

The Effect of Teacher Feedback on Student Achievement in Fifth Grade Mathematics

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Abstract

This study aims to delve deeper into the topic of utilizing specific student feedback to improve overall academic performance. The researcher of this study will utilize specific types of feedback on fifth grade elementary mathematics students receiving advanced academics curriculum in order to demonstrate the extent to which feedback improves student learning. This topic is worthy of investigation because it is important to give students feedback in mathematics in order for student work improvement. Mathematical feedback that is related to standards and relevant to students' work, guides students to more effective learning and can increase their overall academic learning. Some techniques for delivering feedback include one-to-one conferencing which includes observation and the show me technique, written feedback, small group checklists, and individualized feedback forms. Based on the information described and data collected, students showed greater academic achievement upon receiving small group feedback.

CHAPTER I

Introduction

Statement of Problem

One of the many priorities in education is student academic achievement. There are many reasons why student achievement soars or declines. Among these reasons is the delivery and use of teacher-provided feedback on student learning. In many elementary schools, select fifth graders are offered the opportunity to participate in receiving instruction from the advanced academics curriculum. While this can be a life-changing opportunity for some, many fifth graders are unsure of how to shift their mathematical thinking and apply prior knowledge to newly learned content. Students in advanced academics receive mathematics instruction on a faster track and are working within curriculum that is one to one and a half years above their grade level curriculum. Often, teachers are not exactly clear on how to direct students to new learning which in turn produces limited or declined student achievement.

Specific and personalized feedback provided to students can remediate the issues of limited or declined student achievement. When students receive timely, relevant, and specific feedback on their work they can determine how to manipulate their mathematical thinking and accurately solve problems and complete tasks. The problem is that students are unaware of what they need, they are unable to take control of their learning. The study of teacher-provided feedback on student learning is extremely relevant to education because it will provide a closer look at the importance of the student-teacher relationship and the guidance that students need to make learning “real.”

Statement of Research Hypothesis

Null: There will be no increase in student achievement on fifth grade level elementary mathematics unit assessments upon providing individualized feedback, including one-to-one conferencing.

Alternate: There will be an increase in student achievement on fifth grade level elementary mathematics unit assessments upon providing individualized feedback, including one-to-one conferencing.

Operational Definitions

Independent Variables:

One-on-one conferencing: The teacher meets with students on an individual basis and observes mathematical behavior and problem-solving skills. The teacher utilizes information gathered from individual student observations and discussions in order to determine best practices for student achievement.

Small group checklists: The teacher utilizes specific checklists of mathematical behaviors and skills to be demonstrated in problem-solving in order to determine which students need additional scaffolding or extension.

Individualized feedback forms: These forms are designed to give specific feedback for individual students based on students' mathematical work and observations made from the teacher.

Dependent Variables: Baltimore County Public Schools Unit Math Assessments (Pre-Assessment & Post-Assessment)

Pre-Assessments are given to students at the beginning of the unit in order to measure their understanding of skills to be learned based on the Common Core Standards and Baltimore County Public Schools curriculum.

Post-Assessments are given to students at the end of the unit in order to measure their understanding of skills taught and learned based on the Common Core Standards and Baltimore County Public Schools curriculum.

CHAPTER II

Literature Review

This literature review aims to explore the topic of effective feedback practices and its effect on student achievement at the elementary school level. The first section discusses the modern model of an elementary mathematics classroom specifically addressing the interactive and responsive teaching environment and the positive effects of conferencing on student learners. Section two provides an overview of the correlation of feedback to students' self-efficacy. Section three discusses the need for strengthening teachers' mathematical knowledge in order to improve student achievement. In section four, information about students' perceptions of feedback practices, timeliness of feedback, and students' engagement is discussed. Section five describes the influences of feedback on student learning and delves into feedback effectiveness.

A Responsive Teaching Environment with Feedback

In order to provide effective feedback to learners, teachers must utilize responsive teaching to understand their learners and apply best practices. Empson (2014) describes how responsive teaching positively correlates with student achievement. The author describes that responsive teaching requires teachers to take immediate evidence of student learning into account during instructional periods in order to advance learners in content areas. Teachers must respond to students' needs and modify instructional practices before, during, and after first instruction. The author worked with four second graders who were identified by their teachers as needing the most assistance in mathematics. The students had a lack of number sense, which translated to a lack of understanding numbers and values within the base-ten context. By providing students with various mathematical problems, each with differences in terms of level(s) of difficulty, numerical values, and specifications on how to solve, the observer was able

to respond to the students' work and modify instruction and future problems. The author describes that a central problem that many teachers find themselves working against is knowing what problem to provide students with next, when to push children to a more advanced strategy, or when to support students in revising their incorrect thinking rather than taking over their thinking. Empson also discusses that for teachers to effectively utilize responsive instruction, teachers must be aware of opportunities to move students from concrete thinking and strategies to more abstract ones, as well as how to deal with diversity among students. Research will not always provide a definite next step when interacting with children. Most times, teachers must interpret each child's thinking by attending to what was said or done and connecting the student's learning to effective teaching practices, then deciding how to respond to the student(s). Responsive teaching requires teachers to be mindful of students' understanding while instructing, in order to obtain evidence of errors and misconceptions, as well as to build on their correct foundational understanding. Teachers must be able to make sound decisions in the best interest of students before and after instruction, especially during first instruction.

There are a variety of instructional practices that increase student achievement within the elementary classroom. Student achievement and participation within the classroom increase through teacher conferences, modeling of learning practices, and providing student choice in learning and on assignments (Carey, Howard, & Leftwich, 2013). In this article, the authors found that reading conferencing had the greatest effect on student achievement, with modeling and student choice as next best practices. In the study, stakeholders were provided with questionnaires in order to determine the problems within instruction and student learning, and to identify possible working solutions. Some probable causes discussed were lack of student choice, struggling learners, student self-esteem, lack of motivation, and avoidance of school and work.

The study concluded that teachers modeling effective learning behaviors, conferencing, and choice in learning are all effective teaching practices. Based on the data from the study, it is recommended that teachers model behaviors in front of the students. Conferencing also allows teachers to share thoughts, experiences and knowledge, as well as hear students share their learning experiences.

Relationship between Mathematical Feedback and Students' Self-Efficacy

Students' self-efficacy has a direct role in student success. Teacher feedback has a powerful influence on student learning, motivation, and student achievement. Specific types of feedback provided by the teacher can increase students' strategy use and academic skills (Thomas, 2013). Negative feedback is found to bring psychological disengagement and positive feedback has even undermined motivational attempts. Teachers can use social persuasion in order to increase students' achievement and self-efficacy. Thomas references Bandura and states that, "social persuasion may be any message an individual receives from others that provides information about the individual's capabilities and therefore influences the individual's self-efficacy" (p. 82). Social persuasion is only an effective method when students trust the teacher and give merit to the feedback provided. Students who receive effective feedback perform better on tasks after experiencing failure. Positive and negative feedback should be provided to different subgroups equally. The study found that in the United States, teachers typically provided students with negative or corrective feedback first before giving positive feedback. The study also showed that boys, especially African-Americans, tended to receive negative feedback more so than girls. Thomas concludes positive feedback on ability and effort begets higher math skills and student self-efficacy, and negative feedback decreases student skills and self-efficacy.

The same ideology about positive and negative feedback has similar results involving students with learning challenges (Siewart, 2011). Students who received positive feedback had a higher level of math achievement than when receiving negative feedback. Three types of teacher feedback were found to be effective on student learning and achievement: (a) verbal feedback, (b) written feedback, and (c) corrective feedback. Verbal feedback should be immediate and not lengthy. The difficulty with this type of feedback is that teachers must frame it so that it is sincere. Written feedback requires more time and attention from the teacher. This type of feedback provided students with an understanding of their academic achievement up to a specific point in the unit of study and provided time for students to make corrections. Corrective feedback should be frequent but not to the point that it impedes daily instruction or student learning. Students should not waste time by continuously doing incorrect work. Teachers would do better to spend their time on student misconceptions and students should master one unit of study before moving on to the following unit.

Teacher Pedagogy & Student Achievement

Classroom teachers are the most effective and greatest influences on student learning and achievement. Carefully aligned curriculum and feedback must be consistently and fairly implemented to have a positive impact on student achievement (Hoge, 2016). Teachers need to provide the first, effective instruction in order to increase student learning. As teaching and learning are intertwined, teachers are held more accountable for student learning. Teachers change course content, modify instructional practices, and respond to students' needs.

Teachers' mathematical and content knowledge, in addition to their professional beliefs, influence responsive teaching practices (Palmer, 2014). Teachers' knowledge of specific content directly relates to their decision-making in the classroom, which further influences overall

student learning and achievement (Erskine, 2010). Teachers who demonstrate limited understanding of their content, may not always choose to utilize effective feedback strategies within the classroom instruction. Teachers who may have difficulty with the content mathematics could be unsure of how to assist struggling learners. Students may not always be taught the conceptual methods of solving problems and instead could be taught how to solve procedurally.

Student Perception of Feedback Instructional Practices

Feedback, in all forms, as a ‘consequence of performance’ which delves into students’ knowledge of results and/or correction of errors. Based on the research, students provided information that feedback should be timely and succinct (Mulliner & Tucker, 2015). Highly effective feedback is focused and purposefully planned for students’ benefit to increase student achievement. The quality of feedback, in addition to the frequency, timing and method of delivery, is important for student growth. Feedback needs to encourage additional learning from the student and help them to determine next best steps in their unit of study. Even with researched criteria on effective feedback, if students cannot make sense of and use it, it is ultimately ineffective. Teachers must have an ongoing conversation with students about effective feedback between them and one another. Teachers should encourage students to utilize feedback in a manner that will progress their learning and assist them in interpreting work. Individual feedback proves to be the most effective way to communicate with students instead of as a whole group.

Influences of Feedback on Student Learning

Formative feedback is one of the most powerful tools teachers can use to improve student learning (Shrum, 2016). In order to motivate students to change their work habits, look for and

make use of errors, and achieve students must be given descriptive feedback about their work. Students must be allowed to make changes based on the feedback they receive, but the feedback must have quality. Teachers must understand students' strengths and weaknesses so that they can modify their instructional program and provide students with adequate information to improve in their academics. The influence of highly effective feedback on student learning is tremendous. When students are given information about their current position in the unit of study and offered specific and detailed suggestions on how to improve, they are much more likely to find success.

When students are given minimal to no specific feedback students' achievement does not improve and typically decreases (Fyfe & Rittle-Johnson, 2015). It is irresponsible for the teacher to allow students to aimlessly continue in units of study with no direction or assistance as to what their next steps should be. In order for students to grow and progress academically, students must be provided with ample information as to what their misconceptions are, what errors they are making, and what learning they still have not grasped. Responsive and timely feedback from the teacher on student learning is critical to each child's success and overall achievement.

CHAPTER III

METHODS

Design

The research design used for this research is quasi-experimental. Students within the tested classroom are identified as gifted and are receiving instruction and curriculum that is a year above their grade level. The researcher will compare two groups of students within the classroom. To complete the research, the researcher will provide the students with a pre-assessment to be used to measure student understanding of the content and skills to be learned for the unit. Students will be placed into two separate groups, one receiving feedback (individual feedback forms, one-to-one conferencing, and small group checklists), and the other receiving none. The researcher will then analyze pre-assessment data and small group feedback data on the lowest scoring group and provide both groups of students with the post-assessment. Post-assessment data will then be compared to determine what impact small group feedback had on student performance.

Participants

The participants selected are a group of 22 fifth grade gifted and talented students who receive advanced academics mathematics curriculum. Out of the 22 students, 3 are Caucasian females, 11 are Caucasian males, 1 Chinese female and 1 Chinese male student, 1 Russian student, 2 African-American female students, 1 Ethiopian female, 1 Pakistani female, and 1 Hispanic male student. All participants are either 10- or 11-years old. There are 8 female students and 14 male students in the classroom. Participants were placed together in a homeroom specifically due to their advanced academics identification. Due to the results of the pre-assessment(s), students who scored lower will receive specified feedback in order to increase

their overall mathematical academic achievement. Students were split with the 11 highest scoring participants being placed in the control group, and the 11 lowest scoring participants being placed in the experimental group.

Instrument

The pre-assessments range from 3-5 questions and are delivered in three sets that increase in difficulty. Part I of the post-assessment contains 20 questions which measure the students' ability to use the skills learned to solve word problems and complete grade level applications. This is computer-based. Part II of the post-assessment, which is taken on paper, contains 4-7 questions and measure students' ability to apply the grade level content to multi-step word problems. The pre- and post-assessments are developed by curriculum writers that work within the Office of Mathematics, Pre-K-12. The assessments are developed based on the Maryland College and Career Ready Standards and the Baltimore County Public Schools' levels of progressions. The pre- and post-assessments are aligned to the Baltimore County Public Schools' curriculum.

Procedure

The researcher will provide the participants with the Baltimore County Public Schools' pre-assessments and identify the two groups of 11 students to create. Based on the data from the pre-assessment, students who have scored the lowest will be placed in the group that will receive specific feedback during small group instructional time periods. The second group of students will not receive this feedback during small group. The researcher will deliver curricular instruction to all participants and also provide differentiated and varied small group instruction to either provide feedback or not. At the end of the curricular unit, the researcher will provide the students with the post-assessment in order to analyze data and identify if there was an increase in student achievement.

CHAPTER IV

Results

The data displayed in this chapter provides information related to the scores of participants who did receive the small group feedback as well as those participants who did not receive small group feedback. The data displays the pre-assessment scores, post-assessment scores, and the difference in student performance between the administration of these two assessments. The mean of the growth rate in Table 1 is higher than the growth rate in Table 2.

Based on the evidence in Table 1, the majority of students scored below 50% on the pre-assessment. All participants scored higher than 50% on the post-assessment after receiving the treatment of feedback during small group instruction. The mean score of the pre-assessment is 44.55. The mean score of the post-assessment is 86.64. The mean score of the growth for the group of students that received small group feedback is 39.10.

Table 1

Student Group Receiving Small Group Feedback (Treatment)

Student Name:	Pre-Assessment Scores:	Post-Assessment Scores:	Difference/Growth:
Student 1	50%	82%	+32%
Student 2	70%	91%	+21%
Student 3	50%	91%	+41%
Student 4	25%	73%	+48%
Student 5	25%	64%	+39%
Student 6	25%	91%	+66%
Student 7	25%	91%	+66%
Student 8	50%	91%	+41%
Student 9	70%	82%	+12%
Student 10	50%	82%	+32%

Student 11	50%	82%	+32%
Mean Score	44.55	86.64	39.10

The data in Table 2 displays that all students scored either a 50% or above on the pre-assessment. All students scored higher than 50% on the post-assessment. The mean score of the pre-assessment is 74.09. The mean score of the post-assessment is 93.36. The mean score of the growth for the group of students that received small group feedback is 19.27.

Table 2

Student Group Not Receiving Small Group Feedback (Control)

Student Name:	Pre-Assessment Scores:	Post-Assessment Scores:	Difference/Growth:
Student 1	75%	100%	+25%
Student 2	75%	100%	+25%
Student 3	100%	100%	+0%
Student 4	85%	100%	+15%
Student 5	80%	95%	+15%
Student 6	75%	100%	+25%
Student 7	50%	73%	+23%
Student 8	75%	95%	+20%
Student 9	75%	91%	+16%
Student 10	50%	91%	+41%
Student 11	75%	82%	+7%
Mean Score	74.09	93.36	19.27

Table 3 shows that in this study, there was a statistically significant difference between student growth scores in favor of the group receiving feedback. The growth mean for students receiving feedback was 39.09 with a standard deviation of 16.57. The growth mean for students not receiving feedback was 19.27 with a standard deviation of 10.74. The significance level for this t-test analysis was $p < .05$ at .003, and therefore the null hypothesis is rejected.

Table 3

Independent T-Test Analysis

Group Name	N	Average Growth Score	SD	t	df	p
Feedback Group	11	39.09	16.57	3.328	20	.003
Non-feedback Group	11	19.27	10.74			

CHAPTER V

DISCUSSION

Implication of the Results

This study examined whether or not individualized feedback, including one-to-one conferencing, can be used to increase student achievement on a fifth grade level elementary mathematics unit assessment. The implications from the results of the statistical analysis reported in Chapter IV indicated that the directional hypothesis should be retained. The individual conferencing and small group feedback improved overall student achievement on the mathematics assessments.

Threats to Validity

Unfortunately, all research studies must withstand threats to validity. Within educational research, threats to validity are divided into categories that include external validity and internal validity. In this particular study, internal threats were the time constraints to teach curriculum in accordance to the Baltimore County Public Schools pacing guide. The mandate from the County Math Office is that the curriculum unit was to be taught during a specific time period throughout the school year. This time constraint tightens the instructional schedule and forces teachers to teach not necessarily to mastery of standards but more-so for exposure to curricular standards. With that, the assessment(s) could be difficult for students to successfully complete. Additionally, the unit assessments require students to complete problems in which students should have background knowledge on various topics. Most often, students come to fifth grade missing some foundational mathematical skills and this can negate their overall academic success. Threats to internal validity include the designing of the pre-assessment and post-assessment. The pre-assessment provided students with five questions to assess the knowledge

that students already have. Whereas the post-assessment had 20 questions and assessed students' knowledge of content and curriculum taught. The pre-assessment being shorter compared to the post-assessment could impact students' ability to maintain stamina when completing mathematical word problems. There is no validity and reliability testing associated with teacher-created assessments. The pre-assessment is given on paper while the post-assessment is provided online. This test-taking difference requires students to use different sets of skills to showcase their mastery of core content and curriculum. An external threat to this study is that the instructional practices and findings are only applicable to students in advanced academics. The sample size and sample type are also threats to the external validity.

Connections to Previously Existing Literature

This study is similar to other educational studies due to the topic of feedback delivered in the classroom. Many of the preexisting studies described teachers providing feedback in a variety of written and verbal expressions (Siewart, 2011). Within this study, written and verbal feedback were used. Both this study, and other existing literature such as one completed by Carey et al. (2013), drew the same conclusion that student achievement improved based on providing effective teacher feedback at all academic levels. The quality of the teacher feedback, as well as how frequent it is given in addition to the method of delivery is important for student growth. Feedback needs to motivate students to strive for additional learning and assist them in determining their next areas of growth within the unit of study. This research utilized different types of feedback as explained in previous studies such as verbal, written, and corrective feedback (Siewart, 2011).

Implications for Future Research

Implications for future educational practices are that students require feedback and information from the teacher in order to be able to improve their academic achievement. Teacher feedback can be provided in numerous ways, but must be timely, relevant, and specific. Teachers should use assessments that are closely connected to the content and curriculum to measure student success. Teachers should provide feedback to students because the specific communication drives students to shift their learning in order to succeed. Feedback on student learning and understanding is crucial to the teaching process in order to provide highly effective instruction. Teachers should give students feedback in many different forms in order to instruct to all learning styles. One method of student-specific feedback is verbal communication which can be provided at multiple opportunities throughout the lesson. For example, as students describe their mathematical thinking based on the instruction delivered, teachers can provide verbal feedback to correct or confirm student work. Written feedback can be provided to students using their mathematical note sheet, classwork, or formative and summative assessments. This type of feedback should be short and specific to the skill or assignment instructed. Teacher feedback should be given during both whole group and small group instruction to ensure that effective instruction is responsive to students' needs. Teachers should check in with students while working and consider when there is a need to provide instructional feedback for the students' benefit. In order to understand the importance of teacher feedback on student learning and academic performance, teachers need to receive training on what feedback is and how that looks within a classroom. While completing educational programs in undergraduate school, teacher candidates need practice in giving various types of feedback to students. Currently-employed teachers must have professional development opportunities offered to them on how to

be change agents in their classroom for the benefit of their students' learning. Providing feedback is one of many crucial instructional practices that teachers must utilize in order to assist students in taking ownership of their learning and reaching academic success in their mastery of standards.

Conclusion

In order for students to grow successfully in their academics, teachers must remain in constant communication with them in order for students to maintain growth in subject areas. Teachers must be knowledgeable and willing to provide feedback to students and assist them in their areas of weaknesses. Feedback can be provided in a multitude of ways but must remain relevant, timely, and specific in order to meet students' needs. Providing feedback must be of equal importance to providing highly effective instruction and there is a significant need for it within the schoolhouse.

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