing student progress and student current performance as these pertain to mathematics achievement.

Literature Review

Student acquisition of knowledge is a desired outcome of teachers and learning institutions. Effective teachers seek various strategies and methodologies to foster student growth and achievement, including goal setting. Broadly defined, goal setting is the process of establishing clear and usable targets, or objectives, for learning (Moeller, et al., 2012, p.153). Teacher interactions, and frequency thereof, may impact student attainment of educational goals. Such teacher behaviors impact not only the day-to-day achievement of students, but also influence standardized test results such as the NAEP fourth grade mathematics scores. As such, the behaviors of feedback, communication, and goal setting strategies will be explored.

Teacher Feedback

Feedback is one of the most powerful influences on learning and achievement. Hattie (2009) provided a synthesis of over 800 meta-analyses reporting various influences on student achievement. Of the over 100 factors influencing educational achievement, feedback ranked among the top ten influencers.

Feedback is broadly defined across multiple contexts. Often it is defined as providing verbal or written comments or advice after an action has occurred. This type of feedback is summative. Feedback can also include responses ‘in the moment’ of learning, thereby formative in nature. Feedforward is future focused, providing information about what to try differently in the future (Khalil, 2017).

For feedback to be effective it requires that a person has a goal upon which they are trying to act. Feedback should be actionable, timely, ongoing, and consistent. Useful feedback systems involve a clear goal and tangible results related to the goal (Wiggins, 2012).

The impact of feedback can be positive or negative (Hattie & Timperley, 2007) and perceptions about feedback type vary. Feedback using rubrics are noted as ‘accurate’ and digital recordings as ‘easy to understand’. Face-to-face feedback is perceived as personalized (Dawson et al. 2019). Highly technical feedback can become confusing and overwhelming, thus effective feedback is user-friendly (Wiggins, 2012).

Teacher Communication

Teachers have multiple interactions with students on any given day, however these interactions can range from giving directions to having casual conversations. It is noted that key factors in interactions involve questioning and teachers’ reactions to student responses (She, 2002). Thus, the question becomes, do communication behaviors impact student achievement?

She and Fisher (2002) examined the association between teacher communication behavior and student achievement outcomes. The questionnaire consisted of four scales: challenging, encouragement and praise, non-verbal support, and understanding and friendly. When students perceived their teachers as using more

challenging questions, the results demonstrated higher student scores.

Contrary to this finding, Andersen et al. (1981) note little empirical evidence exists to support the idea that teacher communication behaviors have an effect on student learning (p. 377). As such, one part of their research study was to determine if teacher communicator style is related to student cognitive learning. The results indicate that communicator style is not related to cognitive learning.

With consideration to the aforementioned studies Lee, et al. (2009) state teachers should talk with students who have set goals and discuss how they wish to work on the goal and when it will be accomplished (p. 141). They also believe teachers should encourage students to monitor their progress on self-monitoring sheets, specifically targeting when they perform a behavior toward their goal. Further, teachers and students can review together exactly what the self-monitoring sheets are measuring and what the skills needed involve (p. 142). By doing so, teachers can aid in the goal attainment process.

Goal Setting Processes

There are various strategies teachers can employ when helping students set goals and different methodologies exist to help students set and own academic goals. Rader (2005) proposes a six-step process. Steps include:

1. Select a specific goal and write it down.
2. Determine a date for the attainment of the goal.
3. Determine obstacles and a step-by-step plan to achieve the goal.
4. Visualize an image of goal attainment.
5. Be determined.
6. Self-evaluate progress (pp. 123-125).

Providing another model for student goal setting, Day and Tosey (2011) bring forward a five-element framework using the mnemonic POWER.

1. P: State the goal in a *positive* manner; what one wants to accomplish.
2. O: Determine the student's *own role* in accomplishing the goal.
3. W: *What* actions are required to achieve the goal?
4. E: What *evidence* will be used to determine goal progress and attainment?
5. R: Does the goal feel right? What is the student's *relationship* with the goal; does it feel right (pp. 522-523).

Nordengren (2019) summarized knowledge acquired by a district in the midwestern United States through using a research-based goal setting process. Lessons drawn include:

1. Start goal setting with students at an early age.
2. Create short term goals in collaboration with students and establish regular check ins.
3. Keep goals visible through anchor charts and data notebooks.
4. Establish goals with students that have personal relevance.

5. Encourage student ownership of goals through choice in goals to be achieved (pp. 19-22).

Finally, Covey et al. (2020) illustrates the power of the 4 Disciplines of Execution as a way to not only set goals but execute on them to achieve results. The four disciplines are:

1. Focus on the Wildly Important. Write the goal in a From X to Y by When format.
2. Act on Lead Measures. These strategies should be predictive of achieving the goal and influenceable by the individual or team.
3. Keep a Compelling Scoreboard. The scoreboard should be simple and track both lead and lag measures.
4. Create a Cadence of Accountability. Check in on a regular basis with the team or accountability partner.

Common themes emerge from the research which can impact strategies teachers employ. Each of the four goal setting processes presented include having a clearly stated goal. Establishing a deadline for the goal is also a common theme (Rader, 2005; Nordengren, 2019; Covey et al., 2020). Further, regular progress monitoring of the goal is encouraged by both Nordengren (2019) and Covey et al., (2020). Keeping goals visible is noted as an important practice (Nordengren, 2019; Covey et al., 2020). Both Rader (2005) and Day and Tosey (2011) add an affective consideration to the goal setting process, respectively including self-determination and student feeling about the goal in the processes. Additionally, through use of the goal setting methodology, Covey et al. (2020) report numerous examples of student increases in achievement and schools closing achievement gaps.

Teaching Strategies

The Education Commission of the United States (2019) reports that of the fifty states, eleven require a portion of a teacher's workday be dedicated to teacher planning. For many of the other states, this planning time is a negotiated item. It is during this planning time that teachers write lesson plans, grade assignments, and consider what teaching strategies will be used. With the hundreds of instructional strategies which can be utilized, teachers need to determine which ones to use in order to effectively demonstrate the content or meet the needs of their learners. The U. S. Department of Education expects all students to have the same learning goals, however, suggests tailoring instruction by time and presentation (Sparks, 2015) thus encouraging teachers to adjust teaching strategies to meet the needs of all students. Prast et al. (2018) note there is some evidence that differentiation of instruction may enhance student achievement. In the large-scale study Prast et al. (2018) speculate the effects of the professional development training on differentiation positively impacted primary student mathematics achievement due to an increase in teacher competency of implementation of differentiation.

Methods

The National Assessment of Educational Progress (NAEP) has been assessing student achievement in the United States since 1969 (U.S. Department of Education, n.d.). Commonly referred to as the Nation's Report Card, data are reported for students in grades 4, 8, and 12 across multiple subject areas such as reading, mathematics, science, civics, economics, geography, music and visual arts, science, technology and engineering, U.S.

history, and writing. Performance data are reported for student groups, large urban districts, and by state. In addition to achievement scores, survey data are collected. These surveys gather information regarding school characteristics and demographics; teacher training and instructional practices; and student learning, socioeconomic status, and educational experiences. Hosted by the National Center of Education Statistics (NCES), Data Explorer is a web-based system that allows users to explore past assessment results and participate in research of personal interest based on NAEP data. NAEP results are a lens to view success across the nation and may be used to inform policy, research, and advancements in the education process of America's children.

This research includes the jurisdiction of national public schools, as such, the participant and sampling methodology is specific to this group. A multistage sampling design is used to determine the sample of public-school students who will be assessed on the NAEP. Annually, the National Center for Education Statistics (NCES) compiles a list of schools by geographic area, known as the sampling frame. Schools are further combined into strata based on minority enrollment, location, medium income, and achievement scores. From each jurisdiction, approximately 100 schools are selected, with about 60 students identified for a specific assessment (National Center for Education Statistics, n.d.).

The goal of this study is to explore how associations between teacher instructional behaviors, specifically pertaining to goal setting, impact fourth-grade students' mathematics scores. As such, a descriptive quantitative research design will be used.

Approximately 296,900 students participated in the 2019 NAEP mathematics assessment (NAEP, 2022). Results include data from all 50 states, Department of Defense schools, and the District of Columbia. The sample size of fourth grade public school students was 149,500. Of these students, 14% were students with disabilities and 12% were English language learners. 8,280 schools were represented. The assessment was administered on tablet computers between January and March 2019 (The Nation's Report Card, 2019).

The NAEP Data Explorer (NDE) was used to analyze fourth-grade 2019 mathematics scores of students from national public schools. The focus of the scale was number properties and operations and included the following variables:

In your mathematics class this year, how often do you do each of the following with individual students to assess their progress in mathematics?

1. Set goals for specific progress the student would like to make.
2. Determine how to adjust your teaching strategies to meet the student's current learning needs.
3. Discuss progress the student has made toward goals previously set.
4. Discuss each student's current level of performance with them.

Response options included: Never or hardly ever, a few times a year, once or twice a month, once or twice a week, or every day or almost every day.

NAEP Data Explorer uses a t-test to determine significant differences, Differences are reported significant at a level of 0.05. Cohen suggested an effect size of 0.2 is considered small, 0.5 is medium, and 0.8 is a large effect size (McLeod, 2019). An online calculator is used to determine effect-size correlation.

Results

An examination was conducted to determine the impact teacher behaviors have related to goal setting on fourth grade mathematics

number properties and operations scores. In the teacher questionnaire portion of the NAEP assessment, teachers were asked to report the frequency of certain instructional behaviors. These behaviors include interactions with students and a reflection on teaching strategies. Data Explorer, found on the NAEP website, was used to determine this relationship. Four teacher-reported variables were chosen for this analysis and are presented in Table 1.

Table 1
Self-Reported Teacher Variables Chosen for Analysis

Variable Focus	Teacher Questions
Instructional content and practice > Modes of instruction/classroom activities	In your mathematics class this year, how often do you do each of the following with individual students to assess their progress in mathematics? Set goals for specific progress the student would like to make. [ID: T136902]
	In your mathematics class this year, how often do you do each of the following with individual students to assess their progress in mathematics? Determine how to adjust your teaching strategies to meet the student's current learning needs. [ID: T136904]
	In your mathematics class this year, how often do you do each of the following with individual students to assess their progress in mathematics? Discuss progress the student has made toward goals previously set. [ID: T136903]
	In your mathematics class this year, how often do you do each of the following with individual students to assess their progress in mathematics? Discuss each student's current level of performance with them. [ID: T136905]

Questions were answered on a 5-point scale with frequency options ranging from never to every day or almost every day.

Description

The analysis includes 2019 national public data for fourth grade students on the number properties and operations scale. Results include means and standard deviations for all students as well as each tested variable. The average scale score for all students is 243 (SD=36).

Table 2 shows the average scale scores and standard deviation of the researched variables. Independent t-tests were run to determine the significance of each variable. Using the University of Colorado's Effect Size Calculator (Becker, 2000) Cohen's *d* effect size was calculated for all variables to further examine any significance found. Results are presented for each research question.

Table 2*Students' Mathematics Scores by Frequency of Selected Variables*

Variable	Never	Once or twice a year	Once or twice a month	Once or twice a week	Almost everyday
Set goals with students [ID: T136902]	246 (SD=34)				
Analyze teaching strategies [ID: T136904]	243 (SD=35)	247 (SD=35)			
Discuss progress with students [ID: T136903]	246 (SD=34)	246 (SD=35)	244 (SD=36)		
Discuss student current level of performance [ID: T136905]	248 (SD=37)	245 (SD=35)	244 (SD=36)	243 (SD=35)	

Note. No significant values were identified.

Research Question #1

What is the relationship between 4th grade student performance on the number properties and operations scale and teachers setting goals with students?

Table 3*Students' Mathematics Scores Setting Goals Variable [T136902]*

Year	Jurisdiction	Assess math students by setting goals for specific progress	Average scale score	Standard deviation
2019	National public	Never	246	34
		Once or twice a year	245	36
		Once or twice a month	244	36
		Once or twice a week	242	35
		Every day or almost	240	36

Note. Some apparent differences between estimates may not be statistically significant.

Source. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2019 Mathematics Assessment.

Teachers stating, they never set goals with students resulted in an average student scale score of 246(SD=34). Teachers stating, they set goals with students once or twice a year resulted in an average student scale score of 245(SD=36). Teachers stating, they set goals with students once or twice a month resulted in an average student scale score of 244(SD=36). Teachers stating, they set goals with students once or twice a week resulted in an average student scale score of 242(SD=35). Finally, teachers who reported setting goals with students every day or almost every day resulted in an average student scale score of 240(SD=36).

Table 4 shows the means and independent *t*-test results for frequency of goal setting.

Table 4

Difference in Average Scale Scores Between Variables for Frequency of Goal Setting [T136902]

	Never (246)	Once or twice a year (245)	Once or twice/month (244)	Once or twice a week (242)	Every day or almost (240)
Never (246)					
Once or twice a year (245)	x Diff = -1 P-value = 0.4320 Family size = 10				
Once or twice/month (244)	x Diff = -2 P-value = 0.1308 Family size = 10	x Diff = -1 P-value = 0.2988 Family size = 10			
Once or twice a week (242)	< Diff = -3 P-value = 0.0062 Family size = 10	< Diff = -2 P-value = 0.0048 Family size = 10	< Diff = -2 P-value = 0.0227 Family size = 10		
Every day or almost (240)	< Diff = -5 P-value = 0.0003 Family size = 10	< Diff = -4 P-value = 0.0001 Family size = 10	< Diff = -3 P-value = 0.0006 Family size = 10	x Diff = -2 P-value = 0.0773 Family size = 10	
LEGEND:					
<	Significantly lower.				
>	Significantly higher.				
x	No significant difference.				

Note. Within jurisdiction comparisons on any given year are dependent with an alpha level of 0.05.

Students whose teachers never set progress goals with students score significantly higher than students whose teachers set progress goals once or twice a week or every day or almost every day ($p < .001$). Similarly, students whose teachers set goals once or twice a year score better than students whose teachers set goals once or twice a week or every day or almost every day ($p < .001$). Students whose teachers set

progress goals with students once or twice a month score significantly higher than students whose teachers set progress goals once or twice a week or every day or almost every day ($p < .001$).

Table 5 shows Cohen's d effect size of significant mean score differences when setting progress goals.

Table 5

Effect Sizes of Significant Mean Score Differences when Setting Goals for Specific Progress [T136902]

Never (246)	Never (246)	Once or twice a year (245)	Once or twice/month (244)	Once or twice a week (242)	Every day or almost (240)
Once or twice a year (245)					
Once or twice/month (244)					
Once or twice a week (242)	Cohen's $d = 0.12$	Cohen's $d = 0.08$	Cohen's $d = 0.06$		
Every day or almost (240)	Cohen's $d = 0.17$	Cohen's $d = 0.14$	Cohen's $d = 0.11$		

Cohen's d was calculated for all significant mean score differences. Results range from .06 to .17, all indicating a small effect size.

Research Question #2

What is the relationship between 4th grade student performance on the number properties and operations scale and teachers discussing progress with students toward goals?

Table 6

Students' Mathematics Scores with Discussing Progress Variable [T136903]

Year	Jurisdiction	Assess math students by discussing progress toward goals	Average scale score	Standard deviation
2019	National public	Never	246	34
		Once or twice a year	246	35
		Once or twice/month	244	36
		Once or twice a week	242	35
		Every day or almost	240	36

Note. Some apparent differences between estimates may not be statistically significant.

Source. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2019 Mathematics Assessment

Both teachers reporting they never discuss progress toward goals or do so once or twice a year yield the same and highest student average scale scores, 246(SD=34), 246(SD=35). Student scale scores when teachers discuss progress toward goals once or twice a month are 244(SD=36), once or twice a week 242(SD=35) and every day or almost every day 240(36).

Table 7 shows the means and independent *t*-test results for frequency of discussing progress toward goals.

Table 7

Difference in Average Scale Scores Between Variables for Frequency of Discussing Progress [T136903]

	Never (246)	Once or twice a year (246)	Once or twice/month (244)	Once or twice a week (242)	Every day or almost (240)
Never (246)					
Once or twice a year (246)	x Diff = 0 P-value = 0.9927 Family size = 10				
Once or twice/month (244)	x Diff = -2 P-value = 0.0524 Family size = 10	< Diff = -2 P-value = 0.0083 Family size = 10			
Once or twice a week (242)	< Diff = -4 P-value = 0.0021 Family size = 10	< Diff = -4 P-value = 0.0001 Family size = 10	< Diff = -2 P-value = 0.0300 Family size = 10		
Every day or almost (240)	< Diff = -5 P-value = 0.0002 Family size = 10	< Diff = -5 P-value = 0.0000 Family size = 10	< Diff = -3 P-value = 0.0024 Family size = 10	x Diff = -2 P-value = 0.1019 Family size = 10	
LEGEND:					
<	Significantly lower.				
>	Significantly higher.				
x	No significant difference.				

Note. Within jurisdiction comparisons on any given year are dependent with an alpha level of 0.05.

Students whose teachers never discuss progress toward goals with students score significantly higher than students whose teachers discuss progress once or twice a week or every day or almost every day ($p < .001$). Similarly, students whose teachers discuss progress toward goals with students once or twice a year score significantly higher than students whose teachers discuss progress once or twice a week or every day or almost every day ($p < .001$). Finally, students whose teachers discuss progress toward goals with students once or twice a month score significantly higher than students whose teachers discuss progress every day or almost every day ($p < .001$).

Table 8 shows Cohen's d effect size of significant mean score differences when discussing goal progress.

Table 8

Effect Sizes of Significant Mean Score Differences when Setting Goals when Discussing Progress [T136903]

	Never (246)	Once or twice a year (246)	Once or twice/month (244)	Once or twice a week (242)	Every day or almost (240)
Never (246)					
Once or twice a year (246)					
Once or twice/month (244)		Cohen's $d = 0.06$			
Once or twice a week (242)	Cohen's $d = - 0.11$	Cohen's $d = 0.11$	Cohen's $d = - 0.06$		
Every day or almost (240)	Cohen's $d = 0.17$	Cohen's $d = 0.17$	Cohen's $d = 0.11$		

Cohen's d was calculated for all significant mean score differences. Results range from .06 to .17, all indicating a small effect size.

Research Question #3

What is the relationship between 4th grade student performance on the number properties and operations scale and teachers adjusting their teaching strategies to meet student needs?

Table 9

Students' Mathematics Scores with Adjusting Teaching Strategies Variable

[T136904]

Year	Jurisdiction	Assess math students by adjusting teaching strategies to meet needs	Average scale score	Standard deviation
2019	National public	Never	243	35
		Once or twice a year	247	35
		Once or twice/month	243	35
		Once or twice a week	244	35
		Every day or almost	244	36

Note. Some apparent differences between estimates may not be statistically significant.

Source. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2019 Mathematics Assessment.

The average scale score of students when teachers reported never was 243(SD=35). The average scale score when teachers report adjusting strategies once or twice a year was 247(SD=35). Teachers adjusting strategies once or twice a week and every day or almost every day resulted in the same score 244(SD=36), 244(SD=36).

Table 10 shows the means and independent *t*-test results for adjusting teaching strategies.

Table 10

Difference in Average Scale Scores Between Variables for Adjusting Teaching Strategies

[T136904]

	Never (243)	Once or twice a year (247)	Once or twice/month (243)	Once or twice a week (244)	Every day or almost (244)
Never (243)					
Once or twice a year (247)	x Diff = 4 P-value = 0.2016 Family size = 10				
Once or twice/month (243)	x Diff = 0 P-value = 0.8807 Family size = 10	x Diff = -5 P-value = 0.0164 Family size = 10			
Once or twice a week (244)	x Diff = 1 P-value = 0.7531 Family size = 10	x Diff = -3 P-value = 0.0684 Family size = 10	x Diff = 1 P-value = 0.0921 Family size = 10		
Every day or almost (244)	x Diff = 1 P-value = 0.8400 Family size = 10	x Diff = -4 P-value = 0.0492 Family size = 10	x Diff = 1 P-value = 0.2171 Family size = 10	x Diff = 0 P-value = 0.6231 Family size = 10	
LEGEND:					
<	Significantly lower.				
>	Significantly higher.				
x	No significant difference.				

Note. Within jurisdiction comparisons on any given year are dependent with an alpha level of 0.05.

When calculating for teachers adjusting their strategies to help meet the needs of their students, no significant difference was found.

Cohen *d* was not calculated for teaching strategies as the means were not significant.

Research Question #4

What is the relationship between 4th grade student performance on the number properties and operations scale and teachers discussing with students their current level of performance?

Table 11

Students' Mathematics Scores with Discussing Performance Variable

[T136905]

Year	Jurisdiction	Assess math students by discussing current performance level	Average scale score	Standard deviation
2019	National public	Never	248	37
		Once or twice/year	245	35
		Once or twice/month	244	36
		Once or twice/week	243	35
		Every day or almost	243	36

Note. Some apparent differences between estimates may not be statistically significant.

Source. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2019 Mathematics Assessment.

The highest average scale score, 248(SD=37), was reported for students when teachers never discussed student performance levels. The average scale score for once or twice a year were 245(SD=35), once or twice a month, 244(SD=36), once or twice a week 243(SD=35), and every day or almost every day, 243(SD=36).

Table 12 shows the means and independent *t*-test results for frequency of discussing student current level of performance.

Table 12

Difference in Average Scale Scores Between Variables for Discussing Performance

[T136905]

	Never (248)	Once or twice/year (245)	Once or twice/month (244)	Once or twice/week (243)	Every day or almost (243)
Never (248)					
Once or twice/year (245)	x Diff = -3 P-value = 0.1252 Family size = 10				
Once or twice/month (244)	x Diff = -4 P-value = 0.0309 Family size = 10	x Diff = -1 P-value = 0.2870 Family size = 10			
Once or twice/week (243)	< Diff = -6 P-value = 0.0041 Family size = 10	< Diff = -3 P-value = 0.0132 Family size = 10	x Diff = -2 P-value = 0.0242 Family size = 10		

	Never (248)	Once or twice/year (245)	Once or twice/month (244)	Once or twice/week (243)	Every day or almost (243)
Every day or almost (243)	< Diff = -5 P-value = 0.0070 Family size = 10	x Diff = -2 P-value = 0.0435 Family size = 10	x Diff = -1 P-value = 0.1248 Family size = 10	x Diff = 0 P-value = 0.9092 Family size = 10	
LEGEND:					
<	Significantly lower.				
>	Significantly higher.				
x	No significant difference.				

Note. Within jurisdiction comparisons on any given year are dependent with an alpha level of 0.05.

Students whose teachers never discuss their current level of performance score significantly higher than students whose teachers discuss performance once or twice a week or every day or almost every day ($p < .001$). Students whose teachers discuss their current level of performance once or twice a year score significantly higher than students whose teachers discuss performance once or twice a week ($p < .001$).

Table 13 shows Cohen's d effect size of significant mean score differences when discussing performance.

Table 13

Effect Sizes of Significant Mean Score Differences when for Discussing Performance

[T136905]

	Never (248)	Once or twice/year (245)	Once or twice/month (244)	Once or twice/week (243)	Every day or almost (243)
Never (248)					
Once or twice/year (245)					
Once or twice/month (244)					
Once or twice/week (243)	Cohen's $d = 0.14$	Cohen's $d = 0.06$			
Every day or almost (243)	Cohen's $d = 0.14$				

Cohen's d was calculated for all significant mean score differences. Results range from .06 to .14, all indicating a small effect size.

Discussion

This study explored the 2019 NAEP mathematics scores of fourth grade students, specifically targeting teacher self-reported instructional practices. Using the NAEP Data Explorer, research revealed consistent goal setting and conversations with students about their goals does not impact student achievement in mathematics. Frequent and consistent adjustment of teaching strategies yielded similar results. The selected research questions involved the analysis of four teacher-reported frequencies: setting goals with individual students for specific progress, determining how to adjust teaching strategies to meet students' needs, discussing individual goal progress with students, and discussing students' individual performance level with them.

Research Question #1

When answering research question #1, *What is the relationship between 4th grade student performance on the number properties and operations scale and teachers setting goals with students?* students whose teachers never set progress goals with students score significantly higher than students whose teachers set progress goals daily, once or twice a week, once or twice a month, or once or twice a year. The high average scale score for never setting goals is 246(SD=34) compared to the low average scale score of 240(SD=36) when setting goals daily or almost every day. NAEP Data Explorer uses a t-test to determine significant differences, Differences are reported significant at level of 0.05. Cohen suggested an effect size of 0.2 is considered small, 0.5 is medium, and 0.8 is a large effect size (McLeod, 2019). When calculating Cohen's *d* coefficient for the statistically significant correlations, results range from .06 to .17, all indicating a small effect size. These findings are contrary to Martin and Elliot (2015) who note goal-setting can positively impact student achievement. Additionally, student feedback is one of the top factors influencing student achievement (Hattie, 2009) and useful feedback systems involve clear goals (Wiggins, 2012).

Research Question #2 and Research Question #4

When answering research question #2, *What is the relationship between 4th grade student performance on the number properties and operations scale and teachers discussing progress with students toward goals?*, the data reveal the less frequently teachers discuss student progress toward goals, the significantly higher the scores ($p < .001$). Specifically, students with teachers who report never discussing goal progress with students or doing so once or twice a year yielded the highest average scale scores 246(SD=34), 246(SD=35). Cohen's *d* was calculated for all significant mean score differences. Results range from .06 to .17, all indicating a small effect size. These results illustrate there is not a relationship between the frequency teachers discuss performance with students and mathematics achievement.

When answering research question #4, *What is the relationship between 4th grade student performance on the number properties and operations scale and teachers discussing with students their current level of performance?*, students whose teachers never discuss their current level of performance score significantly higher than students whose teachers discuss performance once or twice a week or every day or almost every day. Although there was a significant difference in mean scores when teachers discuss student levels of performance less frequently, when calculating Cohen's *d* the results indicated a

small effect size. These results, related to teacher discussions with students, are similar to research question #2.

Both research question #2 and #4 center on teacher to student discussion, the former discussing progress toward goals and the latter discussing current level of student performance. These findings reinforce the claim of Anderson et al (1981) noting teacher communication behaviors have little empirical evidence of supporting student learning. However, She and Fisher (2002) found students demonstrated higher test scores when they perceive their teachers ask them challenging questions. Further, feedback is ranked as one of the top ten influencers of student achievement (Hattie, 2009).

Research Question #3

When answering research question #3, *what is the relationship between 4th grade student performance on the number properties and operations scale and teachers adjusting their teaching strategies to meet student needs?*, students of teachers reporting adjusting teaching methods once or twice a year had the highest average scale score 247(SD=35). However, the t Test showed no significant difference between any of the means related to the frequency teachers report adjusting strategies and student performance. As such, Cohen's *d* was not calculated as the means were not significant. Worthy of consideration, Prast et al (2018) found differentiating teaching strategies can positively impact mathematics achievement for primary students, which is contrary to the research findings.

The results of this study found that minimal goal-setting and infrequent discussion of goal progress with students and adjustment of teaching strategies yielded higher average scale scores on the 2019 NAEP mathematics assessment for fourth-grade students. As previously referenced, this contradicts much previous research. Possible explanations for these results include:

- Goal setting with students occurs informally in classrooms and conversations are ongoing and organic, thus teachers do not equate this practice to the NAEP question.
- Teachers interpreted the question as implementing a specific formal goal-setting process, thus inferring a process they may use was not reflective of the question asked.
- Teachers infer "adjusting teaching strategies" pertained to formalized differentiated instruction in their classrooms, perhaps a practice not personally utilized or done so by a teaching support team.

Conclusion

This study analyzed whether teacher behaviors relative to discussion, goal setting and adjustment to teaching strategies impact student performance on the fourth-grade mathematics NAEP. The findings of this study suggest that student goal setting and associated conversations about goal setting do not impact student achievement on the 4th grade mathematics NAEP, specifically as it pertains to number properties and operations. Similarly, teacher adjustment of teaching strategies to meet the needs of students garner similar results.

Implications

Goal setting with students

The results of this study show goal setting with students, regarding the progress they would like to make, does not correlate to higher mathematics scores on NAEP. In fact, the study found students where teachers state they never set goals with students resulted in the highest average student scale score. This contradicts the findings of Covey et al. (2020) whereby schools implementing a goal setting process report a positive impact on student achievement. Teachers should weigh the results of this study inclusive of teacher self-reported behaviors with the body of research reflective of the academic gains that can be made when students set goals.

Teacher to student discussions

This study supports the results found in other studies regarding the impact of teacher to student discussion on achievement, specifically the claim of Anderson et al. (1981) noting teacher communication behaviors have little empirical evidence of supporting student learning. This study specifically focused on student current levels of performance, progress toward goals, and how teacher discussions about these topics impact achievement. Students whose teachers never discuss their current level of performance score significantly higher than students whose teachers have more frequent discussions. Similar results occur when discussing progress toward goals. In this study teacher to student discussions did not impact achievement however, teachers are advised to consider Hattie's (2009) meta-analysis whereby of the over 100 factors influencing educational achievement, teacher feedback ranked among the top ten influencers.

Adjusting teaching strategies

The result of this study suggests teachers unevenly adjust teaching strategies to meet students' current learning needs, as no significant difference exists between student performance and the frequency teachers adapt their instructional methods. Given the expectation of the U. S. Department of Education that instruction by time and presentation should be tailored for students (Sparks, 2015), it is cautioned that such behaviors are unevenly reported and demonstrate little impact on student achievement.

Limitations

Limitations exist for this study. All data were collected by NAEP, thus the findings presented herein relied on secondary data, therefore potential validity concerns may exist. As it was necessary to use the variables provided by NAEP, one research question, the frequency teachers adjust teaching strategies, was not linked as tightly to goal setting as the other three research questions. As such, the information gleaned from the data analysis may not be as relevant to student achievement and goal setting. Further, all data analysis results were determined using NAEP Data Explorer and were limited in scope as they are only based on the descriptive statistical analyses the Data Explorer had available.

Recommendations for Future Research

This study utilized data from the 2019 NAEP and the study sought to determine the impact modes of instruction and classroom goal setting activities have on fourth-grade number properties and operations achievement. Instead of using the tight focus of numbers and operations, future research could be

conducted comparing the same variables to the overall mathematics scores or a different strand to determine consistency of results, regardless of the chosen focus area. As feedback is a powerful influence on academic achievement, it would be beneficial if NAEP added questions tied specifically to goal setting and feedback to students. Additionally, an exploration outside of NAEP, to research specific goal setting methodologies and their impact on mathematics performance could prove beneficial to educators as they work to improve the academic performance of students.

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